

Development of valuation index for draught cattle breeds of Tamil Nadu, India

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ABSTRACT

An attempt was made to develop a valuation index for draught cattle breeds of Tamil Nadu, which would help the farmers in getting the right price for their animals sold. The data were collected through personal interview using pre-tested interview schedule from 225 draught cattle owners from selected three districts of Tamil Nadu during the year 2010-11. A multiple linear regression was fitted for arriving at the valuation index of draught cattle breeds viz., Burgur, Kangayam and Umbalacherry. The adjusted R² for overall draught cow valuation index was 0.818. The factors like presence of whirls in acceptable body region, skin and coat, body weight, milk yield and presence of pregnancy were found to be significant and had influenced the value of animal to the tune of Rs. 1642.40, Rs.1250.21, Rs. 36.25, Rs. 679.30 and Rs. 1241.24, respectively from their mean value. The overall draught bullock valuation index was also fitted and its adjusted R² was 0.428. The variable body weight was found to be significant at one per cent level, whereas age was found to be significant at five per cent level and had negative influence on bullock value. The duration of work was found to be significant at five per cent level and it hiked the value at the rate of Rs.528.26. The variables like skin and coat, activeness, whirls, right pair, disease tolerance and breed were found to be non-significant.

Key words : Burgur, Draught cattle, Kangayam, Umbalacherry and Valuation index.

INTRODUCTION

Draught animal power is a consistent and popular farm power resource in most developing countries, especially in India. Draught cattle assist in eliminating poverty, in reducing drudgery and in creation of wealth. Draught cattle were marketed mainly in *shandies*, cattle fairs and at home directly to buyers / farmers or with the help of brokers / commission agents. However, valuation of these animals was not fixed on scientific basis but through traditional “*Hatha*” method where the process of negotiation on pricing the animals is hidden, as the bargainers close their digits with cloth and negotiate through finger palpation method. The information on price of the animals is not open but through various secret codes. Buyers and sellers rely mostly on brokers / intermediaries, who reap major share of animal price bypassing the buyers and sellers. Several malpractices like tooth rasping, horn sharpening and painting, drenching, etc., often interfered with the accurate valuation of animals, when buyers use traditional methods of purchase. Although bullocks were priced based on breed, dentition, body confirmation, shape of horns, skin, shoulders, eyes, hooves and tail, other parameters such as pairing of animals, height, girth, age, whirls and colour were also found to have a prominent role in pricing of bullocks (Selvakumar, 2003). Thus cattle owners, veterinarians, bankers and insurance

officials often find it difficult to judge the price of draught animals. Studies pertaining to valuation of draught cattle breeds are essential for giving scientific guidelines in draught animal price fixation and to minimize the interference of the intermediaries. Hence, the present study was carried out with the objective of developing a valuation index for draught cattle breeds of Tamil Nadu.

MATERIALS AND METHODS

Among various draught breeds prevailing in Tamil Nadu, three breeds viz., Burgur, Kangayam and Umbalacherry were selected based on the wide usage of these breeds in various agricultural operations of the State. To collect data pertaining to Burgur breed, Erode district from Western zone of Tamil Nadu, being the breeding tract of the above said breed was purposively selected. Similarly for Kangayam breed, Tiruppur district of Western zone of Tamil Nadu and for Umbalacherry breed, Nagapattinam district of Cauvery delta zone of Tamil Nadu were selected based on their breeding tract. A sample respondent of 75 animal owners each for Burgur, Kangayam and Umbalacherry were selected randomly from five villages of three selected districts making the total sample size as 225. The data were collected through personal interview using pre-tested interview schedule from 225 draught cattle owners from selected three districts of Tamil Nadu during the year 2010-11

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by the field enumerators. Necessary cross checks were made by the research team and special care was taken to avoid recall bias and reduce error in data collection.

For developing valuation index of a draught animal, multiple linear regression model was fitted as used by Selvakumar (2003) and Pandit and Dhaka (2006). For the present study zero order correlation coefficients among animal values and quantitative factors were worked out to identify multi-collinearity among variables. Those variables that had multi-collinearity problems were dropped from the analysis. Finally, on *a priori* ground the multiple linear regression of the

following model was fitted for arriving at the valuation index for draught cow and bullocks. Shaeffer's formula (Sastry *et al.*, 1983) was used to calculate the body weight of animals.

Draught cow

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \mu$$

The variables for fitting the multiple linear regression on valuation of draught cow are as follows. The breed-wise valuation index and the overall index was fitted by including the variable 'breed'.

