The Australian Journal of Agricultural and Resource Economics, 46:2, pp. 233–255

Hired hooves: Transactions in a south Indian village factor market*

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Bullocks are an important resource in Indian agriculture where they are used as draft animals. Previous research suggests that farmers who do not own bullocks, or own bullocks in insufficient numbers relative to their land holdings, adjust bullock-land ratios through transactions in the land market, rather than by hiring bullock services. The reasons given for this behaviour are that there are 'inhibited' or 'missing' village markets for bullock services. Results from a survey of the activities and transactions of six bullock contractors during an entire cropping period show that village markets for bullock services exist continuously and are far from being inhibited. Close monitoring of the bullock contractors' transactions supplied rich evidence of the manifold contractual arrangements used in this village market for bullock services.

1. Introduction

Bullocks – the main source of draft power in the semi-arid tropics (SAT) of India – are indivisible capital goods that require a considerable amount of wealth to purchase. For this reason, bullock labour capacity is rarely perfectly matched to a farmer's operated area. Furthermore, even if a farmer owns bullocks in numbers appropriate for working his cropped land under most conditions, the uncertainties of nature (i.e., weather, pests and diseases) upset production plans and create conditions where demand for production factors varies widely during a cropping season.

Differences in factor ratios among farmers and differences in factor demands create incentives for farmers to exchange factors of production. Discrepancies

* We thank the anonymous referees for their valuable comments, and the ICRISAT village investigators for their extraordinary support.

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in factor proportions and productivities may still occur when the costs of exchanging production factors are high. To assess factor markets, one must understand how exchanges are carried out and how these exchanges are guided by factor ratios in response to longer and short-term factor demands. Such an assessment requires detailed empirical research, because 'the process of contracting needs to be studied in a real world setting. We would then learn of the problems that are encountered and of how they are overcome, and we would certainly become aware of the richness of the institutional alternatives between which we have to choose' (Coase 1992, p. 718).

In this article, we report on findings relevant to the market for bullock services. The data are from an unusually detailed set of surveys, administered in one Indian village. Details of more than 100 hiring transactions of six bullock owners were recorded for a 124-day cropping season. The analysis of the transactions includes reasons why farmers hired the bullocks, the frequency of particular types of transactions, the search activities of buyers and sellers, the negotiations that led to transactions and important aspects of the contractual arrangements.

We make no specific claims with respect to economic policy. However, we note that economic development analysts sometimes point to 'missing markets' as a rationale for an active government role to supplement market forces with programs that offset the failures of the market. In this context, our research may caution economists to look more closely before labelling a market as 'missing' and proceeding to prescribe remedies.

The spectre of missing markets is not limited to developing agricultural economies. The concept also enjoys some popularity in agricultural resource contexts in rich countries where markets for natural resources are emerging. This paper suggests that it may be useful to scrutinise the exchange activities very closely before presuming that markets are missing.

2. Are bullock markets deficient?

Despite the importance of draft power in agricultural production in SAT-India, most economic studies have focused on markets for other factors, in particular land and credit. Two themes, however, have emerged from the small literature examining the bullock economy. The first theme is that the size of the cattle herd in India, of which bullocks make up a sizeable proportion, is allegedly excessive because of Hindu religious taboos and because of deficient lease markets for bullock labour. Vaidyanathan (1988) convincingly argues against religion as a cause for excessive herd size but maintains that bullock use could be better organised.

The suggestion that the bullock herd may be excessive because of imperfectly organised bullock use is closely related to the second recurrent

theme in the literature on the bullock economy in India: the belief that the equalisation of the proportions of land and bullock labour across farms has to be accomplished through land market transactions because of poorly developed lease markets for bullock services. Binswanger and Rosenzweig (1984) provide a short summary of this literature. Walker and Ryan (1990, p. 42) summarise the alleged causes for the unsatisfactory state of the markets for bullock labour: 'A seasonal market for bullock hiring is incomplete probably because of the synchronic timing of operations in dryland agriculture, which in turn gives rise to a high incidence of covariate demand for draft power among farmers within the same village. … As a result, bullock demand is characterised by sharp seasonal peaks, which inhibit the development of a rental market'.

The most widely known recent study of the economics of bullocks is Rosenzweig and Wolpin (1993). They develop a model of bullock ownership and their consumption–smoothing role for the same region of India that we study here. Consistent with the Walker and Ryan assertion just quoted, Rosenzweig and Wolpin (1993, p. 225–226) state that 'not only is the use of bullocks necessary for production but the uncertainty of the monsoon onset date, the short period of time during which tillage and sowing operations take place, and the high positive covariance in the timing of the demand for animal traction make it almost impossible for farmers to rely on a bullock rental market'. They also claim that 'ownership of work animals is thus required to ensure the timeliness of pre-harvest farm operation' (p. 226). The basic argument in Rosenzweig and Wolpin is that farmers not only own bullocks because they are valuable in production but also because they are a liquid asset that can be bought and sold to smooth consumption over time. They cite as evidence that farmers sell bullocks when their income is low and buy them when their income is high. The lack of a bullock rental market is not fundamental to this hypothesis. Nonetheless, Rosenzweig and Wolpin (1993, p. 229) state that 'The most important elements of the model are that: … (iv) bullocks can be bred, purchased and sold but not rented'.

Although bullock rental markets may be inhibited they are not absent. Walker and Ryan (1990) refer to localities where seasonal rental markets are active and Vaidyanathan (1988, p. 57) reports that the proportion of animal labour in a village leased out or given in exchange is usually between 10 and 25 per cent of total animal labour supply. Our study provides detailed evidence that far from being inhibited, markets for bullock services are quite lively.

3. Guiding theoretical perspectives and questions

With respect to policy suggestions about 'missing' or 'inhibited' markets, we think that there is little prospect to better organise the provision of bullock

services unless we know and can explain the transactions that do occur. For this reason, we embarked on a detailed empirical study of the transactions in a village market for bullock services.

