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Market structure and the demand for veterinary services in India

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Abstract

The livestock sector is emerging as one of the fastest growing agricultural sub-sectors in India and the expectations are that this growth could further accelerate due to growing incomes and the high income elasticity of demand for livestock products. Given the size and relatively equitable distribution of livestock in India, this presents an excellent opportunity for the country to boost rural incomes and accelerate the pace of poverty reduction. But, successful capitalisation of such opportunities requires a policy regime that facilitates growth in productivity at the farm level as well as in the processing sector. 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. The public sector continues to be the primary provider of veterinary services, and the deteriorating fiscal situation of most state governments is making it extremely difficult to either expand the reach of these services or improve the quality of service delivery. Although, on efficiency grounds, there is good rationale for commercialised delivery of these services, serious concerns prevail in India about the equity implications of private sector delivery or full cost recovery within the government system.

Evaluation of the desirability of user fees or private delivery of livestock services requires an understanding of the factors influencing the demand for these services. This paper examines the nature of demand for veterinary services in three states of India and presents first estimates of demand elasticities for veterinary services. The results indicate that price is not an important determinant of the decision to use these services. Also, practically no variation is found in price elasticities across income groups. These results suggest that the fears of sharp declines in the use of these services as a result of full cost recovery and/or private sector delivery are unfounded.

JEL classification: H23; H42; L33; Q12

Keywords: Veterinary services; Privatisation; India; Poor; Livestock health; Demand analysis

1. Introduction

Public provision of subsidised or free animal health services has been a major component of the livestock development strategy in India. Over time, the governments (both state and central) 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 2000 in 1951 to over 50,000 at the end of 1997–1998. These institutions employed some 100,000 professionals and para-professionals. But, the

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quality of service provided by these institutions continues to be poor. Very few 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.

Significant market led opportunities are opening up for the livestock sector. The value of livestock output has grown by over 4.5% per year between 1990–1991 and 1997–1998, and there are expectations of even faster growth in demand for livestock products due to expected increases in incomes combined with the high income elasticity of demand for livestock products.[1] At the global level as well, livestock production is growing faster than any other agricultural sub-sector and, by 2020, this sub-sector is predicted to produce more than half of the total agricultural output in value terms. Growth in demand for livestock products is primarily expected to emanate from the developing countries due to human population growth, increasing urbanisation and rising incomes. This 'livestock revolution' (Delgado et al., 1999) is likely to have a significant influence on global economy in general and the economy of developing countries in particular.

Given that India's animal wealth is large and equitably distributed, these developments present an enormous opportunity for India to boost rural incomes and accelerate the pace of poverty reduction. However, successful capitalisation of these opportunities requires a policy regime that facilitates growth in farm as well as processing productivity. 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. Despite a number of initiatives since the early 1960s to increase milk production and improve the quality and supply of draught animals, the quality of services remains poor. On the health side, the focus throughout the planning period has been on enhancing the supply of veterinary services by expanding the capabilities and coverage of the State Departments of Animal Husbandry. Over 75% of the staff are, however, committed to delivery of curative veterinary care and AI services. The professional staff responsible for disease investigation and control, is a meagre 3.5% of the total, supplemented by limited vaccination input by the para-veterinary staff. As a result, transboundary animal diseases such as FMD are still prevalent in India and undercut India's ability to compete in the global market place.

It is clear that the future growth of the livestock sector will depend crucially on the availability of good quality health services—both preventive and curative. At the same time, the deteriorating fiscal situation in many states combined with low cost recovery is likely to make it extremely difficult to find funds for either expanding the reach of these services or improving the quality of delivery from the existing network. Currently, over 85% of the annual budget of animal husbandry departments is spent on salaries and establishment costs, leaving little funds for essential supplies and medicines.

Most curative and some preventive veterinary services fall into the category of private goods. On efficiency grounds, therefore, there is a good rationale for private sector provision of these services and/or full cost recovery within the government system.[2] Commercialised delivery of these services has the potential of easing the budgetary constraints as well as improving the service quality. But, there are serious concerns in India about the equity implications of private sector delivery or full cost recovery. More specifically, there are concerns that commercialisation could adversely affect the access to these services by poor farmers. Given that over 60% of total livestock in India is owned by small and marginal farms and landless households, it is important that these concerns be adequately examined before initiating the commercialisation of these services.

Evaluation of the desirability of user fees or private delivery of livestock services requires an understanding of the factors influencing the demand for these services, especially the price elasticities, i.e. how the changes in the price of these services are likely to affect their use. To be able to say something about

[1] According to one estimate, the expenditure elasticity for milk is about 1.5 in rural and 1.0 in urban areas. Comparable estimates for the meat and eggs group are 1.04 and 0.75 (Bhalla and Hazell, 1997).