Variables	Specifications
Y	Valuation of draught cow in rupees
X ₁	Colour 1 – At par with breed characteristics and 0 – Otherwise
X ₂	Skin and coat 2 – Shiny, 1 – Dull and 0 – Rough
X ₃	Whirls 1 – Whirls located at acceptable region as perceived by the farmer and 0 – Otherwise
X ₄	Easy handling 1 – Easy to handle and 0 – Otherwise
X ₅	Body weight in Kilograms
X ₆	Age in years
X ₇	Pregnancy 1 – Pregnant and 0 – Otherwise
X ₈	Calving interval in months
X ₉	Sex of the calf 1 – Female and 0 – Otherwise
X ₁₀	Stage of lactation 1 – First stage, 2 – Second stage, 3 – Third stage and 0 – Otherwise
X ₁₁	Milk yield in litres
X ₁₂	Disease tolerance 1 – Disease tolerant and 0 – Otherwise
X ₁₃	Breed 1 – Umbalacherry, 2 - Kangayam and 3 – Burgur
μ	Error term

Bullock

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \mu$$

The variables for fitting the multiple linear regression on valuation of bullock are as follows. The breed-wise valuation index was fitted and the overall index was fitted by including the variable 'breed'.

Variables	Specifications
Y	Valuation of bullock in rupees
X ₁	Colour 1 – At par with breed characteristics and 0 – Otherwise
X ₂	Age in number of years
X ₃	Skin and coat 2 – Shiny, 1 – Dull and 0 – Rough
X ₄	Activeness 2 – Good, 1 – Average and 0 – Poor
X ₅	Whirls 1 – Whirls located at acceptable region as perceived by the farmer and 0 – Otherwise
X ₆	Body weight in kilograms
X ₇	Right Pair 1 – With right pair and 0 – Otherwise
X ₈	Easy handling 1 – Easy to handle and 0 – Otherwise
X ₉	Duration of work in hours per day
X ₁₀	Disease tolerance 1 – Disease tolerant and 0 – Otherwise
X ₁₁	Breed 1 – Umbalacherry, 2 - Kangayam and 3 – Burgur
μ	Error term

RESULTS AND DISCUSSION

For developing valuation index of an animal, multiple linear regression model was fitted for breed-wise and overall female draught cattle as well as draught bullocks and the results are presented as follows.

Valuation index for female draught cattle

For developing valuation index of animal, multiple linear regression model was fitted for female draught cattle using the variables namely colour, skin and coat, whirls, easy

handling, body weight, age, pregnancy, calving interval, sex of the calf, stage of lactation, milk yield, disease tolerance and breed. The results are presented in Table 1 and equations detailed below:

Umbalacherry

$$Y = 4094.21 - 61.67 X_1 + 112.94 X_2 + 685.14 X_3 + 1159.47 X_4 - 2.31 X_5 + 33.28 X_6 + 1405.55 X_7 + 19.95 X_8 + 153.42 X_9 + 194.56 X_{10} + 319.13 X_{11} + 1478.70 X_{12} + \mu$$

Kangayam

$$Y = 4275.46 - 57.39 X_1 + 483.69 X_2 + 2283.04 X_3 - 73.77 X_4 + 25.59 X_5 - 125.46 X_6 + 2206.19 X_7 + 194.00 X_8 - 1114.52 X_9 + 618.70 X_{10} - 667.72 X_{11} + 1396.53 X_{12} + \mu$$

Burgur

$$Y = 3356.07 - 856.33 X_1 + 1450.86 X_2 + 1770.68 X_3 - 791.88 X_4 + 9.47 X_5 + 70.62 X_6 + 2053.30 X_7 + 350.27 X_8 - 874.84 X_9 + 297.75 X_{10} - 817.01 X_{11} - 86.02 X_{12} + \mu$$

Overall draught cow

$$Y = -5101.29 - 44.70 X_1 + 1250.21 X_2 + 1642.40 X_3 + 543.40 X_4 + 36.25 X_5 - 82.98 X_6 + 1241.24 X_7 + 3.22 X_8 - 919.38 X_9 + 325.79 X_{10} + 679.30 X_{11} - 196.29 X_{12} + 1895.13 X_{13} + \mu$$

The co-efficient of multiple determination (Adjusted R²) for the regression equation fitted for the valuation of Umbalacherry cow was 0.596 indicating that 59.60 per cent variations in the price of Umbalacherry cow was explained by the chosen independent variables. Among

various variables, pregnancy was found to be positively significant at one per cent level. It implied that under *ceteris paribus*, presence of pregnancy increased the value of animal to the tune of Rs.1405.55. The variables easy handling and disease tolerance were found to be positively significant at five per cent level. The table revealed that the disease tolerant Umbalacherry cow valued Rs.1478.70 more than that of disease intolerant animals. It was also found animals that are easy to handle increased the price level of animals at the rate of Rs. 1159.47. The variables on weight and colour were found to negatively influence the price of cow, but were non-significant.