Usually, analysts study factor markets in terms of four characteristics: (i) numbers, (ii) types of buyers and sellers, (iii) quantities traded and (iv) prices. Such analyses are adequate for effortless markets where participants have no market power and in the following section we present a model for such a bullock rental market. However, because the economics literature has taken as given that bullock rental markets have failed, we considered it important to investigate both outcomes and transactions in this market in some detail. As we will see, the standard economic model of markets is inconsistent with some features of the bullock rental market. For this reason, we follow the suggestions by Coase (1988) and Dahlman (1979) to disaggregate transactions into several phases.

3.1 Modelling the market for bullock services

Consider the market for bullock services on a given day in an isolated, unmechanised village where, B bullock pairs are the only source of draught power (figure 1). Farmers who own bullocks may use them for work on their own plots, accept contract work, or keep them idle. Ignoring idleness, a bullock owner's decision about whether to use the bullocks on his own plots or to hire them out depends on the difference between the value product of the bullocks when employed on their own plots and the rental price offered by potential hirers of bullock services. When rental prices are high, more farmers will be willing to accept contract work and forego the value product of working on their own plots; when rental prices are low many bullock owners will prefer to employ their bullocks on their own plots and not accept contract work. In figure 1, bullock owners' own demand, OD_o, slopes down to the right, but we have assumed that own demand is never lower than B*, where B* is the number of bullock pairs whose owners, for various reasons, such as social status or poor bullock driving skills, never participate in the bullock hire market.

Some farmers have no bullocks or need more bullocks on the particular day than they have at their disposal. These farmers will be prepared to hire bullocks at some rental price, p, and the number of bullock pairs thus demanded for rental use will be lower the higher the rental price. The market demand curve for bullock services will also fall towards the right as indicated by the market demand curve MD_o in figure 1. Own demand, OD_o, and market demand, MD_o, add up to total demand, TD_o.

At each rental price, p, the number of bullock pairs offered on the rental market for bullock services is equal to the difference between the number of bullocks in the village minus the demand of bullock owners for their own

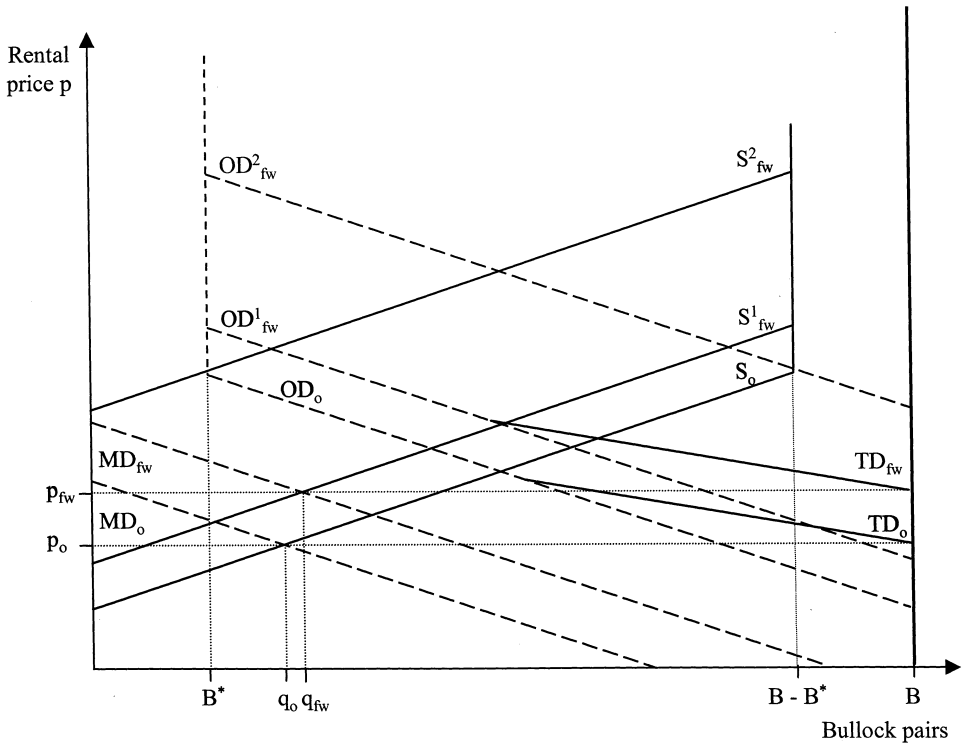

Figure 1 The market for bullock services

bullocks and the market supply of contract work is given by the supply curve $S_o = B - OD_o$. This curve has a kink at B – B* to indicate that the number of bullocks available on the hire market may be smaller than the number of bullocks in the village because some farmers do not accept contract work for their bullocks at any price.

The market clears at price p_o when q_o bullock pairs are hired. Note that p_o is determined by the intersection of market demand, MD_o, and market supply, S_o, or equivalently by the intersection of total demand, TD_o, and the vertical line B which indicates the given number of bullocks available.

We can use this model to explore the impact of changes in weather on demand, supply and on rental price. When farms have similar cropping patterns and practices, weather favourable for crop work will similarly affect market demand and own demand for bullocks. As the value product of bullocks rises when weather is favourable for crop work, own demand increases to OD^1_{fw} at a given rental price and fewer bullocks are available for hire, shifting the market supply curve to the left (S^1_{fw}). Market demand from farmers with few or no bullocks also increases and the market demand curve shifts to the right (MD_{fw}). Therefore in this model, prices for bullock services are higher when

weather is favourable ($p_{fw} > p_o$). When the weather is particularly favourable, own demand may increase so much (OD^2_{fw}) that no hirer of bullocks is willing to pay the cheapest price asked by the bullock owner and no hire transaction occurs. On such a day there would be no transactions in the bullock market and in a rather narrow sense the bullock market would truly be inhibited by covariate demand due to weather. Of course, zero demand for a good is consistent with efficient functioning of markets and a market at which temporarily no transactions occur is still a functioning market.

Similarly, when weather is unfavourable for crop work, market supply shifts to the right as bullock owners are then willing to accept contract work at low rental prices. Market demand also shifts to the left and rental prices fall. Again market inhibition would be observed on particularly bad days when the market demand curve lies below market supply at all rental prices.

