Are the Poor Willing to Pay for Livestock Services?

Evidence from Rural India

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Prepared for presentation at the August, 2001 meetings of the
American Agricultural Economics Association in Chicago, Illinois

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May 2001

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Livestock is an important source of supplementary income for over 70 million rural households in India. Income from livestock accounts for about 15-40 percent of total farm income of the rural households. In 1997-98, livestock sector contributed a healthy 26 percent of total value of output from agriculture and this share has been growing steadily since 1970-71 when it was a little over 15 percent.

In addition to being an important source of income for poor households, livestock has many other important roles. It supplies a significant source of draft power for farming and rural transportation. The organic fertilizer produced in the livestock sector is a key factor of agricultural production and dung from livestock is a major source of cooking energy in rural areas specially among poor households. It is one of the most important productive assets in the rural areas and also serves as a critical store of wealth for farm families and an insurance mechanism to cope with household related crisis.

Sustained growth in per capita incomes in India over the last decade has contributed to the rising domestic cnsumption of livestock products. In response to the rising demand, the domestic output of various livestock products has also grown rapidly. For example, milk and egg output increased at an average annual rate of 8.3% and 5.5% between 1991-92 and 1999-2000. Between 1990-91 and 1997-98 alone, the value of livestock output grew by over 4.5 percent per year, and there are expectations of even faster growth in demand for livestock products.

Given the large livestock population in India and its relatively equitable distribution, these developments present enormous opportunity for India to boost rural incomes and accelerate the pace of poverty reduction. But, successful capitalization of these opportunities requires a policy regime that facilitates growth in productivity in the farm as well as processing sectors. The productive potential of animals depends crucially on the quality of nutrition, genetic material and the animal health system, and, on all these counts, India has a poor record.

Due the importance of livestock for the poor and the assumption that the poor can not afford to pay for these services, a major pillar of the GOI's livestock development strategy over the last

three decades has been the highly subsidized public delivery of livestock services. Overtime, the governments have built-up vast networks of physical and human infrastructure to provide these services to millions of farmers across the country. The number of state-run veterinary institutions had grown from about 2,000 in 1951 to over 50,000 at the end 1997-98. These institutions employed some 100,000 professionals and para-professionals. But, the quality of service provided by these institutions continues to be poor. Very few of these are equipped with clinical diagnosis facilities. Even those that have some facilities are very old. Lack of facilities for clinical diagnosis is at least in part responsible for indiscriminate use of antibiotics and anti-infectives, leading to high costs of drugs and medicines, and presenting a threat to human health because of the risk of inducing drug resistance.

While the demand for livestock services is expected to rise rapidly, a number of state governments are facing serious budgetary difficulties. Fiscal constraints, exacerbated by inadequate cost recovery, and the increasing proportion of department budget eaten up by salaries, are contributing to the deterioration in availability and quality of publicly provided livestock services[1]. Policy initiatives aimed at increased cost recovery, which could alleviate these financial difficulties, however, are often opposed due to the perception among policy makers that farmers will not be willing to pay for these services.

This paper presents first estimates of the willingness to pay (WTP) for curative veterinary services in three states—Gujarat, Rajasthan and Kerala—in India. The study addresses two basic questions

1. How much are people willing to pay for veterinary services? and
2. Does the willingness to pay increase/decrease with income?

The following section presents a brief overview of the structure of livestock sector and the institutional set-up for veterinary services in India. Section 2 describes the methodology and survey design for this study. Section 3 presents some descriptive statistics to describe the current market structure for veterinary services in the study states. The willingness to pay results are presented in Section 4. Finally, section 5 concludes the paper.

[1] Currently, almost 85 percent of the annual non-Plan budget is spent on salaries and other establishment costs.

1. The livestock sector in India and the institutional set-up for veterinary services

India has one of the largest livestock populations in the world. As per the 1992 livestock census, there were 192.7 million cattle, 78.6 million buffaloes and 44.4 million sheep in the country. India ranked first in the case of cattle and buffalo population and accounted for 57 per cent of the world's buffalo population and 16 percent of the cattle population. Of all the livestock species in India, bovines (cattle and buffalo) alone accounted for about 61 percent.

Milk production in India more or less remained stagnant from 1950 to 1970 when the production grew at the rate of a mere 1 percent per annum. Domestic production of milk increased rapidly thereafter, reaching 75 million tonnes in 1998–99. India is currently the largest producer of milk in the world. As a result of this growth, the per capita availability of milk increased from 112 gm per day in 1970–71 to about 235 gm per day in 1998–99. However, it is still below the world average of 285 gm per day.

Agriculture, including livestock, is under the purview of state governments, although the central government plays an important role in shaping the policy environment as well as working with state governments and other institutions to: (*i*) increase the supply of livestock services such as animal health services, Artificial Insemination (AI), feed and fodder supply, and (*ii*) improve livestock management and marketing.

State governments are responsible for financing most animal husbandry and dairying activities. For example, in Gujarat, in the year 1996–97, the state government share of total spending on animal husbandry and dairying was over 60 per cent. Of the total expenditure on animal husbandry, animal health accounted for about 36 percent (Table 1). Other major

Table 1. Expenditure on Animal Husbandry in Gujarat, Kerala and Rajasthan, 1996-97

(Rs. Million)

Programme	Gujarat		Kerala		Rajasthan	
	Total	Share (%)	Total	Share (%)	Total	Share (%)
Administration	28.1	5.6	27.9	5.4	5.2	3.9
Veterinary service and animal health	179.8	35.9	224.1	43.5	94.1	69.8
Cattle and buffalo development	157.9	31.6	116.9	22.7	27.4	20.4
Extension and training	0.4	0.08	3.0	0.6	NA	NA
Feed and fodder development	7.4	1.47	4.5	0.9	1.4	1.0
Poultry and other non-livestock development	70.8	14.2	42.7	8.3	6.2	4.6
Other	56.0	11.2	96.2	18.7	0.5	0.4
Total	500.3	100	515.2	100	134.8	100

NA: Not Available

Source: GOI, 1997b.

expenditures included cattle and buffalo development (31.6 percent), and poultry and other non-livestock development (14.2 percent). In Kerala, about 44 percent of the total budget was spent on veterinary services and animal health services. In contrast, in Rajasthan about 70 percent of the budget was allocated for veterinary services and animal health care. The allocation for activities such as extension and training was less than 2 per cent in all the states.

The veterinarians employed by the State Animal Husbandry Departments (SAHDs) are the primary providers of livestock health services. They provide these services through the network of veterinary dispensaries, veterinary hospitals and polyclinics and First Aid Veterinary Centres (FAVCs)[2]. Except in the case of emergencies, all government services are available at these centres. In the case of emergencies, the government veterinarians are allowed to make home visits and charge

[2] Veterinary polyclinics are the veterinary hospitals with multiple specialities and specialists such as surgery, gynaecology, radiology, etc. These employ several postgraduate veterinarians and are located mostly in state headquarters and sometime in some important district headquarters.