[2] See Umali et al. (1992, 1994), Ahuja and Redmond (2001), Holden et al. (1996) for a conceptual discussion on the economic framework for livestock service delivery.

how the changes will affect service users in different income groups, one needs to also ascertain whether the price elasticity of demand for these services varies with income. In other words, is demand by the poor relatively more sensitive to the changes in prices than by the non-poor. If this is true, price changes may have a larger impact on the use of these services by the poor compared with the non-poor. Against this background, this paper examines the nature of demand for veterinary services in three states of India and presents first estimates of demand elasticities for veterinary services.

The organisation of this paper is as follows. The data used in the study and the econometric specification of the demand model are given in Section 2. Section 3 presents a descriptive analysis of the institutional and the market structure for veterinary services to facilitate understanding of the demand analysis. The results of the econometric analysis and estimates of demand elasticities are presented in Section 4. Section 5 offers concluding remarks and some policy implications of the results.

2. Data and methodology

This study is based on primary data collected in three states of India—Gujarat, Rajasthan and Kerala, during April–June 1999. The survey covered 1185 livestock owning households and collected information on the number and nature of veterinary visits during the 12 months period immediately preceding the survey. This included the expenditure on each visit, travel and waiting time, place of service, type of service provider, and so on. In addition, data were also collected on a number of household-specific variables such as education, farm characteristics, ownership of consumer durables, etc.

The sample for the survey was drawn from 24 villages located across six districts in Gujarat and Rajasthan each, and 28 villages located in seven districts in Kerala. The districts were selected so as to ensure adequate representation of areas with low, medium and high livestock density, as well as agriculturally prosperous and backward regions. Within the districts, the villages were selected randomly using the 1991 population census as the sampling frame.

2.1. Demand for veterinary services: the empirical model

Assuming that (i) the households seek to maximise profits from livestock raising, (ii) the production function is separable between veterinary care and other inputs, and (iii) there are no credit markets for financing the expenditure on veterinary services, economic theory suggests that the demand for veterinary visits depends on the price of milk, the price of veterinary care, household income, and the herd size. That is,

$$N_i = f(v, P, Y_i, B_i) \tag{1}$$

where N_i is the number of veterinary visits to the ith household, v the price of veterinary care, P the price of milk, Y_i the household income, and B_i the number of bovine animals owned by the ith household.

In addition to these variables, a number of other household and location-specific factors are also likely to affect the decision to seek veterinary care. That is,

$$N_i = f(v, P, Y_i, B_i, \boldsymbol{Z}_i, \boldsymbol{D}) \tag{2}$$

where $\boldsymbol{Z}_i$ and $\boldsymbol{D}$ are vectors of household and location-specific characteristics. Further, by including an interaction term between price and income, one can obtain the elasticities for different income levels. With this background, the final estimating model for this study was specified as:

$$N_{ijk} = \alpha_0 + \alpha_1 v_{jk} + \alpha_2 P_{ijk} + \alpha_3 Y_{ijk} + \alpha_4 v_{jk} Y_{ijk} + \sum_l \eta_l Z_{ijk} + \lambda_k D_k + \varepsilon_{ijk} \tag{3}$$

where subscripts j and k refer to the village and districts, respectively. That is, N_{ijk} represents the number of veterinary visits to the ith household in the jth village in the kth district. Other variables are similarly defined. ε_{ijk} is a stochastic error assumed to be distributed normally with zero mean and finite variance.

The two most important variables in Eq. (3) are household income and the price of veterinary care. Both these variables deserve further comment in the context of the problem at hand. We take up each of these in turn.

2.2. Household income

Household income comprises earnings from sale of milk and crop output, as well as non-farm income. Since profits from milk production depend on whether the household seeks veterinary care in the event of an animal getting sick, current household income is clearly determined within the model and is therefore endogenous. To avoid simultaneity bias, therefore, we used an index of assets as an instrument for current household income. Details about the index including summary statistics by groups are presented in Appendix A.

2.3. The price of veterinary services

The household survey data used provide information on the amount spent on each visit. These represent unit values of the veterinary services, and not necessarily the true exogenous prices faced by service users. Unit values are different from the prices in that they reflect the choice of quality as well as the actual prices the household faces in the market. To estimate the true effect of price on demand, it is necessary that the quality effects be netted out of the unit values to obtain true prices (see Deaton, 1997 for a detailed discussion of unit values and prices). Consider the following regression,

$$v_{ijk} = \beta' Z_{ijk} + \sum_j \theta_{jk} d_{jk} + \zeta_{ijk} \quad (4)$$

where v_{ijk} are the unit values reported by the households, Z_{ijk} a vector of service quality indicators and other household and visit-specific characteristics, and d_{jk} the village dummies. The unit values vary from one household to another due to the choice of quality, selected household characteristics, and the actual variation in market prices. Under the assumption that market prices do not vary within a village, θ_{jk} represent the unit values net of the quality and other household-specific effects included in the model.[3] More specifically, these parameters measure how the unit values change from one village to another due to changes in market prices, or how market prices change from one village to another (since it is a binary variable with values 0 or 1). θ_{jk} therefore represent the true village-level prices. These prices are used in the demand model to estimate price elasticities. The service quality and other household and visit-specific characteristics included in the regression are given below:[4]

1. service time;
2. travel and waiting time;
3. whether the veterinarian supplied medicines as part of the service;
4. number of visits it took to cure the animal;
5. provider type;
6. sickness type;
7. whether home service; and
8. whether the household belonged to the bottom 40% of all households ranked according to asset index.