3.2 Elements and impact of transaction costs

Coase (1937) introduced transaction costs into modern economics but he did not clearly distinguish specific transaction cost items. To facilitate empirical identification, transaction costs are often disaggregated according to certain phases of the transaction. Dahlman (1979), for example, disaggregates transaction costs into: (i) search and information costs, (ii) bargaining and decision costs and (iii) policing and enforcement costs. This is also the phase model that guided our empirical investigation of transactions in the bullock hire market. Our emphasis was on the bargaining or negotiation phase, and the policing and enforcement phase of the transactions. Searching for a bullock contractor or searching for a farmer in need of bullock services was expected to be a facile task in closely-knit traditional village economies in India. Negotiating bullock hire contracts, in contrast, can be a more complex task because of the several dimensions of a bullock service contract. We focused our empirical research on three dimensions of contract negotiations: (i) immediate or delayed execution of the contracted work, (ii) arrangements for deciding the exact timing of work to be executed at a later date and (iii) amount and terms of payment. A negotiation is an exchange of promises with the expectation that the promises will be kept (Hicks 1969). Breaching promises by either party of a bullock hire contract causes losses to the other party, and disputes over the validity of the reason for non-performance may further reduce the value of the bullock hire agreement to the contractor, the client, or both. Recording of the promises made, monitoring their execution and providing a procedure for settling disputes may all contribute towards reducing transaction costs and their use by bullock contractors and farmers must be analysed.

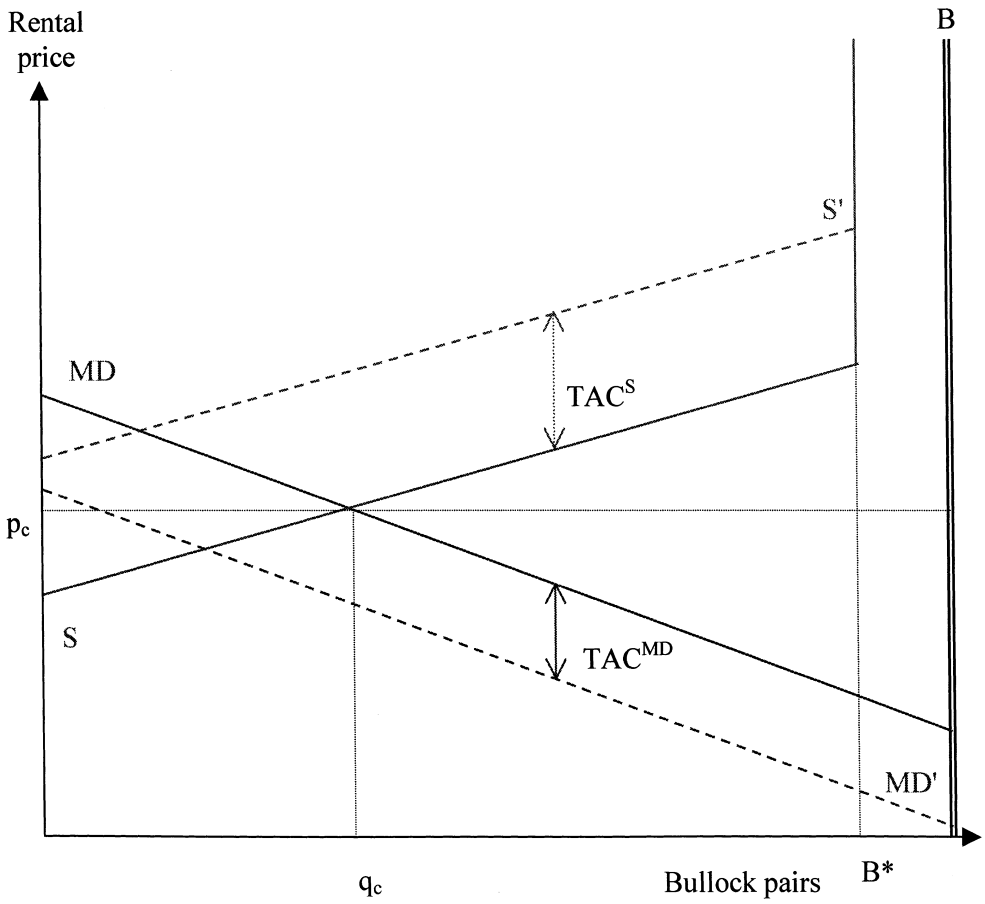

Figure 2 Market for bullock services inhibited by transaction costs

Transaction costs, like transport costs, may inhibit markets (Hirshleifer 1973). In figure 2, the solid lines are market supply (S) and demand (MD) without transaction costs. If sellers of bullock services have to bear a cost TAC^S associated with the hiring of bullocks, fewer bullocks are offered for hire at a given price and the supply curve shifts to the left (S′ in figure 2). Market demand also shifts to the left (MD′) when buyers have to bear a transaction cost TAC^{MD}. With sufficiently high transaction costs for buyers and sellers of bullocks fewer contracts are made and, if transaction costs are sufficiently high, no transactions occur and the market is inhibited.

3.3 Questions

Our empirical research was designed to provide answers to eight questions that arise from the literature on deficient bullock markets, from our model

of the bullock rental market and from the phase model of transaction costs:

1. Can bullock services be rented?
2. Is it possible for farmers to rely entirely on the rental market for bullock services?
3. Is any equalisation of factor proportions of land and bullock labour accomplished through the market for bullock labour?
4. Are there steep seasonal peaks in bullock use?
5. Are peaks in demand reflected in peaks in rental prices for bullocks?
6. Is the development of bullock rental markets inhibited by covariate demand for bullock labour?
7. Can all phases of a transaction be identified in the bullock hire market?
8. Do transaction costs in the bullock hire market seriously inhibit renting of bullock services?

4. Surveying a bullock hire market in village India

4.1 Research location

Our survey was conducted in the village of Aurepalle on the Indian Deccan of Andhra Pradesh over a 124-day period during the rainy (*kharif*) season from 20 May 1990 until 20 September 1990. The village was chosen because it is one of the villages that were thoroughly studied for more than 10 years beginning in 1975 by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and whose social and economic characteristics have been reported and analysed in considerable detail by Walker and Ryan (1990). Aurepalle was also included in the ICRISAT-data set covering the period 1975–1984 that was used by Rosenzweig and Wolpin (1993).