Veterinary hospitals are institutions with inpatient facilities and with usually one or two qualified veterinarians. These are located mostly in district headquarters.

Veterinary dispensaries are same as hospitals but without inpatient facilities and with only one qualified veterinarian.

Veterinary first aid centres are minor dispensaries in panchayats manned by paraprofessionals.

a nominal fee to cover the transportation cost. After office hours, however, they are allowed to engage in private practice.

Alternative sources of livestock services include co-operative unions, private veterinarians and some NGOs. Co-operatives are active only in some districts of Gujarat. The co-operative service is mostly delivered at home. They utilize the network of primary co-operative milk societies (PCS) at the village level to receive information about sick animals and then dispatch veterinarians from their central facility[3]. Private veterinarians are far and few and generally operate in selected areas where the government and co-operative providers are not able to meet the demand.

2. Methodology and survey design

This study uses household survey data covering 1163 households to examine the WTP for veterinary services. A contingent valuation (CV) approach is adopted because the estimation of demand function is greatly complicated by many types of services, different pricing schemes and government interventions in the market. Using a split sample CV design, we study WTP for two types of services – visits to the government veterinary centers, and the home visits by a veterinarian.

Three states – Gujarat, Rajasthan, and Kerala – which have already introduced some fee for different livestock services were selected for the study. In Kerala, AI services are delivered with full recovery of material cost. Rajasthan sponsors the training of private para-veterinarians, who are provided start-up grants to set up their own animal breeding enterprise and provide basic animal health care. Amul model of Gujarat has also been running on the principal of cost recovery. The sample for this study is drawn from 76 villages across 19 districts in the three states. The villages were selected randomly using 1991 population census as the sampling frame.

The reliability of WTP estimates obtained using CV technique has been a subject of much scrutiny and debate. This study followed what have come to be known as the best practices for CV design. Prescribed by the National Oceanic and Atmospheric Administration (NOAA) panel, these practices are designed to minimize some of the commonly known problems with the CV technique. Table 2 summarizes these guidelines and the procedures followed in this survey to meet these guidelines.

[3] Most of the PCSs are located within the villages and are easily accessible to all households in the village.

Two scenarios were constructed for eliciting the willingness to pay for curative veterinary services. One for visits to the government veterinary centers and the other for more valuable home service. These are given below

Scenario A (for utilizing the services at the centre): The government is starting a new scheme to provide services at the government veterinary centres. The plan of the scheme is as follows. The farmers will be given a yellow card. Only those who have the yellow card will be able to take their animals to the government veterinary centres and they will be provided services just like they are provided services currently. Of course, those do not have the yellow card will still be able to call the veterinarian for home service and pay the price currently being paid for such service. The cost of the yellow card is Rs. _____ and it will be valid for one year.

Scenario B (for home visits): The government is starting a new scheme for home service by government veterinarians. The plan of the scheme is as follows. The farmers will be given a blue card. Only those who have the blue card will be able to call the veterinarian to their home/field. Those who do not have the blue card will still have other options for treatment of sick animals. They will be able to take sick animals to the government veterinary centre and pay the government set prices there. Or they may be able to hire the government veterinarian for home services at a much higher price than is currently being paid. The cost of the blue card is Rs. _____ and it will be valid for one year.

Table 2: Contingent Valuation—NOAA guidelines and the procedures followed in this survey

Guideline	Procedure followed
1. Personal interview.	All households were personally interviewed.
2. The respondent should be made to vote to a given price rather than given open-ended questions.	The referendum format was used.
3. The survey must begin with a scenario that describes the expected effects of the programme under consideration.	All households were described the scenario in the same manner, including the expected effects.
4. The survey should elicit WTP for future incidents rather than the past.	The scenario describes a future policy change.
5. The survey should remind the respondent that the payment would reduce consumption of other goods and services.	Investigators were trained to address this issues, although a specific line in the survey did not appear.
6. The survey should remind the respondent about the availability of substitutes.	Questions about alternative sources of service preceded the CV module.
7. The survey should include follow-up questions to ensure that respondents understood the question being asked.	There were two sets of follow-up questions: One, to ensure the respondents understood the scenario, and two, to understand why they answered 'no' or 'can't decide'.

Source: Portney (1994) and Griffin et al. (1995).

After describing the scenario, the farmers were asked following set of questions

1. Have you understood the scheme? Do you have any questions regarding the scheme?

Understands ___ Does not understand _____ (Those who said they did not understand were repeated the scenario

(If the answer is 'no', or 'can't decide') Please tell us why you said 'no' or 'can't decide'

1. I still don't understand the scheme ____
2. I do not have enough money ____

3. I think the card is too costly ____
4. I do not believe the card will be needed for obtaining the service ____
5. Any other reason _____

Note that in both scenarios, no suggestion is made about any improvement in service quality. Thus, the resulting estimates are contingent on the current quality of these services. Yes, there is an assurance of guaranteed service in those scenarios, which means that the WTP estimates presented in this paper are for guaranteed service at the same quality.

The cards were offered to the respondents at five different prices. Following the questions that determine whether the respondent understood the scenario, the interviewer asked if the respondent would purchase the card. The offer prices for the two types of cards are given in Table 3.

Table 3: Offer prices for livestock service cards

(Rupees/year)

Gujarat and Rajasthan		Kerala	
Yellow card	Blue card	Yellow card	Blue card
100	300	50	100
200	600	150	200
300	900	250	350
400	1200	400	500
500	1500	500	600

Note: Rs.45=US$1 (approx.)

3. Market structure for veterinary services in the study states

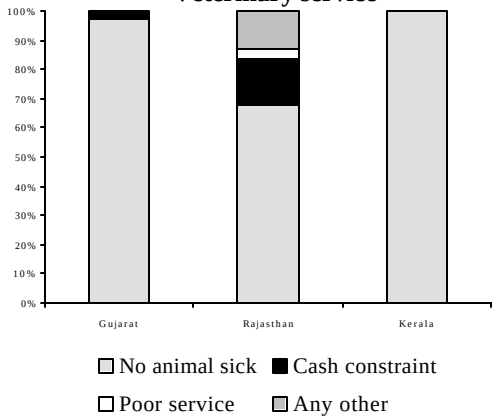
In addition to the CV questions, the survey collected information on various aspects of use of veterinary services in order to understand the current market structure for these services. This section presents selected descriptive statistics to facilitate the interpretation of the CV results.

Access to veterinary services

Access to veterinary services can be examined in two different ways. First, by specifically asking the non-users why they did not use the service during the reference period of the survey, and second, by directly asking all the respondents whether they would be able to obtain the service as and when they needed it.