3. Institutional and market structure for veterinary services in the study states

Livestock health provision in India is primarily in the public domain. In all three states, veterinarians employed by the State Animal Husbandry Departments (SAHDs) are the primary service providers. They provide services through the network of veterinary dispensaries, veterinary hospitals and polyclinics and First Aid Veterinary Centres (FAVCs).[5] Except in the case of emergencies, all government services are available at the centres. In the case of emergencies, the government veterinarians are allowed to make home

[3] Eq. (4) is a slightly modified version of the model presented by Deaton (1997). Deaton uses a logarithmic functional form and household expenditure as a proxy for quality effects. We use a linear model and explicitly include variables such as service time, number of visits to cure, etc. as measures of service quality.

[4] Measurement of these variables is explained in the results section.

[5] Veterinary polyclinics are veterinary hospitals with multiple specialties and specialists such as surgery, gynecology, radiology, etc. These employ several postgraduate veterinarians and are located mostly in state headquarters and 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 the 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 number of these centres also have trained technicians who provide AI service.

visits and charge a nominal fee to cover transportation costs. 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 utilise 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.[6] Private veterinarians are rare and generally operate in selected areas where the government and co-operative providers are not able to meet demand.

3.1. 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 need it.

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

The proportion responding 'yes' to the second question—whether they would be able to obtain the service as and when they need it—is given in Table 1. Approximately 93% of the respondents in Gujarat and 99% in Kerala said they would be able to obtain the service when needed. In Rajasthan, the comparable figure was 63%. The proportion of those having access to co-operative veterinary service was 47% in Gujarat and about 15–17% in Rajasthan and Kerala.

Another important question in this context pertains to the choice. That is, do the users have a choice of providers when it comes to using the service. In Gujarat approximately 40% of the respondents reported having a choice of either the government or the co-operative union doctor. Overall, nearly half of the sample households had access to more than one provider. In Kerala and Rajasthan comparable figures were 30 and 11% (Table 2).

Table 1
Access to livestock health services

Do you have access to	Responding yes (%)		
	Gujarat	Rajasthan	Kerala
Ethnic/traditional healer	58.8	85.8	5.2
Private veterinarian[a]	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

[a] The figure with respect to private veterinarians 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 government and private veterinarians. 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, some measurement error in this regard cannot be ruled out.

3.2. Use pattern

Table 3 presents the number of veterinary visits made by different providers during the 12-month period immediately preceding the survey, as reported by the sample farmers. Even though, except in

Table 2
Choice of modern veterinary service providers (%)

Provider type	Gujarat	Rajasthan	Kerala
Government only	46.6	63.6	69.8
Co-operatives only	2.9	0.5	0.2
Private only	0.0	3.0	0.0
Government and co-operatives	38.7	8.8	10.2
Government and private	6.0	5.5	12.6
Co-operative and private	0.5	2.2	0.0
All three	4.1	2.5	6.9
None	1.2	21.6	0.0
Total	100.0	100.0	100.0

[6] Most PCSs are located in villages and are easily accessible to all households in such a village.

Table 3
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 co-operative veterinarian	
	At home	At the centre			
Gujarat	130	10	98	69	327
Rajasthan	178	79	55	9	321
Kerala	304	230	22	2	538

Table 4
Number of veterinary visits per year by household wealth category

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%	0.65	0.31	0.46	0.15	1.67	1.41
Middle 20%	1.21	0.49	1.35	0.41	2.32	1.76
Top 20%	1.07	0.40	1.87	0.60	2.16	1.81

emergencies, government services are only available at centres, a larger number of these cases were attended at home. In Gujarat, for example, in-centre veterinary service was practically nil. Of a total of 140 sample visits by government veterinarians in Gujarat, only 7% were attended at the centres. Comparable figures for Rajasthan and Kerala were 30 and 43%. 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.

Since the focus of the study is on the poor, it is natural to ask whether there are any significant differences in the use pattern of these services across income groups. More specifically, (i) is the rate of utilisation of these services lower among the poor households? (ii) do the poor rely more on the government system than the rich? and (iii) do the rich opt for home service more often than the poor? Tables 4–6 present the use pattern for veterinary services in the bottom, middle and top 20% households (as ranked by the asset index). It can be seen from Table 4 that the number of visits in Rajasthan and Kerala per adult bovine increased with income whereas the trend was not so sharp in Gujarat. Similarly, the proportion of home visits showed an increasing trend in these two states. Given that a large proportion of home visits were either

Table 5
Home vs. in-centre service by household wealth category (%)

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

Table 6
Use of different providers by household wealth category (%)