In 1989, the last year for which data from a village census conducted by ICRISAT are available, the village comprised 664 households of which 278 owned bullocks and the bullock herd numbered 653 head and the number of bullock pairs (B in figure 1) most likely exceeded 300. Nearly all of the households that owned bullocks also owned land but only about half the number of households that owned some land also owned bullocks (table 1). The bullock density for the village households that owned land was 0.47 bullocks per ha and was the lowest with the largest landowner group and the highest for households owning between 0.5 and 2 ha of land. While tractors have grown in importance in India (Ray *et al.* 1996), tractors were rarely used for crop work in Aurepalle, as in most of SAT India, at the time of our survey.

There are a variety of methods to organise production. Many farmers own their own pair of bullocks and farm their own or other's plots. As we will see, these farmers sometimes hire bullock services to supplement the work done by

Table 1 Availability of bullocks in landed and landless farm households in Aurepalle, 1989

Households			Bullocks				Land area owned		
Farm-household class	No.	% of total	No. of households with bullocks	% of all households with bullocks	No. of bullocks	% of total number of bullocks	ha	% of total area	Bullock density (animals per ha)
All households	664	100.0	278	100.0	653		1356		0.48
Landless households	123	18.5	5	1.8	10	1.5	0	0	
Landed households	541	81.5	273	98.2	643	98.5	1356	100	0.47
Thereof:									
< 0.5 ha	73	11.0	6	2.2	12	1.8	27	2.0	0.44
0.5–2 ha	259	39.0	99	35.6	182	27.9	287	21.2	0.63
2–4 ha	124	18.7	96	34.5	199	30.5	334	24.6	0.60
> 4 ha	85	12.8	72	25.9	250	38.3	709	52.3	0.35

their own pair. Other farmers do not own bullocks and have to hire all of their bullock services. Wealthier farmers will own several pairs of bullocks and hire farm labourers to operate them. Some bullock owners form cropping groups, or partnerships, of two to five members and jointly farm rented or sharecropped land. This latter class of farmers is a significant percentage of the population. In 1990, there were an estimated 40 farmers, or nearly 15 per cent of bullock owning farmers, participating in cropping groups.[1]

The rainy season (*kharif*) is the main cropping season in the village and more than 90 per cent of the area cultivated is planted during this season. The major crops are sorghum intercrops, castor and irrigated rice (Walker and Ryan 1990).

4.2 The weather during the survey period

The literature on bullock use and the claims that bullock rental markets cannot exist focus, in part, on the weather in the Indian SAT. The climate of Aurepalle is characterised by erratic and often intense rainfall. The onset of the monsoon in late May to early June is rarely vigorous. In most years farmers have only a short period of 2–4 days to plant their rainy season crops before the upper layers of the village's red soils have dried up again. As a consequence, planting tends to be spread over a long period and it takes about a month until 95 per cent of the dryland fields have been sown.

For this research, weather observations were taken from a small meteorological field-station located close to the village dwellings and from 20 rain gauges distributed throughout the village cropping area. The weather station was erected to obtain reliable weather data during the *kharif* season. The purpose of the rain gauges was to see whether rainfall variation within the village agricultural area was sufficiently high to be considered as a cause for variation in bullock labour demand among farmers whose plots are located in different micro-climate sections.

The weather during the survey period was not unusual for Aurepalle. Before the survey of the bullock activities started on 20 May 1990, there were some pre-monsoon rainfalls in early April, early May and in mid-May. After initiation of the bullock monitoring activities, there were a few days with light showers and high temperatures in late May and early June (see figure 3). Then the monsoon broke on 12 June 1990 when 31 mm of rain fell and the temperature dropped. During the 124-day survey period there were 36 days with rain period. Most often the rains lasted only for a day or two and there

[1] In 1990, 13 cropping groups were identified. Eight of these were intensively surveyed. The results of these surveys are contained in Townsend and Mueller (1998). A follow-up visit in 1994 identified 24 groups.

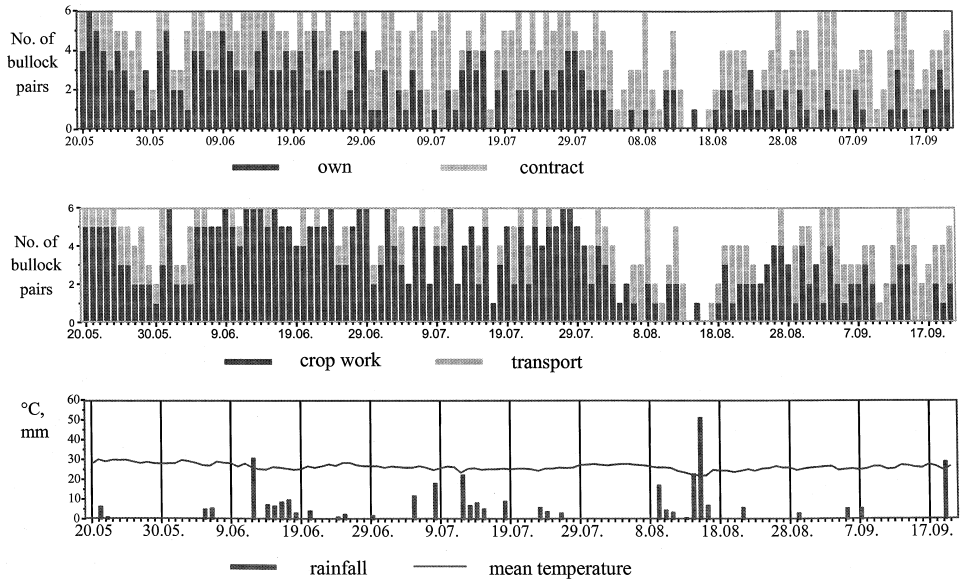

Figure 3 Weather and the activities of six bullock pairs during the rainy season: crop work and transport

were only four occasions during the survey period when rain fell on more than two consecutive days.