In Gujarat, of the 405 households included in the survey, nearly 50 percent had not used any veterinary service during the 12 months period immediately preceding the survey. Of these over 95 percent cited 'no animal sick' as the reason for not using the service. Similarly, in Rajasthan, the proportion of non-users was about 50 percent of which approximately 68 percent cited the same reason. Comparable figures for Kerala were 30 percent and 92 percent. In Rajasthan, approximately 16 percent of the non-users also cited 'cash constraints' as the reason for not using the service (Figure 1).

Figure 1: Reasons for not using the Veterinary service



The proportion responding 'yes' to the second question—whether they would be able to obtain the service as and when they needed it—is given in Table 4. Approximately 93 percent of the respondents in Gujarat and 99 percent in Kerala said they would be able to obtain the service when needed. In Rajasthan, the comparable figure was 63 percent. The proportion of those having access to co-operative veterinary service was 47 percent in Gujarat and about 15-17 percent in Rajasthan and Kerala.

Table 4: Access to livestock health Services

Do you have access to	Percent responding yes		
	Gujarat	Rajasthan	Kerala
Ethnic/traditional healer	58.8	85.8	5.2
Private veterinarian*	10.7	13.4	19.5
Co-operative veterinary service	46.6	14.2	17.4
Government veterinary centre	93.7	63.2	99.3
Home service by a government veterinarian	93.0	57.7	99.0

- The figure with respect to private veternarians needs to be interpreted with caution. It was observed during the survey that in some, though not a very significant number of cases, the farmers did not make a distinction between the government and the private veterinarian. That was because the government veterinarian for that area had always provided service in his/her private capacity, and for all practical purposes was regarded as a private veterinarian by the farmers. Although the investigators were instructed to distinguish between different provider types, the possibility of some measurement error in this regard can not be ruled out.

An important question in the context of this study is whether poor households have similar access to these services as the rich. For the purpose of comparison across income groups,

households were classified in different categories based on the ranking by an index of wealth[4]. An examination of the access profile across groups showed that in Gujarat and Kerala, all households had good access, while in Rajasthan the poor felt more constrained with respect to receiving veterinary services. For example, in Rajasthan approximately 64 percent of the households in the bottom group reported having access to government veterinary services at the centre against 94 percent in the top group. Comparable figures for home service were 58 percent and 93 percent.

Use Pattern and prices

Recall from section 1 that (i) government is the primary provider for these services, and (ii) the services are to be delivered at government veterinary centers, except in case of emergencies. The household survey data, however, revealed that, in reality, a large number of veterinary cases are attended at home (Table 5). In Gujarat, for example, the in-centre veterinary service was practically nil. Of a total of 140 sample visits by government veterinarians in Gujarat, only 7 percent were attended at the centers. Comparable figures for Rajasthan and Kerala were 30 and 43 percent. It was quite common for the government veterinarians to attend even ordinary sickness cases at farmers' homes and the majority of such visits were undertaken in a private capacity.

Table 5: Number of sample veterinary visits disaggregated by provider type

District	Number of visits by				Total
	Government veterinarian		Home service by private veterinarian	Home service by cooperative veterinarian	
	At home	At the centre			
Gujarat	130	10	98	69	327
Rajasthan	178	79	55	9	321
Kerala	304	230	22	2	538

It is also interesting to observe that on per adult bovine basis, the number of visits in Rajasthan & Kerala increased with income whereas the trend was not so sharp in Gujarat (Table 6).

[4] See Annex 1 for details on the index as well as some statistics demonstrating robustness and internal coherence of the index.

Similarly, the proportion of home visits increased with income in these two states (Table 7). Given that a large proportion of home visits were either by private veterinarians, or by government veterinarians in private capacity, the fees for home visits were significantly higher. Again, in Gujarat, there was no significant difference in the proportion of home versus in-centre services across income groups. Both these trends were, at least partly, explained by the availability of relatively inexpensive home service from the co-operative unions in Gujarat. It is clear from Table 8 that in Gujarat a significantly larger proportion in the bottom 20 percent group relied on the co-operative system. In all the three states, the proportion of those opting for the services of private veterinarians increased with income. This was specially evident in Rajasthan and Kerala where private usage of the top 20 percent was more than double the rate of lowest 20 percent. At least part of this tendency could be explained by the fact that private veterinarians established themselves in relatively higher income areas.

Table 6: Number of veterinary visits per year

Wealth category	Gujarat		Rajasthan		Kerala	
	Visits per household	Visits per adult bovine	Visits per household	Visits per adult bovine	Visits per household	Visits per adult bovine
Bottom 20 percent	0.65	0.31	0.46	0.15	1.67	1.41
Middle 20 percent	1.21	0.49	1.35	0.41	2.32	1.76
Top 20 percent	1.07	0.40	1.87	0.60	2.16	1.81

Table 7: Home versus in-centre service disaggregated by wealth categories

(Percent)

Wealth category	Gujarat		Rajasthan		Kerala	
	Home	Centre	Home	Centre	Home	Centre
Bottom 20 percent	96.6	3.5	69.7	30.3	45.3	54.7
Middle 20 percent	93.4	6.6	72.6	27.4	68.8	31.2
Top 20 percent	97.5	2.5	86.4	13.6	58.8	41.2

Table 8: Use of different providers disaggregated by wealth categories

(Percent)

Wealth category	Gujarat				Rajasthan			Kerala		
	Govt	Coop	Priv	Oth	Govt	Priv	Oth	Govt	Priv	Oth
Bottom 20 percent	27.6	43.1	13.8	15.5	87.9	9.1	7.0	97.2	2.8	0.00
Middle 20 percent	42.0	21.0	28.4	8.60	82.1	15.1	2.4	97.5	2.5	0.00
Top 20 percent	43.8	26.3	27.6	2.50	71.8	25.2	3.0	91.6	7.4	0.00

For veterinary services at the centre, the prices prescribed by the government are either zero or very nominal (Rs.5.00 per visit in Gujarat; no fees in Rajasthan and Kerala,). However, the service users often paid much higher prices. To understand the structure of the price paid by the users, data were collected on three components—fee paid to the veterinarian (comprising of service charge, transportation charge in case of home service and any drugs and medicines supplied by the veterinarian); price of additional medicines purchased from private medical stores; and additional transportation and communication expenditures incurred by the user.

The average fee paid to the veterinarian for in-centre service was about Rs.40.00 in Rajasthan and Rs.18.00 in Kerala (Table 9). The average price paid per visit including the price of drugs and medicines was Rs. 128 in Rajasthan and Rs. 50 in Kerala. Recall that in both these states treatment received at the centre are supposed to be provided for free[5].

