Why Do Bangladeshi Cattle Yield High Positive Returns?

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Outline

What is the debate all about?

Why is it relevant for Bangladesh?

What have we done?

What are the results?

Why returns to livestock primarily positive and high in Bangladesh?

What are the implications for livestock development in Bangladesh?

CLARIFICATION: CATTLE OR LIVESTOCK=COWS (FEMALE COW) AND BULLS (MALE COW)

CAUTION: PRELIMINARY FINDINGS (PLEASE DO NOT CITE)

What is the debate all about?

Preponderance of negative rates of return from livestock in India. [Anagol et al. (2017), Attanasio and Augsburg (2018), Gehrke and Grimm (2018)]

Economic rationality: Farmers should invest elsewhere not in cattle - core of economics.

Ad hoc Explanations: 'non-embedded' ideas (Acemoglu)
- Measurement error
- Preference for home produced milk
- Preference for illiquid savings
- Labor market failures
- Religious and social status value

No convincing explanation exists, the puzzle is not solved!

Why is it relevant for Bangladesh?

If we also have predominantly negative returns like India then,

- Should we give up livestock development programmes ?

- Should we question the usefulness of asset transfer programmes (e.g. CLP)?

- We do not have rigorous/systematic estimate of RORs of livestock in Bangladesh.

What have we done?

We estimated ROR from BIHS (Bangladesh Integrated Household Survey) panel data of IFPRI which is nationally representative (rural)

We used the method used by Gehrke and Grimm (2018) and estimated average and marginal returns from raising livestock

Sample

Sample Households

	2011	**2015**
Only bullock	322 (30.23)	236 (26.70)
Only milch cow	381 (35.77)	310 (35.07)
Both bullock and milch cow	362 (33.99)	338 (38.24)
All	1,065 (100.0)	884 (100.0)

Household characteristics: cattle owners vs. non-owners

Cattle-owning households are more likely to be male-headed than non-cattle owning households

The heads of the households with cattle are also older by about 3 years

Household size is also larger for households with cattle

Male-female ratio is significantly higher for the cattle-owning households

Households that raises cattle have higher amount of land

Household characteristics: cattle owners vs. non-owners

| | 2011 | | | | | 2015 | | | | |
| | No cattle | | Cattle owners | | | No cattle | | Cattle owners | | |
	Mean	SD	Mean	SD	p value	Mean	SD	Mean	SD	p value
Male household head	0.74	0.43	0.92	0.26	0.000	0.73	0.44	0.91	0.27	0.000
Age of household head	42.36	14.28	45.58	13.19	0.000	44.15	14.05	47.13	12.89	0.000
Household size	3.98	1.55	4.59	1.76	0.000	4.13	1.67	4.68	1.80	0.000
Household head is literate	0.45	0.49	0.43	0.49	0.128	0.49	0.5	0.44	0.49	0.0016
Male female ratio	1.06	0.87	1.24	0.89	0.000	1.07	0.85	1.25	0.88	0.000
Per capita Food expenditure (monthly BDT)	1341	800.67	1061	654.38	0.000	1310	886.82	1028	650.51	0.000
Per capita total expenditure (monthly BDT)	2717	2318.72	2474	2312.60	0.000	3038	3479.64	2450	2811.33	0.000
Homestead land owned (decimal)	7.64	10.47	10.80	13.14	0.000	6.91	10.11	10.13	11.83	0.000
Total land owned (decimal)	36.10	84.76	89.04	154.82	0.000	38.97	98.61	95.41	170.22	0.000
Cultivated land (operated) (decimal)	34.72	81.73	148.38	195.79	0.000	39.02	92.39	142.84	195.71	0.000
Distance to local shop(km)	0.58	0.62	0.67	0.72	0.000	0.42	0.56	0.51	0.61	0.000
Observations	2,606		1,817			2,776		1,643		

Note: BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT). Cattle owner means a household is currently (at the end period) raising bullock and/or milk cow. "Only Buffalo" raising households have been excluded.

Characteristics of cattle farming

Total and average values of the stock increased between the survey years in real terms