Wealth category	Gujarat				Rajasthan			Kerala		
	Government	Co-operative	Private	Others	Government	Private	Others	Government	Private	Others
Bottom 20%	27.6	43.1	13.8	15.5	87.9	9.1	7.0	97.2	2.8	0.0
Middle 20%	42.0	21.0	28.4	8.6	82.1	15.1	2.4	97.5	2.5	0.0
Top 20%	43.8	26.3	27.6	2.5	71.8	25.2	3.0	91.6	7.4	0.0

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 (Table 5). 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 6 that in Gujarat a significantly larger proportion relied on the co-operative system in the bottom 20% category than in the middle and top 20%. In all the three states, the proportion of those opting for the services of private veterinarians increased with income (Table 6). This was specially evident in Rajasthan and Kerala where private usage of the top 20% was more than double the rate of lowest 20%. At least part of this tendency could be explained by the fact that private veterinarians established themselves in relatively higher income areas.

3.3. Prices paid

For veterinary services at the centre, the prices prescribed by the government are either zero or very nominal. For example, in Gujarat, the prescribed fee per veterinary visit was Rs. 5 (Rs. 2 for small ruminants) inclusive of drugs and medicines. In Rajasthan and Kerala, veterinary services at the centres are supposed to be free. However, service users often paid much higher prices. To understand the structure of the amount spent on veterinary services by 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); expenditure on additional medicines purchased from the medical store; 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 in Rajasthan and Rs. 18 in Kerala (Table 7). Including expenditure on drugs and medicines, total expenditure per visit was Rs. 128 in Rajasthan and Rs. 50 in Kerala. Recall that in both these states no fee was to be charged for the service when treatment was received at the centre.[7]

[7] Due to the limited extent of in-centre service in Gujarat, statistics for in-centre service in Gujarat are not reported.

Table 7
Average expenditure for veterinary service at the government veterinary centre (Rs. per visit)

State	Doctor's fee	Total charges[a]
Rajasthan	41.3	128.1
Kerala	18.4	54.9

[a] Including the cost of additional medicines.

This is not to say, however, that no one received free service at the veterinary centres. Indeed, over 60% of the cases attended at the veterinary centres in Rajasthan and about 58% in Kerala were provided free service.[8] Recall, however, that only about 30% of total cases attended by government veterinarians in Rajasthan were at the veterinary centres. As a share of total cases attended by government veterinarians, therefore, only about 18% received the service for free in Rajasthan (25% 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 could be justified by transportation costs. Estimated average expenditure for a home visit (excluding the cost of medicines purchased at the stores) by a government veterinarian was Rs. 94 in Kerala, Rs. 110 in Gujarat and Rs. 227 in Rajasthan (Table 8). In all three states, less than 5% of the cases attended at home were reported to be treated for free.

What matters to the user, however, is the total charge for the service including the expenditure on drugs and medicines. Table 9 presents the total visit cost (including additional expenditures on medicines for home visits in addition to what the veterinarians supplied). A comparison of Tables 8 and 9 suggests that in Gujarat and Rajasthan, the additional medicine expenditures per visit for government veterinarians was significantly higher than for private veterinarians. The difference between government and private veterinarians, which was about Rs. 75 per visit in Table 8, narrows to Rs. 41 in Table 9. In Rajasthan, on the other hand, where the charge per visit was higher for government veterinarians, the difference

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

Table 8
Average fee per home visit[a] (Rs. per visit)

Disease	Gujarat			Rajasthan		Kerala	
	Government	Co-operative	Private	Government	Private	Government	Private
General sickness	100	44	157	225	147	107	112
Gynecological problem	175	59	284	300	278	96	–
FMD	–	–	–	177	–	65	–
Mastitis	–	–	–	–	–	85	94
Pneumonia	–	–	–	237	–	–	–
Diarrhea	80	–	–	214	–	–	–
Others	106	38	138	225	208	105	–
Overall average	110.5	44.5	184.5	227.2	206.0	94.3	98.0

Not calculated due to insufficient observations (–).
[a] Including the cost of any drugs and medicines supplied by the veterinarian.

Table 9
Total charges per home visit (Rs. per visit)

Disease	Gujarat			Rajasthan		Kerala	
	Government	Co-operative	Private	Government	Private	Government	Private
General sickness	153	49	173	275	214	175	140
Gynecological problem	248	59	284	306	316	180	–
FMD	–	–	–	292	–	134	–
Mastitis	–	–	–	–	–	235	–
Pneumonia	–	–	–	258	–	–	–
Others	146	50	157	314	–	120	–
Overall average	161.2	51.5	202.2	332.8	286.4	178	204.2

Not calculated due to insufficient observations (–).