Table 9: Average expenditure for veterinary service at the government veterinary centre

(Rupees per visit)

State	Doctor's fee	Total visit cost*
Rajasthan	41.3	128.1
Kerala	18.4	54.9

* including the cost of additional medicines

This is not to say, however, that no one received free services at the veterinary centres. Indeed, over 60 percent of the cases attended at the veterinary centres in Rajasthan and about 58 percent in Kerala were provided free service[6]. However, as only about 30 percent of total cases attended by government veterinarians in Rajasthan were at the veterinary centres, free services

[5] Due to the limited extent of in-centre service in Gujarat, the statistics for in-centre service in Gujarat, are excluded.

actually only accounted for about 18 percent of total cases attended by government veterinarians in Rajasthan and 25 percent in Kerala.

The prescribed fee for emergency home visits was equivalent to that for in-centre service except that the government veterinarians were allowed to charge a nominal amount to cover transportation cost. In reality, however, the charges were significantly higher than what could be justified as the transportation cost. Estimated average price for a home visit (excluding the cost of medicines purchased at the stores) by a government veterinarian was Rs.94.0 in Kerala, Rs. 110.0 in Gujarat and Rs.227.0 in Rajasthan (Table 10). In all three states, less than 5 percent of the cases attended at home were reported to be treated for free. Examination of the total visit cost (including additional expenditures on medicines for home visits in addition to what the veterinarians supplied), indicated that, in Gujarat and Rajasthan, the additional medicine expenditures per visit for government veterinarians was significantly higher than for private veterinarians. Both these comparisons indicate that private veterinarians normally provided more medicines during the visit, whose costs were incorporated in the fees charged for the visit. Only in Kerala, the medicine component in the case of private veterinarians was higher than in the case of government veterinarians but the difference was small.

[6] Excluding the cost of medicines purchased at the stores.

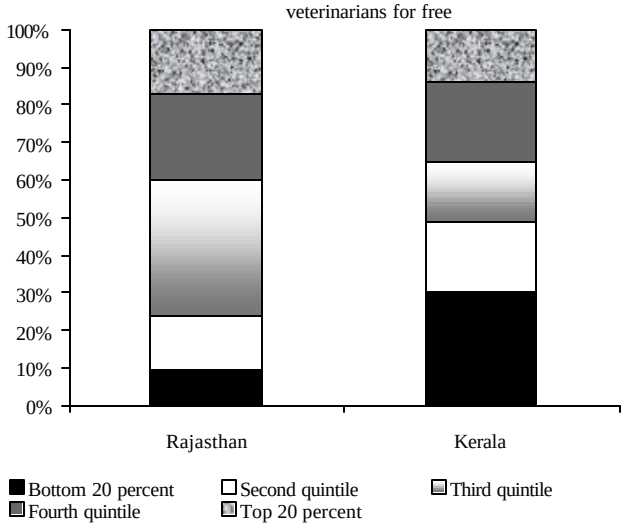
Table 10: Average visit cost per home visit

(Rupees)

Disease	Gujarat			Rajasthan		Kerala	
	Govt	Coop	Private	Govt.	Private	Govt	Private
Visit charge	110.5	44.5	184.5	227.2	206.0	94.3	98.0
Additional drugs & medicines	56.7	7.5	17.7	10.6	80.4	83.7	106.2
Total visit cost	161.2	51.5	202.2	332.8	286.4	178	204.2

It is clear from the preceding discussion that a large proportion of *veterinary service users paid prices for government service that were several times higher than what was officially prescribed*. Indeed, for home visits, the average price paid for treatment received from a government veterinarian was only slightly lower that those charged by private veterinarians. Only a small fraction – approximately 15 percent in Rajasthan, 25 percent in Kerala, and less than 1 percent in Gujarat – received services for free, and not all of those receiving free service actually belonged to the 'poor' catgeory. In Rajasthan, only about 10 percent of those receiving free service belonged to bottom quintile. In Kerala, the comparable figure was about 30 percent. In both the states, about 40 percent of those receiving free service belonged to top two quintiles (Figure 2).

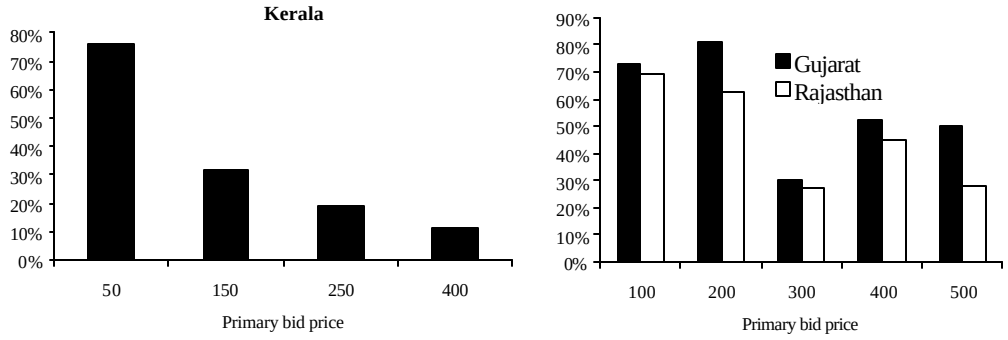
Figure 2: Distribution of cases attended by government veterinarians for free



4. Willingness to pay: Findings from CV survey

As noted before, a total of five different price levels were used in this survey for eliciting WTP. The distribution of those who agreed to buy the offered card is shown in Figure 3. In Gujarat and Rajasthan, approximately 70 percent of those who were offered the yellow card at the price of Rs.100.00 responded 'yes', they would buy it. At the highest price of Rs.500.00, the proportion fell to approximately 28 percent in Rajasthan and 50 percent in Gujarat. In Kerala, the lowest bid price for the yellow card was Rs.50.00. At this price, about 76 percent of the respondents agreed to buy the card, with the proportion falling down to 11 percent at the highest price of Rs.400.00. In the case of the blue card, approximately 90 percent of the respondents agreed to buy the card at the lowest price of Rs.100.00 in Kerala. In Gujarat and Rajasthan, where the lowest price was Rs.300.00, the proportion agreeing to buy the blue card was between 70–75 percent. The proportion declined with successive increments in the bid price and was in the range of 10–15 percent for the highest price of Rs.1,500.00 (Figure 4).