The herd size is the highest for those having both milch cows and bullocks

Herd size increased during the survey periods

Average appreciation increased

Characteristics of cattle farming

	2011 Mean (no. of observations)	SD	**2015** Mean (no. of observations)	SD	p-value
Total value of stock of cattle (BDT)	32848 (1065)	29546.95	16411 (884)	30294.17	0.026
Average cattle value (BDT)	15581 (1065)	8444.29	16308 (884)	8941.44	0.035
Herd size: Only Bullock	1.91 (322)	1.19	2.03 (236)	1.48	0.283
Herd size: Only Milk Cow	1.72 (381)	1.00	1.91 (310)	1.39	0.037
Herd size: Both Milk cow and bullock	2.87 (362)	1.66	2.73 (338)	1.52	0.250
Herd size: All	2.17 (1065)	1.41	2.26 (884)	1.51	0.181
Appreciation (BDT)	4182 (1065)	12286.1	6356 (884)	12276.13	0.000
Milk revenue (BDT)	10164 (482)	23354.6	10811 (486)	18462.54	0.632
Manure revenue (BDT)	1974 (1053)	2190.70	1540 (765)	1692.97	0.000
Revenue from calves (BDT)	8467 (391)	3088.34	8288(327)	3060.95	0.436
Fodder cost (BDT)	4870 (883)	10880.21	4694 (725)	6568.19	0.703
Value of the cattle lost (BDT)	29833 (15)	36941.88	16912 (06)	15183.65	0.422
Family labor cost (total) (BDT)	6974 (1055)	5371.44	3864 (882)	2026.66	0.000
Family labor cost (male) (BDT)	4348 (895)	5087.90	2552 (800)	1622.45	0.000
Family labor cost (female) (BDT)	3487 (994)	2254.42	1614 (846)	994.75	0.000
Total time spent on livestock (hours)	667(1060)	488.86	794 (883)	397.72	0.000
Family time spent on livestock (hours)	655 (1055)	465.82	788 (882)	395.40	0.000
Hired time spent on livestock (hours)	729 (22)	599.37	851 (07)	659.68	0.650
Quantity of calves	1.18 (391)	.431	1.15 (327)	.428	0.436
Value of the cattle sold (BDT)	27732 (141)	19846.02	26389 (153)	25062.7	0.612
Wage labor BDT (total)	8751 (22)	15038.26	3588 (07)	3053.30	0.380
Wage labor BDT (male)	8937(21)	15293.28	3588(07)	3053.30	0.372
Wage labor BDT (female)	2425(02)	813.17	--	--	--

Note: BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT). **Total value of the stock** is defined as total value of cattle of all the sample households divided by the number of sample households). Average cattle value is defined as total value of the stock of a sample household divided by the herd size of a sample household. Numbers in the parentheses are no. of observations (households) with positive value of various cattle farming variables.

Basic Principle of Estimating Returns from Livestock

Returns from livestock has two components:

- Appreciation of depreciation of livestock as an asset

$$\delta = \left({(K - K_0)}/{K_0} \right)$$

- Net revenue of sales from livestock products

(Value of milk, manure, etc.) – (Fodder, Labour, treatment, etc.)

Production and Profit functions
Gehrke and Grimm (2018)

- The household level aggregate production function of cattle-

- $Q = Af(K, L, X, F)$

- Where, Q= milk, calves, manure; K = current value of cattle; L= labour; X = land; F = fodder, A= household and region-specific characteristics that influence the TFP of inputs.

- The profit function-

- $\pi = P.Q - cK - wL - gF - rX + \delta K$

- Where, P = price vector of outputs; w= wage rate (both market and imputed); g= price of fodder; r= rent of land; c=other costs associated with K; δ =rate of appreciation/depreciation.

- Price of capital is assumed to be zero, following Gehrke and Grimm, (2018), We also set r=0.

Average and marginal returns
Gehrke and Grimm (2018)

Average return of raising livestock is given by,

$$\frac{\pi}{K} = P.\frac{Q}{K} - c - \frac{wL}{K} - \frac{gF}{K} + \delta$$

We estimate marginal returns using a CES production technology

$$\pi'(K) = P.Q'(K) - c + \delta$$

Or $\pi'(K) = P.\alpha_1.\frac{Q}{K} - c + \delta$ --------(1)

Log transformation of CES production function-

$$Log(PQ) = \alpha_0 + \alpha_1 logK + \alpha_2 log\ L + \alpha_3(herd\ size) + \alpha_4 logF$$
$$+ \alpha_5(year\ dummy) + \in ------(2)$$

We get alpha from equation (2) and plug in to equation (1) to get marginal return.

Estimation of the CES production function

	2011		2015		FE	
	Full sample	Constant herd size	Full sample	Constant herd size	Full sample	Constant herd size
Capital stock	.46***	.57***	.53***	.80***	.29*	.39**
Labor	.14*	.07	.16	.13	.06	.08
Fodder	.00002***	.00002***	.00001**	.00002**	.00003**	.00003**
Herd size	.03	.13***	-.004	-.0019	-.11	.07
Year dummy					-.03	-.03
Constant	2.17**	1.59	1.49	-.92	4.92***	3.47*

What are the results? High appreciation!

High appreciation of asset value of livestock (55% for bullocks and cows in 2011 and 51% for bullocks and 28% for cows in 2015) due to freer markets for trading of cattle.