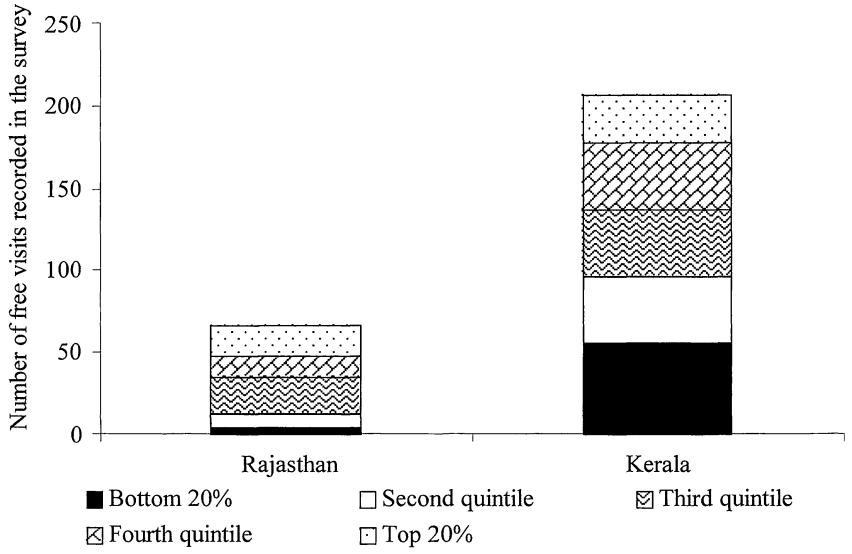

Fig. 1. Distribution of cases attended by government veterinarians for free across wealth categories.

widens. Both these comparisons indicate that private veterinarians were providing more medicines during the visit, whose costs were incorporated in the fees charged for the visit. Only in Kerala is the medicine component slightly higher in the case of private veterinarians than in the case of government veterinarians.

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 the price charged by private veterinarians. Only a small fraction—approximately 15% in Rajasthan, 25% in Kerala, and less than 1% in Gujarat—received services for free, and not all of those receiving free service actually belonged to the 'poor' category. In Rajasthan, only about 10% of those receiving free service belonged to bottom quintile. In Kerala, the comparable figure was about 30%. In both the states, about 40% of those receiving free service belonged to top two quintiles (Fig. 1).

4. Demand function and elasticities

The descriptive statistics presented in the preceding section show that a large proportion of service users are already paying significantly higher prices than prescribed. Thus, raising the prescribed fees to recover costs may not have an adverse impact. On the other hand, it is conceivable that raising the official prescribed prices would lead to a rise in the price currently paid by the users to government veterinarians operating in their private capacity. At the same time, however, due to the potential threat of entry, the price must remain below that charged by the private providers. Hence, at most, cost recovery/privatisation could lead to a price rise equivalent to the difference between the prices charged by private and government veterinarians.

The descriptive analysis also shows that in Gujarat, the average difference between average fees of government and private veterinarians was approximately Rs. 75 per visit. In Kerala, the difference was less than Rs. 5 per visit. In Rajasthan, on the other hand, the fees charged by government veterinarians are marginally higher than those charged by private veterinarians. But these are simple descriptive statistics that do not control for variations in sickness type, location, etc. Since these variables also cause variation in prices, it is important to examine price differences between different providers after netting out the effects of other variables. Thus, before investigating the demand pattern, it is necessary to examine if there are significant differences in the prices of services across different provider types—government, co-operative, and private. If there are no significant differences, then it can be reasonably concluded that full cost recovery/formal privatisation of these services will not affect the service users, for they are paying private prices anyway. If the prices charged by government providers are lower than those charged by private providers, then at least part of the subsidy is actually reaching livestock owners. In this case it would make sense to ask what will be the impact on different groups of eliminating this subsidy.

To rigorously establish price differences across providers it is essential to have critical number of data points for each provider type. However, given the limited private veterinary practice in India, one inevitably runs into small sample problem with respect to private practitioners. Anticipating this problem, the sample in Gujarat was extended to purposely include three additional villages where there was prior information on private activity. Thus, in Gujarat this analysis could be done with reasonable degree of confidence. In Kerala and Rajasthan, on the other hand, the sample for private veterinarians is quite small, and the findings in these two states must be interpreted with caution.

Even if the price differences cannot be established with good confidence, the demand analysis can still provide important insights. At the very least, one can speculate on the likely effect on service utilisation, *if* subsidy withdrawal leads to a rise in the prices now paid by the users of veterinary services. In the following, we present the analysis to examine price differences across government, private and co-operative providers, and the estimated price elasticity of demand for veterinary services for different income groups.

Regression results explaining the variation in visit prices are presented in Table 10. The table presents the results of three different regressions for each state.