Figure 3: Percent Agreeing to Purchase the Yellow Card



Whether the respondents believe in the scenario being presented to them is an important concern in the CV studies. For those who agreed to buy the card, it is reasonable to assume that they believed in the scenario. For those who declined the offer, a set of follow-up questions was included to assess whether the decline was due to skepticism with respect to the scenario or due to other legitimate reasons. Figure 5 shows the distribution of those answering 'no' by the reason provided by the respondents. It is interesting to observe that a large number of 'no' responses were driven by either the lack of funds for purchasing the card, or a judgment that the card was overly priced in relation to its value. Both these are legitimate reasons for a 'no' response and, combined together, these accounted for over 80 percent of the 'no' responses in Gujarat and Rajasthan and

Figure 4: Percent Agreeing to Purchase the Blue Card

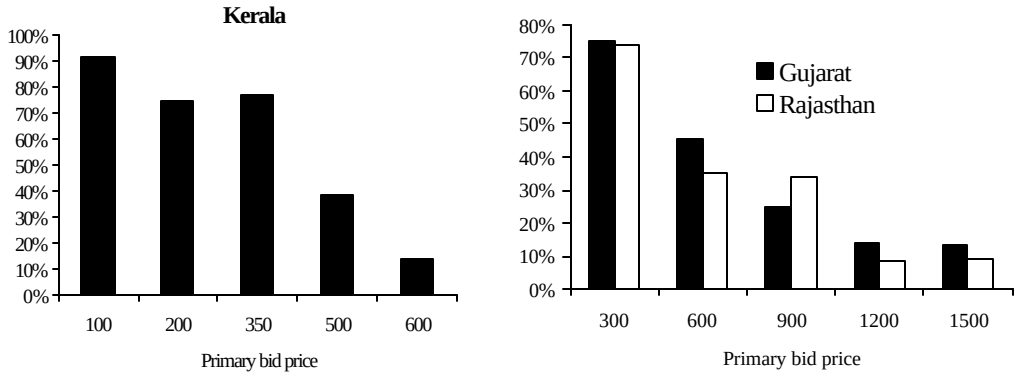
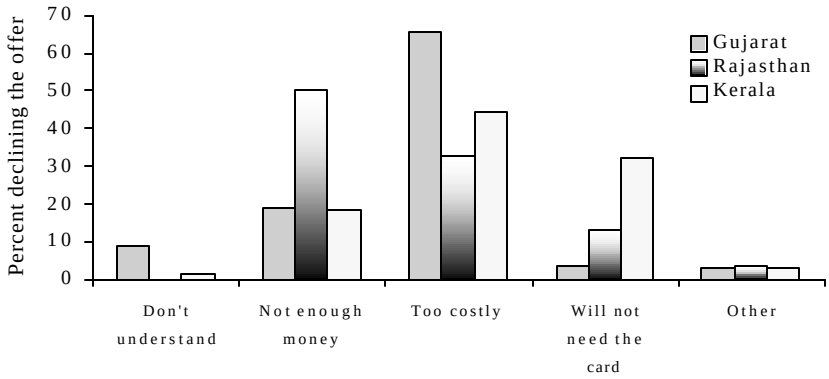


Figure 5: Reasons for not agreeing to purchase the card



about 65 percent in Kerala. This lends a fair degree of credibility to the resulting WTP estimates.

A number of complex econometric models can be employed to analyze the binary choice CV responses. But, these models often complicate and obscure the simple information content of

these responses. For the purpose of inferring average willingness to pay, we use relatively simple non-parametric estimator[7]. One difficulty with this estimator, however, is that it requires making assumptions about the maximum amount anyone would be willing to pay. That is, the price at which no one would agree to the offer. The estimates in this study were obtained by assuming two upper bounds for each type of service in each of the states. The estimates of WTP along with assumed upper bounds are given in Tables 11a and 11b. The estimates are not very sensitive to the upper bounds. For example, in case of home service in Gujarat and Rahasthan, raising the upper bound by over 10 percent leads to an increase of less than 2 percent in average WTP. Similarly, in Kerala, an increase in upper bound by 25 percent results in the increase of average WTP by less than 4 percent.

Table 11a: Non parametric estimates of mean WTP: Gujarat and Rajasthan

(Rs./year)

Assumed upper bound (Rupees)	Service type			
	Home		In-centre	
	Gujarat	Rajasthan	Gujarat	Rajasthan
750	..	..	376.3	307.8
1000	..	..	438.8	342.8
1800	666.3	631.9	..	..
2000	679.5	640.9	..	..

Table 11b: Non parametric estimates of mean WTP: Kerala

(Rs./year)

Assumed upper bound (Rupees)	Service type	
	Home	In-centre
500	..	139.0
600	..	145.6
800	305.8	..
1000	316.6	..

[7] Also known as Turnbull estimator. See, Haab and McConnell (1999).

The estimates suggest that, on average, the farmers are willing to pay between Rs.630.00–680.00 per household per year for home veterinary services in Gujarat and Rajasthan and about Rs.300.00-320.00 per household per year in Kerala. For the service at the centre, the farmers would be willing to pay approximately Rs.300.00–350.00 in Rajasthan and Rs.140.00–150.00 per annum in Kerala. These estimates suggest that there is significant scope of raising revenues from livestock services delivered by government and/or setting up private veterinary practice.

The second question – whether there is any systematic relationship between the WTP and income/wealth level – cannot be addressed in the non-parametric framework. To analyze the determinants of WTP, the binary choice responses were analyzed using the Probit model. Results are presented in Table 12. The signs on the coefficients are generally consistent with a-priori expectations. The coefficient on offer price is consistently negative and statistically significant. Similarly, except in case of in-centre service in Kerala, the coefficient on wealth index is positive and statistically significant in the case of in-centre service in all states and for home service in Gujarat

To appreciate the coefficients on 'wealth index' it is helpful to focus on home and in-centre service separately. First, for home service, the farmers in Gujarat have more choice than in Rajasthan and Kerala. In the survey, approximately 40 percent of the respondents reported having access to both government and cooperative service providers. The comparable figures for Rajasthan and Kerala were 8.8 and 10.2 percent respectively. The implication is that the poor in Gujarat have the alternative of switching over to home service by cooperative unions whereas in Kerala and Rajsthan, they do not have that option. In absence of alternatives, the poor are willing to pay as much as the relatively rich in Rajasthan and Kerala.

The second question – whether there is any systematic relationship between the WTP and income/wealth level – cannot be addressed in the non-parametric framework. To analyze the determinants of WTP, the binary choice responses were analyzed using the Probit model. We specify a model of willingness to pay that depends linearly on the wealth index, education of the household, number of bovine animals, proportion of cross breeds, and the number of veterinary visits in the previous year. Thus the willingness to pay is given by

$$WTP = b_0 + b_1 wealth + b_2 education + b_3 bovine + b_4 cross + b_5 visits + e$$

where e is a normal variate distributed $N(0,\sigma^2)$. The probability of a yes response is the probability that WTP exceeds the offer price of the card:

Prob(yes) = Prob(WTP>offer price) =

Prob($b_0 + b_1$wealth + $b_2$education + $b_3$bovine + $b_4$cross + $b_5$visits + e>offer price)

=Prob([b_0+$b_1$wealth+ $b_2$education+ $b_3$bovine+ $b_4$cross+ $b_5$visits -offer price]/ σ> -e/σ)

The last statement is suitable for estimation with a probit, because e/σ is N(0,1). Results are presented in Table 12. The signs on the coefficients are generally consistent with a-priori expectations. The coefficient on offer price is consistently negative and statistically significant. Similarly, except in case of in-centre service in Kerala, the coefficient on wealth index is positive and statistically significant in the case of in-centre service in all states and for home service in Gujarat.