The spatial variation of rainfall was considerable. Rainfall measured at the various locations of the rain gauges differed considerably from the measurements taken at the meteorological station. For the comparable set of 18 rain gauge sites, smaller numbers of rainfall events were observed at 14 sites than was recorded at the meteorological station, and at five sites rain was recorded on only 44 days instead of the 48 days at the meteorological station (table 2). The differences in daily rainfall at different locations of the village cropping area reached 20 mm or more. Such differences are important for cropping operations; for example, ploughing may not be done on a plot that remained dry, but may be done on plots where the soil was softened by rains.

5. The market

5.1 Suppliers of bullock services: Selection and characteristics

When organising the survey, fifteen suppliers of bullock rental services were identified in this village, but there may have been others who escaped our attention. Although we do not have an exact measure of the number of bullocks available in the hire market (B – B* in figure 1), as this would have

Table 2 Cropping season rainfall measured at different locations in Aurepalle, 1990

	Measurements		Difference rain gauge to met-station		
Rain gauge No.	Rainfall events (No.)	Rain (mm)	Rain (mm)	Mean absolute deviation (mm)	Max. abs. daily deviation (mm)
Met Station	48	518	–	–	–
1	48	544.7	26.7	1.3	8.8
2	41	517	−1	4.2	22.4
3	49	556.9	38.9	2.2	19.2
4	49	598.2	80.2	3.2	26.0
5	49	609	91	3.0	28.8
6	47	592.5	74.5	2.3	15.4
7	47	601.4	83.4	3.6	18.4
8	47	561.9	43.9	1.7	14.6
9	47	572.6	54.6	2.4	10.0
10	47	567.6	49.6	2.6	13.6
11	45	555.3	37.3	2.7	12.8
12	45	571.6	53.6	3.4	14.8
13	44	599.2	81.2	4.4	18.4
14	40	534.1	16.1	4.8	22.4
15	44	592.9	74.9	4.1	22.4
16	44	599.1	81.1	3.9	19.2
17	44	587	69	3.6	19.6
18	44	557.5	39.5	3.2	14.8
19	45	551.2	33.2	2.8	13.8
20	45	572	54	2.8	19.2
Mean rain gauges†	46.1	577.3	59.3		

† Without rain gauges 2 and 14 for which data were deemed unreliable.

required a full survey of the village bullock owners' willingness to accept contract work, our first question, whether bullock services can be rented, has been answered in the affirmative.

Because of limited interviewer capacities, only six farmers who were known to accept contract work for their bullock pair were approached and their consent was obtained to monitor daily the activities of their bullocks throughout the *kharif* season. Although the number of contractors surveyed was small, in this way we obtained from them and their thirty-one clients observations on 539 bullock activities and 105 hire contracts. We limited our study to the *kharif* season because few crops are grown by dryland agriculture in SAT India during the dry season and bullocks are only lightly occupied by crop work after *kharif*.

All six of the surveyed bullock contractors owned one bullock pair and operated small areas of land, most of which was dryland (table 3). All contractors except one owned more bullocks per hectare of land than the average farmer of the respective size-class in the village.

Table 3 Resources of the bullock contractors and their clients

	Bullock contractor						Clients		
Resource	#1	#2	#3	#4	#5	#6	*n*†	mean*	s. dev.*
No. of resident family members	7	8	4	4	6	8	30	5	1.7
No. of draft bullocks owned	2	2	2	2	2	2	16	2.75	1.4
Total land owned (ha)	0.75	1.92	1.52	3.24	1.22	2.23	31	2.35	2.21
Wetland owned (ha)	0.04	0.30	0.30	0.00	0.00	0.61	17	0.97	1.11
Dryland owned (ha)	0.71	1.62	1.22	3.24	1.22	1.62	31	1.82	1.46
Total land operated (ha)	0.75	1.92	1.52	4.05	2.63	2.84	31	2.96	2.81
Wetland operated (ha)	0.04	0.30	0.30	0.30	0.00	1.22	18	1.13	1.37
Dryland operated (ha)	0.71	1.62	1.22	3.75	2.63	1.62	31	2.27	1.88
Bullocks per ha operated land	2.67	1.04	1.32	0.49	0.76	0.71	16	0.68	0.20

† Number of cases for which we obtained information (e.g., for 30 clients we obtained information on resident household members).

* Mean and standard deviation of non-zero cases.

5.2 Buyers of bullock services

We obtained the names of buyers of bullock services from the bullock contractors and we interviewed these buyers. In this way, 31 farmers who had contracted bullock services from the respondent contractors were included in the survey. Approximately half of these client farmers owned bullocks but demanded additional bullock labour nonetheless. Consistent with our prior expectations, the contractors have more bullocks per unit of land than clients who own bullocks (table 3).

Half the clients relied solely on rented bullock power; several of them leased in land and none leased out any. Also, the average farm size of the clients, measured in terms of operated area, is at 2.96 ha, slightly higher than the average farm size in Aurepalle, which was 2.6 ha in 1989. It is also higher than the average operated area of the bullock contractors, which was 2.3 ha. Obviously, these farmers rely on the daily rental market for bullocks to equalise factor proportions and the question of whether factor proportions are equalised only through the land market and not through the bullock market is answered in the negative.

5.3 Why farmers hire bullocks

We obtained 84 responses to our question on why farmers hired bullock services for crop work. The answers demonstrated that the bullock market was used to adjust factor proportions as needed. The most frequently cited reason for hiring (39 responses) was that the buyer did not own bullocks but

operational convenience was also cited as an important class of reasons for hiring bullocks. For example, the second most frequently cited reason for hiring was the need to finish important crop work in time (28 responses). Buyers who cited this reason had bullocks of their own. A similar reason, that it is more practical to work with a couple of bullock pairs, was cited seven times. Two other reasons were cited twice each. One reason is that the clients do not have enough bullocks to cultivate all of the land themselves. The other is that the buyers' animals are too weak or too old to do the work in time. Finally, miscellaneous reasons were cited six times. The fact that not having enough bullocks was cited so few times by clients who owned bullocks suggests that almost all farmers who own bullocks own at least the required bullock labour capacity for the usual work on the area of land they operate.