Table 10
Regression analysis variation in price

Explanatory variable	Dependent variable: veterinarian charge per visit								
	Gujarat			Rajasthan			Kerala		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	87.68* (3.76)	82.38* (2.81)	–	34.7 (0.87)	−65.89 (−1.10)	–	14.84 (1.45)	14.83 (1.24)	–
Service time	–	0.67* (2.72)	0.78* (3.07)	–	0.34 (1.32)	0.11 (0.45)	–	1.00* (5.34)	0.81* (3.89)
Travel and waiting time	–	−0.029 (−0.70)	−0.05 (−0.80)	–	0.03 (0.72)	−0.02 (−0.72)	–	−0.20* (−4.5)	−0.056 (−1.20)
SUPMED (1 if supplied medicines during the visit, 0 otherwise)	–	−1.29 (−0.12)	15.13 (1.40)	–	70.2* (2.4)	99.3* (3.6)	–	13.7* (3.18)	2.89 (0.63)
VETVIS (number of visits to cure)	–	−9.86 (−1.17)	−16.5** (−2.01)	–	79.0* (3.2)	74.8* (3.6)	–	−5.73* (−2.09)	0.11 (0.04)
GOV (1 if government veterinarian, 0 otherwise)	−40.06* (−3.69)	−44.85* (−4.07)	−67.3* (−5.16)	28.5 (0.85)	42.8 (1.23)	−13.4 (−0.4)	1.81 (0.18)	−4.31 (−0.42)	−4.72 (−0.66)
COOP (1 if co-operative veterinarian, 0 otherwise)	−108.4* (−9.25)	−103.3* (−8.17)	−94.5* (−6.45)	−102.6 (−1.19)	−92.5 (−1.0)	−132.3 (−1.4)	–	–	–
SICK1 (1 if gynecological or surgical case, 0 otherwise)	35.13* (3.17)	33.64* (2.97)	36.36* (3.27)	87.0** (1.97)	92.8** (1.76)	129.1* (2.75)	−5.75 (−0.58)	−14.6 (−1.35)	8.78 (0.77)
SICK2 (1 if pneumonia, FMD, or HS case, 0 otherwise)	−32.46 (−0.92)	−32.46 (−0.92)	−58.6 (−1.78)	9.44 (0.22)	12.00 (0.27)	26.7 (0.66)	−10.98* (−2.52)	−14.9* (−3.08)	−5.50 (−0.95)
SOLVED (1 if the problem was solved in that visit, 0 otherwise)	–	−0.48 (−0.05)	2.64 (0.29)	–	−61.0* (−2.07)	−79.9* (−3.2)	–	8.83** (2.01)	−4.3 (−0.9)
HOME (1 if home service, 0 otherwise)	67.63* (2.78)	67.62* (2.78)	55.02** (2.25)	200.3* (7.52)	172.6* (5.4)	145.7* (4.6)	79.7* (20.9)	65.8* (13.9)	63.5* (12.7)
POOR (1 if household belongs to bottom 40%, 0 otherwise)	−0.16 (−0.01)	0.578 (0.045)	5.53 (0.42)	−99.35 (−1.27)	−101.9 (−1.23)	−81.2 (−1.01)	20.8 (0.83)	17.2 (0.68)	31.3 (1.33)
GOV × POOR	−33.05** (−1.82)	−27.81 (−1.62)	6.05 (0.28)	62.37 (0.73)	68.3 (0.78)	30.12 (0.36)	−20.22 (−0.80)	−15.05 (−0.56)	−22.71 (−0.95)
Adjusted R-squared	0.26	0.27	0.72	0.14	0.18	0.63	0.43	0.44	0.75
N (sample size)	356	356	356	340	340	340	612	612	612

Note: Figures in parentheses are t-statistics.
* Significant at 1% level.
** Significant at 5% level.

Model 1 includes sickness type, provider type, place of service and whether the household is poor as explanation variables. For this purpose, households belonging to bottom 40% category based on wealth ranking are considered poor. Model 2, in addition to all the variables in Model 1, includes travel and waiting time and the quality indicator variables (service time, number of visits to cure, whether medicine was supplied during the visit, etc.). Finally, Model 3, in addition to all the variables in Model 2, controls for village-specific characteristics by including village dummies. Table 10, however, does not present the coefficients on village dummies.

Looking first at the coefficients on the variables GOV and COOP, it is clear that except in Gujarat, there was no significant difference in the fee charged by government and private veterinarians. In Gujarat, although the users paid prices that were higher than prescribed, these were still lower than the prices charged by private providers. Controlling for service quality as well as location-specific characteristics, the average difference between private and government services appears to be in the range of Rs. 60–70. Service from co-operative unions in Gujarat is still cheaper.[9]

Another question of interest pertains to the price paid by poor vis-a-vis non-poor. In Kerala and Rajasthan, the coefficient on the interaction term between GOV and POOR is statistically insignificant in all the three models. Only in Gujarat is the coefficient is statistically significant at the 10% level in the first model. When quality and area-specific characteristics are included in the regression, this significance vanishes. This implies that there is no targeting of relatively cheaper services towards the poor in any of the three states. While the prevailing price in poorer areas was somewhat lower than in richer areas, both poor and rich paid the same price within a given area.

Other statistically significant variables in Table 10 are home service, sickness types, and service time. Home service costs more. So does a relatively complex gynecological or surgical visit. Interestingly, prices are also positively linked to the time spent by the veterinarian during the visit. This may be an indication the perceived quality of service. In addition, it might also be the case that those who spent more time per visit also provided advice about after care, etc. something the users may have valued positively.