To appreciate the coefficients on 'wealth index' it is helpful to focus on home and in-centre service separately. First, for home service, the farmers in Gujarat have more choice than in Rajasthan and Kerala. In the survey, approximately 40 percent of the respondents reported having access to both government and cooperative service providers. The comparable figures for Rajasthan and Kerala were 8.8 and 10.2 percent respectively. The implication is that the poor in Gujarat have the alternative of switching over to home service by cooperative unions whereas in Kerala and Rajsthan, they do not have that option. In absence of alternatives, the poor are willing to pay as much as the relatively rich in Rajasthan and Kerala.

Coming now to in-centre service, first it should be noted that the yellow card was offered to those who normally took their animals to veterinary centers instead of calling the veterinarian home. Thus, the sample for this category comprised of relatively poorer households than the sample of respondents who were offered the blue card. Within this sample, in both Gujarat and Rajasthan, the willingness to pay increased with wealth level. However, in Kerala, positive responses to the willingness to pay question tend to increase when the wealth level goes down.

There can be several reasons for the mixed response to the wealth variable. First, since this is a computed variable, there could be some error in its measurement. Second, there is collinearity between the number of bovine animals and the wealth index. And for Kerala, where the effect of the wealth variable is negative, the number of bovine animals as a very strong positive effect on the probability of a yes response.

Table 12: Probit analysis of binary choice contingent valuation responses

Variable	In-centre service			Home service		
	Gujarat	Rajasthan	Kerala	Gujarat	Rajasthan	Kerala
Intercept	2.772 (0.77)*	3.128 (0.568)	0.336 (0.46)	1.351 (0.31)	1.490 (0.380)	1.078 (0.444)
Price	-0.752 (0.189)	-0.665 (0.122)	-0.679 (0.09)	-0.245 (0.030)	-0.222 (0.030)	-0.413 (0.060)
Wealth index	1.232 (0.565)	0.606 (0.31)	-0.292 (0.128)	0.310 (0.11)	0.108 (0.105)	0.047 (0.125)
Average education level of the household	0.149 (0.085)	0.154 (0.08)	0.078 (0.04)	0.056 (0.03)	0.028 (0.051)	0.014 (0.048)
Number of bovine animals owned by the household	0.148 (0.114)	0.017 (0.02)	0.280 (0.17)	0.06 (0.02)	0.014 (0.021)	0.191 (0.11)
Proportion of crossbreds in total bovine	0.076 (1.22)	0.072 (1.31)	0.058 (0.213)	0.552 (0.74)	1.355 (0.690)	0.329 (0.22)
Number of veterinary visits during the preceding year	-0.086 (0.142)	0.19 (0.10)	0.041 (0.07)	0.220 (0.068)	0.155 (0.06)	0.080 (0.060)
Chi-square value	37.8	48.9	83.2	153.3	88.0	63.8
Number of observations	97	139	203	309	212	201
Percent predicted correctly	78.3	83.4	78.6	79.6	76.4	75.0

* Figures in parentheses are standard errors.

In order to get a better sense of differences in the average willingness to pay for different groups, we calculated the percent difference in the WTP between first and third quintile and third and fifth quintile. These are shown in Figures 6a and 6b. It is interesting to observe that the difference between 3rd and 5th quintile is relatively much higher than the difference between 1st and 3rd quintile. For home service in Gujarat the willingness to pay for the top 20 percent group was almost 40 percent more than those in the middle 20 percent group. On the other hand, the difference between bottom 20 percent and the middle 20 percent was only about 20 percent. In Rajasthan and Kerala,

these differences were statistically not significant. In the case of in-centre service in Kerala, the WTP for the middle 20 percent was slightly lower than the bottom 20 percent.

Figure 6a: Estimated percent difference in the WTP for in-centre veterinary service

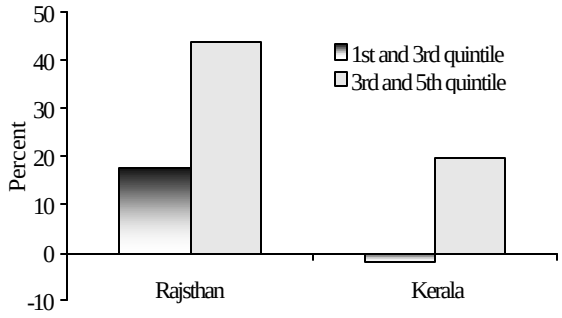
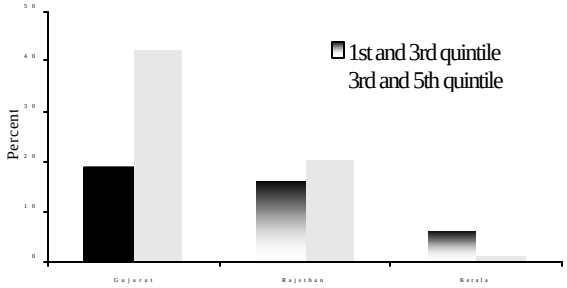


Figure 6b: Estimated percent difference in the WTP for home veterinary service



Other important variables in Table 12 are the size of bovine stock and the number of veterinary visits undertaken by the household during the 12 months period immediately preceding the survey. In Gujarat and Kerala, households with larger bovine stock were willing to spend more on veterinary services. Similarly, the households who undertook larger number of visits during the preceding year were willing to pay more for veterinary services, which illustrates the role of expectation formation. Those households who undertook more visits during the 12 months preceding the survey also expected the number of visits to be higher in future and thus, on an annual basis, were willing to pay more.

Conclusion

This paper has presented the estimates of WTP for curative veterinary services in three states of India, and an analysis of its determinants. It is found that most farmers are willing to pay for receiving veterinary services. Since a larger proportion of households are opting for home service, it suggests that the farmers have a preference for home service.

For home service, a significant, positive relationship is found between income and WTP in Gujarat. This suggests that WTP for home service by government veterinarians is lower for poorer households in this state. In the other two states, such a relationship could not be established. For in-centre service, on the other hand, WTP for government service is lower for poorer households in both Gujarat and Rajasthan.

One direct message from this analysis is that there is significant demand for these services. Service users, including the poor, are willing to pay, and are paying, to receive these services. There is significant potential for private sector participation and for cost recovery. Adjusting official rates towards full cost recovery can enable the government to raise the necessary resources to improve the availability and quality of its services and in leveling the playing field between government and private providers, attract greater private participation that could improve the availability of livestock services for all farmers. As area specific characteristics, such as income levels, size and composition of livestock herds, do influence WTP significantly, these factors will need to be considered in formulating an appropriate pricing policy for livestock services.