The valuation pattern of Kangayam cow was depicted through the multiple linear regression model as mentioned in Table 1. The adjusted R² was found to be 0.619, indicating that 61.90 per cent of variations in price of Kangayam cow was explained by the included independent

TABLE 1: Valuation index for female draught cattle

	Independent variables	Umbalacherry	Kangayam	Burgur	Overall
α	Constant	4094.21 (2.108)*	4275.46 (0.731)	3356.07 (1.187)	- 5101.29 (1.918)
X ₁	Colour (1 – at par with breed characteristics and 0 – Otherwise)	- 61.67 (0.121)	- 57.39 (0.054)	- 856.33 (1.697)	- 44.70 (0.085)
X ₂	Skin and coat (2 – Shiny, 1 – Dull and 0 – Rough)	112.94 (0.523)	483.69 (0.522)	1450.86 (2.841)**	1250.21 (3.934)**
X ₃	Whirls (1 – Whirls located at acceptable region as perceived by the animal owner and 0 – Otherwise)	685.14 (1.423)	2283.04 (2.193)*	1770.68 (3.538)**	1642.40 (3.274)**
X ₄	Easy handling (1 – Easy to handle and 0 – Otherwise)	1159.47 (2.464)*	- 73.77 (0.041)	- 791.88 (1.540)	543.40 (0.935)
X ₅	Body weight in Kgs	- 2.31 (0.360)	25.59 (3.187)**	9.47 (1.763)	36.25 (9.586)**
X ₆	Age in years	33.28 (0.334)	- 125.46 (0.461)	70.62 (0.255)	-82.98 (0.597)
X ₇	Pregnancy (1 – Pregnant and 0 – Otherwise)	1405.55 (2.904)**	2206.19 (2.332)*	2053.30 (4.795)**	1241.24 (2.493)*
X ₈	Calving interval in months	19.95 (0.342)	194.00 (0.891)	350.27 (1.910)	3.22 (0.037)
X ₉	Sex of the calf (1 – Female and 0 – Otherwise)	153.42 (0.369)	- 1114.52 (1.179)	- 874.84 (1.870)	-919.38 (1.914)
X ₁₀	Stage of lactation (1 – First stage, 2 – Second stage, 3 – Third stage and 0 – Otherwise)	194.56 (1.125)	618.70 (1.322)	297.75 (2.068)*	325.79 (1.708)
X ₁₁	Milk yield in litres	319.13 (1.286)	- 667.72 (1.744)	- 817.01 (1.359)	679.30 (3.26)**
X ₁₂	Disease tolerance (1 – Disease tolerant and 0 – Otherwise)	1478.70 (2.216)*	1396.53 (0.754)	- 86.02 (0.137)	-196.29 (0.282)
X ₁₃	Breed 1 - Umbalacherry, 2-Kangayam and 3 – Burgur)	-	-	-	1895.13 (4.95)**
	Adjusted R ²	0.596	0.619	0.728	0.818
	F value	6.529**	7.082**	9.013**	45.162**
	n	46	46	37	129

Figures in parentheses indicate t values

* Significant at five per cent level

** Significant at one per cent level

variables in the model. Among various variables, body weight was found to be highly significant, which implied that one kg increase in body weight would increase the value of animal by Rs.25.59. Similar to Umbalacherry breed, the variable pregnancy was found to be significant but at five per cent level. The value of Kangayam cow increased by Rs.2206.19, in case of pregnancy. In addition, the variable on whirls in favourable region was found to be statistically significant at five per cent level and it increased the value of animals by Rs.2283.04. The variables colour, easy handling, age, sex of the calf and milk yield were found to be non-significant and negatively influenced the valuation of Kangayam cows.

The multiple linear regression on Burgur cow valuation index revealed 72.80 per cent variations in value was explained by the variables mentioned in the Table 1. The variables *viz.*, pregnancy, presence of whirls in favourable location, skin and coat and stage of lactation were found to be statistically significant and per unit rise in these variables increased the value of Burgur cow at the rate of Rs. 2053.30, Rs. 1770.68, Rs. 1450.86 and Rs. 297.75, respectively. The variables like body weight, age and calving interval were found to be positive and not significantly influencing the value of Burgur cow.