5.4 Activities of the bullocks

As previously noted, during the 124 days of observation we obtained data on a total of 539 bullock activities and 105 contracts for bullock crop work. The shares of contracted bullock activities was slightly more than half (53 per cent) of the total bullock activities (figure 3).

All bullocks were idle for slightly more than one day out of four. Overall, on 40 of the 124 days all six bullock pairs were occupied either with crop or with transport work. On 13 days all six bullock pairs were occupied with crop work and on 40 days at least five pairs worked on crops. There appears to be some positive correlation in the timing of demand.

Crop work is driven by weather and conditioned by soil–rainfall interactions. Market demand for bullock crop work (MD), as indicated by the requests for work received by the six contracts, closely follows the highly variable weather conditions (figure 4). The actual work schedules of the contractors' bullocks show equally marked peaks and troughs (figure 3). Supply of bullocks for hire (S) depends on the contractors' own demand for bullock labour (OD) and the availability of their accustomed driver, who is always hired together with the bullocks. Of the two, own demand for crop work is the more important and rarely is market supply of bullocks reduced because of bullock drivers being unavailable (shift in B* to the right).

Most of the bullocks' time was spent on crop work after the first pre-monsoon showers had wetted the soil in late May. Crop work was reduced when no further rains fell before early June (figure 3). With the onset of the Monsoon in the middle of June, all bullock pairs were employed in crop work for several days. Employment fell below full employment from late June until late in July, when demand on the bullocks was again high. Demand fell to zero during a short period of heavy rains in the middle of August (figure 4). These pronounced spikes would seem consistent with the hypothesis of

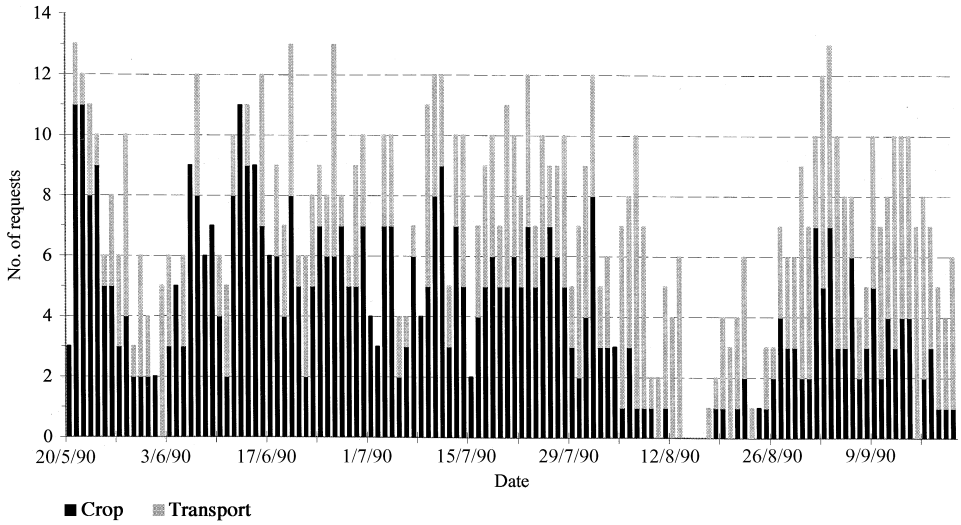

Figure 4 Development of requests for crop and transport work, Aurepalle, *kharif* 1990

synchronous weather-induced shifts in own demand for bullock services and demand from farmers hiring bullocks to take advantage of favourable weather. Furthermore, the variations in micro-climate that we observed were obviously not large enough to eliminate covariation in bullock demand.

Almost all (96 per cent) crop operations by the six bullock pairs were done on only three crops: castor, paddy (rice) and sorghum. Among the various crop operations weeding with a local wooden plough took the most time – 37 per cent of the days worked. Seed related operations were performed 24 per cent of the time, while ploughing accounted for only 13 per cent of the time. No strong differences between own and hired work was found in the timing of other operations. All hired ploughing, however, was done for farmers who did not own bullocks.

The observed activities of hired bullocks at Aurepalle demonstrated that some farmers relied on the bullock market. Despite the correlated weather shocks, farmers frequently hire bullocks and their drivers for crop work. Furthermore, the development of requests for crop work (figure 4) and the development of the number of bullock pairs employed in crop work (figure 3) leave no doubt about the occurrence of sharp peaks in bullock use for crop work.

6. The transactions

Our surveys indicate that the bullock service market in Aurepalle works in the following way. Potential hirers search for someone to do work for them.

Searches will not always be successful in the first try. Upon finding someone possibly willing to do the work, the terms of the contract are negotiated on the spot. Contracts may be for single or multiple jobs; they can be for payment or may involve an exchange of bullock services; and, they can be for today or tomorrow (a spot contract), or they can be for a future date (a forward contract).

6.1 Search and requests for services

In general, search effort is saved when the party that is irregularly participating in a market searches for suitable partners among the more regular participants. Hence, we expected that the farmer-clients search for contractors and not *vice versa*.

Both, contractors and their clients were asked about whether they searched for a transaction partner. Both surveys unambiguously showed that farmer-clients searched for suppliers of bullock services. There was, however, conflicting evidence on whether the contractors also searched for clients. The farmer-clients indicated that bullock contractors – not necessarily the surveyed ones – asked them for work, while the suppliers said that buyers always approached them. With this caveat in mind, we report in figures 4 and 5 the development and the frequency distribution of requests for crop and transport work during the survey period.