Annex: The Asset Index

This study uses a composite index based on indicators of household assets to classify households in various income categories. The index was constructed using weights chosen by principal components as proposed by Filmer and Pritchett (1998). This annexure describes the methodology used for constructing the index as well as presents some statistics to demonstrate the robustness and internal coherence of the index.

This index uses 24 asset variables which can be divided into four categories: ownership of consumer durables, characteristics of the house occupied by the household, ownership of land, and finally, ownership of livestock. Specific variables considered in each of these groups are listed below.

Ownership of consumer durables	House characteristics	Land ownership	Livestock ownership
• Radio	• Own/rented	• Irrigated land (acres)	• Number of local c
• Camera	• Number of rooms	• Un-irrigated land (acres	
• Scooter	• In-house piped wate supply		• Number of crossbred cows
• Car	• Flush toilet		
• Refrigerator	• Construction materia		• Number of buffaloes
• Washing machine			
• Fans (number)			
• Heater			
• Television (B&W)			
• Television (colour)			
• Petromax			
• Cooker			
• Watches (number)			

The index is a weighted linear wealth index where the weights are obtained using the procedure of principal components[8]. The index is constructed as follows

$$A_{ij} = \sum_k f_k \frac{(a_{ijk} - a_{jk})}{s_{jk}}$$

8 Principal components is a procedure for extracting from a large number of variables those linear combinations that capture common information in those variables.

where A_{ij} is value of index for i^{th} household in j^{th} state, f_k is the factor score coefficient for the k^{th} asset as determined by the principal component procedure, a_{ijk} is value of k^{th} asset for i^{th} household in j^{th} state, and a_{jk} and s_{jk} are the mean and standard deviation of the k^{th} asset over all households in j^{th} state. Table A1 presents the factor coefficients used as the weight for constructing the index and the summary statistics for the states as a whole.

The index uses seven continuous variables: number of watches owned, number of fans owned, number of rooms in the house, area under irrigated land, area under un-irrigated land and number of indigenous cows, crossbred cows and buffaloes owned by the household. All other variables take the value of one if the household owns that asset, zero otherwise.

The interpretation of the index is simple–for continuous variables, the difference between the value of index represents the difference between mean asset ownership weighed by f_{kj}/s_{jk}. For discrete variables, the ownership of asset simply raises the index by f_{jk}/s_{jk}.

Mean value of the index is zero by construction. The standard deviation ranges from 0.95 to 1.00 across states (Table A2). The mean for the poorest households is -0.84, -0.77 and -1.00 for Gujarat, Rajsthan and Kerala, respectively. Comparable figures for the richest households are 1.60, 1.57 and 1.56 (Table A3).

Table A2: Asset index summary statistics

Summary measure	Gujarat	Rajasthan	Kerala
Mean	0.00	0.00	0.00
Standard deviation	0.99	1.00	0.95
Minimum	-1.04	-0.94	-1.33
Maximum	5.80	5.59	3.54

Table A3: Mean values of asset index by wealth categories

Category	Gujarat	Rajasthan	Kerala
Bottom 20 %	-0.87	-0.77	-1.00
2^{nd} quintile	-0.61	-0.58	-0.65
3^{rd} quintile	-0.34	-0.33	-0.28
4^{th} quintile	0.20	0.16	0.36
Top 20 %	1.60	1.57	1.56

The index does very well in separating poor, middle and rich households. Table A4 presents the

summary statistics for the variables used in constructing the index across bottom, middle and top 20 percent categories as ranked by the asset index. It is clear that index produces a very sharp difference across these groups in nearly every asset. For example, in Gujarat, ownership of unirrigated land is 1.6 acres for the poorest households and 7.6 acres for the richest. Comparable figures for irrigated land are 0.33 acres and 5 acres. Similarly, the poorest 20 percent households in the sample in Gujarat owned 1.25 cattle compared to 1.27 for the top 20 percent. Also, the proportion of crossbreds in cattle stock was almost 2 percent for the poorest households compared to 42 percent for the richest households. Similar separations can be seen across all variables in all the three states.

Table A1: Factor coefficients and summary statistics for the variables used in constructing the index

	Gujarat			*Rajasthan*			*Kerala*		
	Factor coeff	*Mean*	*SD*	*Factor coeff*	*Mean*	*SD*	*Factor coeff*	*Mean*	*SD*
Own radio	*0.084*	*0.446*	*0.582*	*0.082*	*0.435*	*0.560*	*0.067*	*0.852*	*0.417*
Own camera	*0.074*	*0.019*	*0.137*	*0.039*	*0.014*	*0.139*	*0.027*	*0.017*	*0.128*
Own scooter/motorcycle	*0.121*	*0.175*	*0.405*	*0.103*	*0.083*	*0.547*	*0.109*	*0.150*	*0.357*
Own car	*0.066*	*0.019*	*0.218*	*0.034*	*0.008*	*0.091*	*0.057*	*0.048*	*0.272*
Own refrigerator	*0.120*	*0.105*	*0.330*	*0.110*	*0.036*	*0.187*	*0.135*	*0.190*	*0.393*
Own washing machine	*0.052*	*0.002*	*0.490*	*0.054*	*0.003*	*0.053*	*0.061*	*0.076*	*0.364*
Number of fans	*0.146*	*1.242*	*1.303*	*0.143*	*0.784*	*1.357*	*0.139*	*1.657*	*1.696*
Own heater	*0.053*	*0.016*	*0.128*	*0.070*	*0.025*	*0.292*	*0.068*	*0.035*	*0.185*
Own television (B&W)	*0.061*	*0.187*	*0.397*	*0.121*	*0.216*	*0.486*	*-0.007*	*0.147*	*0.355*
Own television (colour)	*0.096*	*0.064*	*0.246*	*0.097*	*0.022*	*0.147*	*0.119*	*0.369*	*0.483*
Own petromax	*0.007*	*0.014*	*0.119*	*0.049*	*0.003*	*0.053*	*0.030*	*0.021*	*0.145*
Own cooker	*0.136*	*0.419*	*0.642*	*0.120*	*0.066*	*0.335*	*0.126*	*0.335*	*0.573*
Number of watches	*0.124*	*1.402*	*1.258*	*0.118*	*1.177*	*1.287*	*0.128*	*2.230*	*1.500*
Own phone	*0.103*	*0.048*	*0.213*	*0.092*	*0.022*	*0.147*	*0.128*	*0.174*	*0.379*
Own sewing machine	*0.046*	*0.062*	*0.252*	*0.105*	*0.230*	*0.477*	*0.058*	*1.007*	*0.418*
Own house	*0.015*	*0.983*	*0.129*	*0.015*	*0.992*	*0.091*	*0.007*	*0.992*	*0.084*
Number of rooms in the house	*0.091*	*2.210*	*1.130*	*0.107*	*2.280*	*1.702*	*0.115*	*3.795*	*1.711*
Concrete walls	*0.016*	*0.134*	*0.341*	*0.002*	*0.089*	*0.285*	—	*0.000*	*0.000*
Cement brick walls	*0.076*	*0.326*	*0.469*	*0.092*	*0.230*	*0.421*	*0.050*	*0.140*	*0.347*
Mud brick walls	*0.019*	*0.141*	*0.349*	*-0.017*	*0.269*	*0.444*	*-0.002*	*0.502*	*0.500*
Unbaked brick walls	*0.009*	*0.019*	*0.137*	*-0.007*	*0.006*	*0.074*	*-0.002:*	*0.119*	*0.324*
Mud walls	*0.048*	*0.249*	*0.433*	*-0.051*	*0.219*	*0.414*	*-0.043*	*0.069*	*0.254*
In-house piped water supply	*0.039*	*0.205*	*0.404*	*0.089*	*0.162*	*0.369*	*0.089*	*0.193*	*0.395*
Flush toilet	*0.084*	*0.041*	*0.198*	*0.080*	*0.019*	*0.138*	*0.077*	*0.790*	*0.407*
Irrigated land (acres)	*0.094*	*1.763*	*4.542*	*0.076*	*4.304*	*8.416*	*0.076*	*0.496*	*1.329*
Un-irrigated land (acres)	*0.054*	*3.642*	*8.358*	*-0.004*	*6.662*	*18.67*	*0.004*	*1.130*	*2.045*
Number of local cows	*0.004*	*1.203*	*3.754*	*0.011*	*2.941*	*5.257*	*0.010*	*0.535*	*0.776*
Number of crossbred cows	*0.064*	*0.159*	*0.787*	*0.032*	*0.047*	*0.281*	*0.004*	*0.797*	*0.938*
Number of buffaloes	*0.008*	*1.605*	*2.585*	*0.026*	*1.510*	*3.108*	*-0.01*	*0.024*	*0.168*