4.1. Demand for veterinary services

Regression results for the demand for veterinary services are presented in Table 11. Since a large number of households reported zero visits during the reference period, estimation is carried out using a censored (Tobit) regression model.

The primary variables of concern in Table 11 are the price of veterinary care, the wealth index, and the interaction between price and wealth. The coefficient on price is negative in all three states.[10] This is consistent with economic theory and implies that a higher price depresses overall demand. It is worth recalling at this point that the number of visits per adult bovine was highest in Kerala where the price was lowest among the three states. On the other hand, in Rajasthan, where the price was highest, the number of visits was lowest. Neither of the other two variables—wealth index and the interaction between wealth and price—is statistically significant. This implies that income is not a major determinant of demand. The sign on the wealth parameter is positive in Rajasthan and Kerala, which is consistent with a priori expectations. In Gujarat, however, the analysis shows a negative wealth effect. We already saw in the previous section that number of veterinary visits per year per adult bovine animal in Gujarat was higher for the bottom and middle 20% wealth categories then for the top 20%. This negative relationship persists even after controlling for visit price. One possible explanation for this result could be that, in Gujarat, the incidence of sickness may be lower for richer households compared to the poorer ones due to better diet and care, whereas that relationship is not very strong in other two states. This would suggest that including the quantity and composition of diet and other care-related variables in the regression might cause a reversal of sign on wealth index in Gujarat regression. For lack of data on these variables, however, we are not able to test this hypothesis.

[9] Recall that the sample size for private veterinarians in both Kerala and Rajasthan is too small to allow meaningful testing of the differences. The finding of no significant difference in these two states is not very robust.

[10] Although statistically not significant in Rajasthan.

Table 11
Tobit estimates of demand for veterinary services

Explanatory variable	Department variable: number of veterinary visits during the reference period of the survey		
	Gujarat	Rajasthan	Kerala
Intercept	0.938 (1.04)	−0.145 (−0.157)	1.00 (0.65)
Milk price	0.002 (0.003)	0.005 (0.05)	0.227*** (1.80)
Price of veterinary service	−0.010** (−2.12)	−0.003 (−1.59)	−0.012** (−2.54)
Wealth index	−0.362 (−1.40)	0.417 (1.49)	0.278 (1.07)
Veterinary service price × wealth index	0.035 (1.23)	−0.002 (−0.89)	−0.002 (−0.62)
Average education in the household	0.040 (0.79)	0.042 (0.81)	0.022 (0.43)
Sickness dummy (1 if no animal sick during the reference period, 0 otherwise)	−8.77 (−0.33)	−7.34 (−0.24)	−11.66 (−0.28)
Service time (min)	0.080* (2.65)	0.007* (3.06)	−0.044* (−2.33)
Travel and waiting time (min)	−0.003 (−0.76)	−0.002 (−1.10)	−0.005 (−0.09)
Number of buffaloes owned by household	−0.020 (−0.25)	0.047$ (1.79)	−0.77 (−1.1)
Number of cows owned by household	0.100 (1.10)	0.028 (1.25)	0.592* (4.31)
Proportion of crossbreds in bovine stock	–	–	0.014* (3.99)
Sample size	367	297	387
log likelihood	−289.71	−296.11	−567.80

Figures in parentheses are Z-values.
* Significant at 1% level.
** Significant at 5% level.
*** Significant at 10% level.

Table 12
Price elasticity of demand for veterinary services

Category	Gujarat	Rajasthan	Kerala
Bottom 20%	−0.017	−0.09	−0.15
Middle 20%	−0.013	−0.03	−0.13
Top 20%	−0.017	−0.03	−0.14
Overall	−0.016	−0.04	−0.14

Estimates of price elasticity of demand are presented in Table 12. Although the slope of the demand functions do not vary with income, we have still calculated the elasticities for different income groups by valuing them at the mean price and visits for these groups. It is evident from the table that the overall price elasticity of demand for these services is quite low. In Gujarat and Rajasthan, for example, a price increase of 100% could lead to a decline in the use of veterinary services between 2 and 4%.[11] Although in Kerala the demand is relatively more elastic, even there the extent of decline in response to a 100% increase in price is less than 20%, with not much difference across rich and poor. Since these are curative veterinary services and production is likely to fall if the animal is not treated, low elasticities make sense.

[11] While in Gujarat this drop is distributed uniformly across income groups, in Rajasthan the use of these services from the poorest group is likely to decline to the extent of 9% vis-a-vis 3% for the richest group in the sample.

5. Conclusions and implications

Our primary objective in estimating the demand functions was to evaluate the effect of introducing/raising user fees or the private sector delivery of veterinary services. In evaluating this effect, cost recovery or privatisation must be balanced against the utilisation of these services. Indeed, the primary rationale for providing subsidised services is to reduce barriers to access to these services.

It is clear that any evaluation of increasing user fees requires knowledge of demand elasticities and how these vary across income groups. Our estimates show that price is not an important determinant of the decision to use veterinary services.