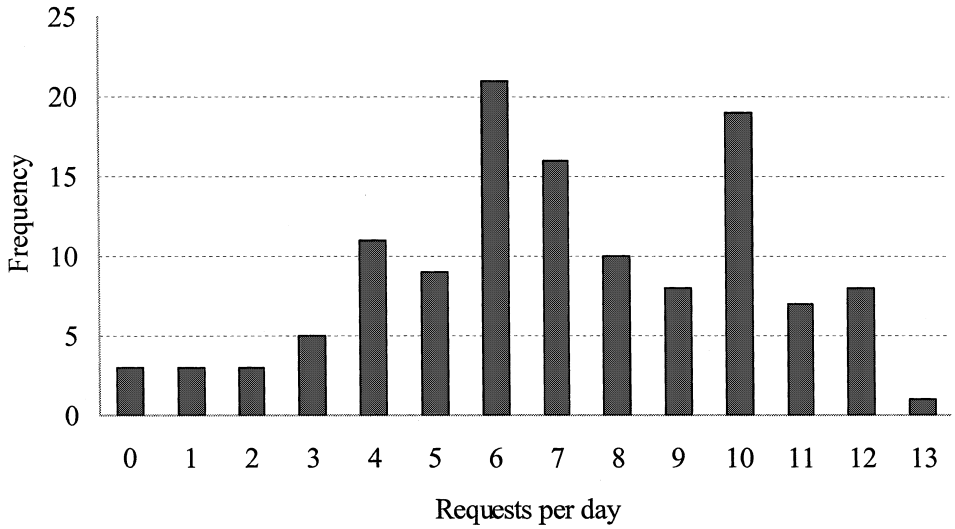

Figure 5 Frequencies of requests for bullock work, Aurepalle, *kharif* 1990

Table 4 Number of daily requests for bullocks for crop and transport work

	Mean	Median	Standard deviation
Bullock work	7.1	7	3.0
Crop work	4.1	4	2.7
Transport work	3.0	3	2.1

The most remarkable information from figure 5 is that there were only three days on which the contractors received no requests for hired bullock work. A market of such continuity can hardly be considered as being incomplete, as seems to be assumed by most analysts of bullock markets in India.

Not all searches by farmers for a bullock contractor are successful. On average, we observed more requests per day than there were bullock contractors in our sample (table 4) and on 35 of the 124 days there were enough requests to hire all of the six bullock contractors. Of course, on any given day, more than one request could be from the same potential buyer. Furthermore, searchers' offers for work may be turned down by a contractor. The most common reason cited for turning down an offer was that the supplier had to do his own crop work. The next most common reason, cited less than 10 per cent of the time, was that the bullock driver was not available.

It is not uncommon in markets that some offers are rejected – for example, employees sometimes refuse to work overtime because they have work to do at home. Labour markets are not usually considered inhibited for this reason. We also have no reason to call bullock rental markets inhibited when bullock owners do not accept contract work. The fact that farmers regularly search for bullock contractors is sufficient evidence that the rental market is continuous and that the market is largely uninhibited by covariate own demand and market demand for bullock labour, as has been claimed in the literature.

6.2 Contractual terms

Bullock hire contracts differ in three main dimensions. The contract can be for immediate execution of the contracted work or it can be for some future period, payment may be in cash or in kind to be paid either immediately or in the future, and the contract may be for one or for several activities. Negotiations could be tedious if all dimensions were explored in each transaction. This is obviously not the case as no contractor or farmer complained about excessive time spent on negotiating the terms of a hire. Nevertheless, the type of arrangement affects the issues that arise during contract negotiations.

Table 5 Frequency of arrangements for crop work

	Single job, for payment	Single job, in exchange	Multiple jobs, for payment	Multiple jobs, in exchange	Total
Spot	49	5	5	1	60
Forward	15	4	5	0	24
Total	64	9	10	1	84

Table 6 Pairs of draft animals owned by hirers and frequencies of contract types

Pairs	Spot	Forward
0	26	11
1	29	12
2	5	1
3	1	1

Types of arrangements

Table 5 summarises the frequencies of the types of arrangements made by the bullock contractors and their clients. Sometimes a farmer-buyer hired more than one bullock contractor. These are counted as one hire in terms of the numbers of contracts. Slightly more than 70 per cent of the arrangements are spot contracts that have been arranged either on the same day or the day before the work is done. Most contracts, both spot and forward, are for payment. However, one-sixth of forward contracts were for exchange in kind as compared with one-tenth of spot contracts.

If the spot market for bullocks were considered unduly risky for hirers, one would expect those without bullocks of their own to be active in the forward market. The data, however, do not support this conjecture. Table 6 shows that hirers' bullock endowments had no effect on whether the contract was spot or forward. It should be noted that this table lists more hires than table 5. The reason is that several times the client hired more than one bullock supplier. In table 6, unlike table 5, they are counted as separate hires.

The most complex arrangement is the exchange contract for multiple jobs. This is also the least common arrangement in the village and we refrain from describing the details of the one case that we observed.

Decisions when to work

Unlike spot contracts, forward contracts must specify when work should be done. Unpredictable events, such as rainfall and soil moisture levels, affect the timing of farming operations, making it undesirable to firmly commit in advance to working at a specific date. The dominant arrangement (13 out of

18 responses) was to discuss again when to do the work. Responses from both contractors and clients indicated that the client always made this decision, irrespective of whether the arrangement was for pay or in exchange. Most of the time the contractor was informed of the farmer's decision 2 or more days before the work was needed to be done.

Means and amount of payment

Coase (1988, p. 38) regarded the discovery of the relevant prices '… the most obvious cost of ''organising'' production through the price mechanism'. There are three issues to consider when negotiating payment. First, there is the discovery of the relevant prices. Second, the means of payment can be costly. Third, the value of cash to the seller may fluctuate, as is the case of the value of money in terms of food when local food availability varies seasonally.

Given the large shifts in demand for bullock services, we would expect large and rapid changes in prices for bullock services (p_o and p_{fw} in figure 1). The striking feature of the cash payments in our sample is that most were for the same amount, Rs 35 per day. Most spot contracts (28 out of 32) were for this amount as were 12 out of the 18 payments for single-job, forward contracts. There was no apparent pattern to the timing of the payments that were not Rs 35 per day.

The uniformity of cash payments is a puzzle. The standard economic model illustrated in figure 1 predicts that factor inputs are paid their marginal product. Given the considerable fluctuations in demand for bullock services, marginal products fluctuate as well and prices for bullock services should follow.