Note: SD - Standard Deviation.

Table A4: Summary statistics for the variables used in constructing the index disaggregted by wealth categories

	Gujarat			*Rajasthan*			*Kerala*		
	Bottom 20 %	*Middle 20 %*	*Top 20 %*	*Bottom 20 %*	*Middle 20 %*	*Top 20 %*	*Bottom 20 %*	*Middle 20 %*	*Top 20 %*
Own radio	*0.079*	*0.415*	*0.902*	*0.103*	*0.403*	*0.845*	*0.506*	*0.893*	*1.036*
Own camera	*0.000*	*0.000*	*0.097*	*0.000*	*0.000*	*0.070*	*0.012*	*0.000*	*0.048*
Own scooter	*0.000*	*0.061*	*0.682*	*0.000*	*0.000*	*0.338*	*0.000*	*0.012*	*0.578*
Own car	*0.000*	*0.000*	*0.085*	*0.000*	*0.000*	*0.028*	*0.000*	*0.012*	*0.169*
Own refrigerator	*0.000*	*0.000*	*0.512*	*0.000*	*0.000*	*0.183*	*0.000*	*0.000*	*0.807*
Own washing machine	*0.000*	*0.000*	*0.012*	*0.000*	*0.000*	*0.014*	*0.000*	*0.0.36*	*0.034*
Number of fans	*0.202*	*0.902*	*2.866*	*0.039*	*0.264*	*2.745*	*0.129*	*1.524*	*3.687*
Own heater	*0.000*	*0.000*	*0.085*	*0.000*	*0.000*	*0.127*	*0.000*	*0.012*	*0.145*
Own television (B&W)	*0.022*	*0.134*	*0.439*	*0.000*	*0.014*	*0.817*	*0.082*	*0.226*	*0.084*
Own television (colour)	*0.000*	*0.000*	*0.317*	*0.000*	*0.000*	*0.113*	*0.000*	*0.214*	*0.879*
Own petromax	*0.011*	*0.000*	*0.036*	*0.000*	*0.000*	*0.014*	*0.000*	*0.024*	*0.072*
Own cooker	*0.034*	*0.146*	*1.244*	*0.000*	*0.000*	*0.323*	*0.000*	*0.131*	*1.024*
Number of watches	*0.416*	*1.427*	*2.707*	*0.211*	*0.986*	*2.479*	*0.824*	*2.214*	*3.759*
Own phone	*0.000*	*0.000*	*0.220*	*0.000*	*0.000*	*0.113*	*0.000*	*0.000*	*0.735*
Own sewing machine	*0.022*	*0.037*	*0.171*	*0.000*	*0.125*	*0.760*	*0.023*	*0.262*	*0.422*
Own house	*0.942*	*1.000*	*1.000*	*1.000*	*0.980*	*1.000*	*1.000*	*0.990*	*1.000*
Number of rooms in the house	*1.460*	*2.073*	*3.121*	*1.486*	*2.653*	*4.507*	*2.365*	*3.714*	*5.349*
Concrete walls	*0.056*	*0.085*	*0.207*	*0.039*	*0.099*	*0.113*	*0.000*	*0.000*	*0.000*
Cement brick walls	*0.045*	*0.305*	*0.622*	*0.000*	*0.167*	*0.619*	*0.000*	*0.190*	*.0301*
Mud brick walls	*0.213*	*0.195*	*0.048*	*0.210*	*0.292*	*0.183*	*0.459*	*0.560*	*0.469*
Unbaked brick walls	*0.034*	*0.024*	*0.000*	*0.000*	*0.013*	*0.000*	*0.129*	*0.107*	*0.048*
Mud walls	*0.449*	*0.256*	*0.073*	*0.552*	*0.139*	*0.028*	*0.235*	*0.012*	*0.000*
In-house piped water supply	*0.115*	*0.100*	*0.451*	*0.081*	*0.097*	*0.352*	*0.012*	*0.155*	*0.434*
Flush toilet	*0.011*	*0.012*	*0.183*	*0.000*	*0.000*	*0.098*	*0.376*	*0.917*	*1.000*
Irrigated land (acres)	*0.328*	*1.138*	*5.000*	*0.957*	*2.647*	*11.47*	*0.062*	*0.337*	*1.157*
Un-irrigated land (acres)	*1.645*	*2.227*	*7.560*	*3.380*	*8.313*	*4.112*	*0.263*	*0.725*	*2.713*
Number of local cows	*1.224*	*1.158*	*0.732*	*1.445*	*3.402*	*3.140*	*0.500*	*0.535*	*0.590*
Number of crossbred cows	*0.023*	*0.073*	*0.537*	*0.000*	*0.083*	*0.084*	*0.702*	*0.928*	*0.710*
Number of buffaloes	*1.247*	*1.585*	*1.500*	*0.878*	*1.312*	*2.309*	*0.059*	*0.000*	*0.012*

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