Also, there is practically no variation in the price elasticities across income groups. Given the fact that these services have a direct impact on the productivity of livestock, and thereby on household income, the finding of low demand elasticity is plausible.

Low demand elasticities across all income groups suggest that the fears of sharp declines in the use of these services as a result of full cost recovery and/or private delivery of these services are unfounded. On the other and, the rapidly rising demand for livestock products is likely to translate into a similar sharp increase in demand for livestock services by farmers in the decades to come. The concurrent increasing competition for increasingly scarce government budgetary resources is going to place stringent constraints on the Animal Husbandry Department's ability to exclusively satisfy the rising demand for livestock services.

Fiscal crises in the study states are already impinging on their capacity to provide veterinary services. Curative veterinary services could be provided in a cost-effective manner by the private sector, and the demand for these services is fairly inelastic. These conditions open critical windows of opportunity for the government to share the responsibility of delivering curative veterinary services with private providers. Although complete privatisation of these services in the immediate future may not be a feasible or desirable, the long term goal must be to move towards private delivery of those services which are of private good nature.[12]

There may be certain areas where aggregate demand is not sufficient to support private practice. In such areas it may be necessary to continue direct government provision of these services or to create incentives for private providers to practice in such areas (e.g. provision of start-up grants). The identification of such areas as well as the implementation of targeted services and monitoring and control all require additional expenditure. Withdrawal of the government from high potential areas can free up resources for better targeting of services towards marginal areas. This can have both positive efficiency and distributive effects.

In the longer term, as the private livestock services sector develops and takes over the provision of curative services, the government should dedicate itself to 'public good' tasks such as policy development and other services that have tended to be neglected due to limited budgetary resources. These include disease surveillance, sanitary control, disease prevention and food hygiene and other development tasks, such as technology generation and dissemination and natural resource management-related activities.

[12] Services such as disease prevention and control, vaccination against infectious diseases, etc. will however need to remain the responsibility of the government.

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Appendix A. The asset index

This study uses a composite index based on indicators of household assets to discriminate between poor and non-poor households. The index was constructed using weights chosen by principal components as proposed by Filmer and Pritchett (1998). This Annex describes the methodology used for constructing the index and presents some statistics to demonstrate is robustness and internal coherence.

This index uses 24 asset variables which can be divided into four categories: ownership of consumer durables, characteristics of the dwelling occupied by the household, ownership of land, and 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 cows
Camera	Number of rooms	Un-irrigated land (acres)	Number of crossbred cows
Scooter	In-house piped water supply		Number of buffaloes
Car	Flush toilet		
Refrigerator	Construction material		
Washing machine			
Fans (number)			
Heater			
Television (B&W)			
Television (colour)			
Petromax			
Cooker			
Watches (number)			

Table A.1
Factor coefficients and summary statistics for the variables used in constructing the asset index

	Gujarat			Rajasthan			Kerala		
	Factor coefficient	Mean	S.D.	Factor coefficient	Mean	S.D.	Factor coefficient	Mean	S.D.
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

Table A.2
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 A.3
Mean values of asset index by wealth category

Wealth category	Gujarat	Rajasthan	Kerala
Bottom 20%	−0.87	−0.77	−1.00
Second quintile	−0.61	−0.58	−0.65
Third quintile	−0.34	−0.33	−0.28
Fourth quintile	0.20	0.16	0.36
Top 20%	1.60	1.57	1.56

The index is a weighted linear wealth index where the weights are obtained using the procedure of principal components, and is constructed as follows:

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

where A_{ij} is value of the index for the ith household in the jth state, f_k the factor score coefficient for the kth asset as determined by the principal component procedure, a_{ijk} the value of the kth asset for the ith household in the jth state, and a_{jk} and s_{jk} are the mean and standard deviation of the kth asset over all households in the jth state. Table A.1 presents the factor coefficients used as weights, and the summary statistics for the states as a whole.

Table A.4
Summary statistics for the variables used in constructing the asset and index disaggregted by wealth category

	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	0.0301
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

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 1 if the household owns the asset in question, and 0 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}.

The mean value of the index is zero by construction. The standard deviation ranges from 0.95 to 1.00 across states (Table A.2). The mean for the poorest households is −0.84, −0.77 and −1.00 for Gujarat, Rajasthan and Kerala, respectively. Comparable figures for the richest households are 1.60, 1.57 and 1.56 (Table A.3).

The index does very well in separating poor, middle and rich households. Table A.4 presents summary statistics for the variables used in constructing the index across bottom, middle and top 20% 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 un-irrigated land is 1.6 acres for the poorest households and 7.6 acres for the richest households. Comparable figures for irrigated land are 0.33 and 5.0 acres. Similarly, the poorest 20% households in the sample in Gujarat owned 1.25 cattle compared to 1.27 for the top 20%. At the same time, however, the proportion of crossbreds in cattle stock was 1.8% for the poorest households compared to 42% for richest households. Similar separations can be seen across all variables in all three states.

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