The overall draught cow valuation index was also fitted and it explained 81.80 per cent of variations through the included variables. The variable breed was included for fitting the overall valuation model and was found to be significant at one per cent level and the positive value of coefficient implied that value of cows were more for Burgur and Kangayam compared to Umbalacherry cow. The factors like presence of whirls in acceptable body region, skin and coat, body weight and milk yield were found to be highly significant and had influenced the value of animals to the tune of Rs. 1642.40, Rs.1250.21, Rs. 36.25 and Rs. 679.30, respectively. The pregnant animal was found to be significant at five per cent level and it hiked the value at the rate of Rs. 1241.24. The variables like colour, age, sex of the calf and disease tolerance were found to have negative influence on the animal value and they were non-significant. Although presence of whirls has no scientific basis to influence the price of animal, the psychological perception of owners resulted in the significant influence on the value of draught cows. The factors like skin and coat and body weight directly reflects the health of the animal, which might have determined the value of animal. As pregnant animals will be calving a young one, which is an added benefit to the farmer, its value was more compared to non-pregnant animals. Apart from these factors, milk yield influenced the animal value, which might be due to the feeding of unweaned calves and added advantage of domestic milk consumption.

Valuation index for bullock

Multiple linear regression models were fitted for valuation of bullock using the variables namely colour, age, skin and coat, activeness, body weight, right pair, easy

handling, duration of work, disease tolerance and breed. The results are shown in Table 2 and equations as detailed below:

Umbalacherry

$$Y = -4714.95 + 998.06 X_1 - 57.43 X_2 + 381.04 X_3 + 1281.74 X_4 + 2082.93 X_5 + 17.18 X_6 + 2112.93 X_7 + 1129.03 X_8 + 724.79 X_9 + 280.68 X_{10} + \mu$$

Kangayam

$$Y = -6945.07 + 1157.69 X_1 - 1675.89 X_2 + 1519.34 X_3 + 327.10 X_4 + 3887.06 X_5 + 80.81 X_6 + 1733.46 X_7 - 1477.03 X_8 + 278.83 X_9 - 245.90 X_{10} + \mu$$

Burgur

$$Y = 1098.98 - 190.48 X_1 + 40.10 X_2 - 95.87 X_3 + 1469.10 X_4 + 610.63 X_5 + 16.15 X_6 + 895.37 X_7 - 402.86 X_8 + 578.70 X_9 + 1435.27 X_{10} + \mu$$

Overall bullock

$$Y = -5130.52 - 71.57 X_1 - 468.19 X_2 + 592.22 X_3 + 1227.90 X_4 + 1054.02 X_5 + 42.45 X_6 + 1145.75 X_7 - 918.41 X_8 + 528.26 X_9 + 591.53 X_{10} + 645.12 X_{11} + \mu$$

The co-efficient of multiple determination (Adjusted R) for the regression equation fitted for the valuation of Umbalacherry bullock was 0.685 indicating 68.50 per cent variations in the price of Umbalacherry bullock explained by the chosen variables. Among various variables, whirl was found to be positively significant at one per cent level. It implied that presence of whirls at acceptable region increased the value of the animal to a tune of Rs.2082.93. The variables activeness, right pair and duration of work were found to be positively significant at five per cent level. The table revealed that the activeness increased the value of Umbalacherry bullock by Rs.1281.74. It also revealed that the price of one bullock available in pair was Rs. 2112.93 more than that of single bullock. Duration of work (in hours) increased the value of Umbalacherry bullock by Rs.724.79. The variable age was found to negatively influence the price of bullock, but was non-significant.

The valuation pattern of Kangayam bullock was depicted through multiple linear regression model and is given in Table 2. The adjusted R² was found to be 0.551, indicating 55.10 per cent of variations in price of Kangayam bullock which was explained by the included variables. Among various variables, body weight was found to be highly significant, which implied that one kg increase in body weight would increase the price of animal by Rs.80.81. Similar to Umbalacherry breed, the variable whirl was found to be significant at five per cent level. The value of Kangayam bullock increased by Rs.3887.06, by presence of whirls in favourable location as perceived by the respondents. In addition, the variable age was found to be statistically significant at five per cent level and it decreased the value of animals to a tune of Rs.1675.89 for every unit increase in age of bullock. The variables on easy handling and disease tolerance were found to have a negative influence on the valuation of Kangayam bullocks and were non-significant.