Some of this fluctuation was met through additional non-cash payments. One out of three spot transactions included some payment in kind and five out of the 18 forward transaction included payment in kind (table 7). Often, the in-kind portion of a mixed cash and in-kind payment was fodder for the bullocks. The use of mixed cash and in-kind payment allows for some variation in real payments without varying money price. It is not clear that these variations are enough to be consistent with the variability in demand

Table 7 Frequencies of forms of payment in spot and forward contracts

	Type of contract	
Form of payment	Spot	Forward
Cash	32	13
In-kind	7	2
Cash and in-kind	9	3
All	48	18

for bullock services, particularly since we did not observe any pattern in the timing of payments that were not Rs 35 per day. Unfortunately, our survey results do not provide us with any data on why money prices for bullock services vary so little. A likely explanation is that constant prices reduce the haggling needed to equalise price and marginal cost in every transaction. Any effort spent on negotiating prices would be wasted in this relatively closed and transparent village market if at the end of a year very similar revenue flows obtained from contracts whose money prices were or were not adjusted to reflect temporary scarcities of bullock labour. Another possible explanation is that this might be a custom that provides some implicit insurance.

One further observation concerning means of payment warrants reporting. All paddy (rice) threshing operations were paid in paddy rather than cash. Paddy, unlike the other main crop castor, is used for subsistence. Consequently, payment in-kind avoids the costs of purchasing paddy for subsistence.

Naturally, other matters than money were at issue in negotiations for exchange contracts. For the single-job exchange contract, in three cases out of nine, contractors and their clients discussed when to do the work, in six cases the discussion involved whether other crop work should be exchanged, and six times transaction partners discussed whether to work together. In the single observation of a multiple job exchange contract, it was discussed whether other crop work should be done in exchange and whether the bullocks should work together.

In exchange transactions a unit of measuring bullock services must be chosen. Bullock services may be measured in terms of bullock time or in terms of area operated. In most (six out of eight) exchange arrangements service was measured in terms of time (hours or days) and only in two cases did the partners agree on working on the same size of plots.

6.3 Recording, monitoring and enforcement

Like most transactions, contracting for bullock service involves mutual promises that might not be kept, for valid or opportunistic reasons. Aware of the risk from broken promises, buyers and sellers usually take some precautions against opportunism.

Some transaction costs can be avoided and enforcement of contracts is facilitated when contracts are recorded. Our survey data indicate that recording of the terms of contract is not a great concern. Contracts were never put in writing. Given the low level of literacy in the village, this may be as much an indicator of the high costs of recording a contract as an indicator of negligible expected costs from disputes over the terms of the contract. Having witnesses present at the oral negotiation is a another way to record contractual information. Rarely are witnesses present at the negotiations of

bullock service contracts and if they are present at all, then only when complicated arrangements are negotiated. Single job contracts, both spot and forward, almost never had other people present at the negotiations. Plausibly, contract compliance is sufficiently assured by both parties anticipating a long-term relationship (Johnson 1950).

Much monitoring is implicit because farmers and contractors work together. The responses from the bullock contractors indicated that either the bullocks worked together or the farmer-buyer supervised the contractor and we can unambiguously conclude that supervision is the rule rather than the exception.

Low transaction costs are incurred with oral contracts and implicit monitoring. Both are indicators of infrequent or unimportant problems with contractual compliance. The absence of any reports about problems with contractual compliance in all types of arrangements, whether spot or forward, cash or in-kind, single job or multiple job, could therefore be expected. Furthermore, since effort spent on search and negotiation are also low, we have no evidence that transaction costs are sufficiently high to seriously impede the market for bullock services.

7. What we have learned

Our survey of the transactions in a village market has shown:

1. Farmers with and without bullocks hire from the market.
2. The market is used not only for transport services but also for crop work services.
3. There are short-term and long-term fluctuations in demand for bullock labour and the market for bullock labour buffers peaks in the demand for labour by owned bullocks.
4. Some farmers exclusively farm with hired bullocks and the market is active on every day when weather permits bullock work.
5. There are spatial variations in rainfall frequency and intensity. These variations may help sustain a market in bullock services.
6. Single job, spot contracts are the most common arrangement.
7. Bullocks are not hired separately from their driver.
8. For crop work, hired bullock services are always supervised by the farm operator.
9. There are no special efforts to enforce contracts, and enforcement is never reported to be a problem.
10. Payment is usually in cash, except at the end of the season when it is in paddy.
11. Despite demand fluctuations, prices do not vary much.

Our sample is limited to transactions from a single cropping season in a single village. Neither season nor village are, however, atypical for conditions in South India. Indeed, our sample village has been taken as typical in the literature on the Indian semi-arid tropics. For these reasons, our evidence indicates that analysts of village economies need to be cognisant of the role that markets for draught power play in the organisation of production.

Our survey confirms Coase's expectation that by studying contracting in a real world setting, one becomes aware of the richness of institutional alternatives. The farmers in our sample were not highly trained traders. Nevertheless, as a group they demonstrated considerable skills in the art of deal making. Even for bullock labour there are a number of alternatives to simple spot contracts. Farmers have evolved an arsenal of contractual choices that can be adjusted on several margins to the specific requirements and preferences of exchange partners.

It is the nature of this type of research that the results often suggest many new questions that were not addressed in the survey design. When we designed our survey instrument we were primarily interested in investigating the details of transactions in the bullock hire market. As noted, several interesting questions that arise from our study cannot be answered from our data. Such questions include: (i) what causes price rigidity, (ii) at what price do farmers who do not usually offer bullock services choose to become suppliers in the bullock hire market and (iii) to what extent do farmers adjust factor proportions through transactions in the land as well as the bullock hire markets? The expense of conducting surveys such as ours also makes it difficult to do a quick follow-up survey. Our hope is that future researchers who design detailed market structure surveys will be able to build upon our efforts to address a wider range of questions.

Transaction analyses, like the one reported here, have their downside. Our study required that an investigator was trained to apply the battery of 19 questionnaire schedules, that he stayed in the village for the entire cropping season so that each contractor could be interviewed on each work day, that contractors and their clients were willing to spend considerable time giving answers to what must have seemed to them very repetitive questions, and that an assistant reliably recorded precipitation measurements after each rainfall event from each of the twenty rain gauges distributed throughout the village plots. Such efforts are labourious and they certainly are not intellectually challenging. But sometimes labourious data collection and analysis is needed to prevent us from advancing policy recommendations derived from models that misrepresent important aspects of reality.

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