TABLE 2: Valuation index for draught bullock

	Independent variables	Umbalacherry	Kangayam	Burgur	Overall
α	Constant	- 4714.95 (1.773)	- 6945.07 (0.810)	1098.98 (0.400)	- 5130.52 (1.997)*
X ₁	Colour (1 – at par with breed characteristics and 0 – Otherwise)	998.06 (0.847)	1157.69 (0.368)	- 190.48 (0.547)	- 71.57 (0.078)
X ₂	Age in number of years	- 57.43 (0.212)	-1675.89 (3.251)**	40.10 (0.216)	- 468.19 (2.322)*
X ₃	Skin and coat (2 – Shiny, 1 – Dull and 0 – Rough)	381.04 (0.692)	1519.34 (1.145)	- 95.87 (0.207)	592.22 (1.149)
X ₄	Activeness (2 – Good, 1 – Average and 0 – Poor)	1281.74 (2.199)*	327.10 (0.089)	1469.10 (2.347)*	1227.90 (1.592)
X ₅	Whirls (1 – Whirls located at acceptable region as perceived by the farmer and 0 – Otherwise)	2082.93 (2.509)**	3887.06 (2.209)*	610.63 (1.575)	1054.02 (1.543)
X ₆	Body weight in Kgs	17.18 (1.721)	80.81 (5.642)**	16.15 (4.361)**	42.45 (6.241)**
X ₇	Right pair (1 – With pair and 0 – Otherwise)	2112.93 (2.049)*	1733.46 (0.476)	895.37 (2.337)*	1145.75 (1.273)
X ₈	Easy handling (1 – Easy to handle and 0 – Otherwise)	1129.03 (1.175)	- 1477.03 (0.698)	- 402.86 (1.177)	- 918.41 (1.205)
X ₉	Duration of work in hours per day	724.79 (2.110)*	278.83 (0.373)	578.70 (2.274)*	528.26 (2.063)*
X ₁₀	Disease tolerance (1 – Disease tolerant and 0 – Otherwise)	280.68 (0.366)	- 245.90 (0.129)	1435.27 (1.234)	591.53 (0.665)
X ₁₁	Breed (1 - Umbalacherry, 2-Kangayam and 3 – Burgur)	-	-	-	645.12 (0.991)
	Adjusted R ²	0.685	0.551	0.700	0.428
	F value	9.050**	5.546**	9.620**	8.685**
	n	38	38	38	114

Figures in parentheses indicate t values

* Significant at five per cent level

** Significant at one per cent level

The multiple linear regression on Burgur bullock valuation index revealed 70 per cent variations in value of Burgur bullock which were explained by the variables mentioned in the Table 2. The variables *viz.*, activeness, body weight, right pair and duration of work were found to be statistically significant and per unit rise in these variables increased the value of Burgur bullock at the rate of Rs. 1469.10, Rs. 16.15, Rs. 895.37 and Rs. 578.70, respectively. The variables like age, whirls and disease tolerance were found to be positive and were not significantly influencing the value of Burgur bullock.

The overall draught bullock valuation index was also fitted and it explained 42.80 per cent of variations through the explanatory variables taken for the study. The variable body weight was found to be significant at one per cent level and positive value of co-efficient implied that the value of bullocks increased at the rate of Rs.42.45 per kg increase in weight of animals. In contrast, age was found to be significant at five per cent level and had negative influence on bullock value. In other words, one year increase in age of bullock decreased its value by Rs.468.19. The duration of work was found to be significant at five per cent level and it

hiked the value at the rate of Rs.528.26. The variables like skin and coat, activeness, whirrs, right pair, disease tolerance and breed were found to be non - significant and had positive influence. The variables namely colour and easy handling were identified to be negative and non-significant factors on bullock valuation.

CONCLUSIONS

Draught cattle play a fundamental and pivotal role in livelihood improvement of its owner as they provide farm power and contribute to food security, poverty reduction, income generation and to some extent gender equity. Since there were no scientific basis for draught cattle valuation, intermediaries gained more share in the animal value during their transactions. It is the need of the hour to regulate cattle markets to culminate the malpractices involved and safeguard the interest of draught cattle owners. The cattle owners, Veterinary Assistant Surgeons, officials of non-government agencies and institutions like banks and insurance find it difficult to fix the value of draught cattle. The study revealed that the price for female draught cattle was mainly fixed based

on skin and coat condition, whirrs located at acceptable region, younger age, pregnancy, milk yield and breed. As bullocks are exclusively meant for draught purpose, draught quality was taken as the primary factor in fixing the price of the bullock. As the factors like age, body weight and duration of work directly indicates the draught quality, these factors influenced bullock price fixation. Hence, the formula / index developed by this study for valuation of draught cattle may be utilized by the farmers and needy institutions / agencies. Also, animal owners should be made aware about the factors that are important for fixing the animal value. Banks and micro-financing institutions could provide loans to farmers based on the valuation index developed by this study for purchase of draught cattle that would be realistic in fixing values for the specific draught cattle breeds.

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