Components of revenue and cost (2011)

	Revenue				Cost				
	Appreciation	Milk revenue (BDT)	Manure revenue (BDT)	Value of calf (BDT)	Wage labor (BDT)	Family labor (BDT)	Fodder cost (BDT)	Medicine and other cost (BDT)	Value of the cattle lost
Households with only Bullock	.55	0.00	1483	0.00	6058	6371	3444	365	41000
Households with only Milk cow	.55	11163	1843	8126	4450	6942	4549	489	20062
Households with both Bullock and Milk cow	.23	9393	2560	8747	11111	7542	6408	659	0.00
Full sample=1065	.44	10164	1974	8467	8751	6974	4870	512	29833

Note: Appreciation (depreciation) means real rate of increase (decrease) of the cattle stock in last 12 months' period. BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT). All the revenue and cost components show average numbers for the sample households with positive amount of the respective components (i.e. 27732 = value of the cattle sold means the average value of a sold cattle of households with positive amount of 'cattle sales').

Components of revenue and cost (2015)

	Revenue				Cost				
	Appreciation	Milk revenue (BDT)	Manure revenue (BDT)	Value of calf (BDT)	Wage labor (BDT)	Family labor (BDT)	Fodder cost (BDT)	Medicine and other cost (BDT)	Value of the cattle lost
Households with only Bullock	.51	0.00	1304	0.00	0.00	3518	4782	400	6546
Households with only Milk cow	.28	10032	1419	7917	981	3670	4116	479	27277
Households with both Bullock and Milk cow	.24	11379	1870	8565	4023	4284	5145	569	0.00
Full sample=884	.33	10811	1540	8288	3588	3864	4694	496	16912

Note: Appreciation (depreciation) means real rate of increase (decrease) of the cattle stock in last 12 months' period. BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT). All the revenue and cost components show average numbers for the sample households with positive amount of the respective components (i.e. 26389 = value of the cattle sold means the average value of a sold cattle of households with positive amount of 'cattle sales').

What are the results? Widespread positive returns!

Estimated average and marginal returns from cow and bullocks are positive (40% for cows and 8% for bullocks in 2011 and 46% for cows and 15% for bullocks in 2015)

Average and marginal returns from raising livestock, 2011

	Total annual profit (BDT)		Average return		Marginal return
	With family L	Without family L	With family L	Without family L	
Households with only Bullock	-4598	1713	-25.13	8.11	.56
Households with only Milk cow	4359	11211	5.48	39.51	.66
Households with both Bullock and Milk cow	5045	12546	11.57	37.19	.36
Full sample=1065	1884	8793	-1.70	29.23	.53

Average and marginal returns from raising livestock, 2015

	Total annual profit (BDT)		Average return		Marginal return
	With family L	Without family L	With family L	Without family L	
Households with only Bullock	471	3989	-2.53	14.77	.51
Households with only Milk cow	8873	12531	29.22	46.01	.40
Households with both Bullock and Milk cow	13651	17923	36.14	49.95	.37
Full sample=884	8457	12312	23.39	39.18	.42

Note: BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT).

What are the results? Some negative returns for bulls!

27-30% of the households who raise bullocks have negative returns. It is low for those who raise only cows (12%).

Incidence of positive and negative ROR, 2011

HH category	Average ROR (with family L)		Average ROR (without family L)	
	Negative (%)	Positive (%)	Negative (%)	Positive (%)
Only bullock	68.94	31.06	30.12	69.88
Only milk cow	43.04	56.96	11.02	88.98
Both milk cow and bullock	33.70	66.30	12.98	87.02
All (1065)	47.70	52.30	17.46	82.54

Incidence of positive and negative ROR, 2015

HH category	Average ROR (with family L)		Average ROR (without family L)	
	Negative (%)	Positive (%)	Negative (%)	Positive (%)
Only bullock	49.58	50.42	27.12	72.88
Only milk cow	23.55	76.45	11.61	88.39
Both milk cow and bullock	16.27	83.73	6.80	93.20
All (884)	27.71	72.29	13.91	86.09

What are the results? Returns are heterogeneous

For a large range of herd size (1-3) there is a tendency for decreasing returns to scale. It is only at very large herd size (4 and above) there is some IRTS.

There seems to barrier to entry.

Most profitable herd size is less than 2 and the highest return herd size is 1 (max AR and MR).

Herd size and returns, 2011

Herd size	average value of total stock(BDT)	average return (with family L)	average return (without family L)	marginal return	Observation
1	17097	-3.27	38.75	.62	418
2	14889	-1.68	26.47	.49	328
3	14150	1.40	22.88	.38	171
4	13995	-4.60	15.95	.67	84
>4	15127	3.89	15.63	.32	39

Herd size and returns, 2015

Herd size	average value of total stock(BDT)	average return (with family L)	average return (without family L)	marginal return	Observation
1	17174	27.78	50.60	.52	324
2	16875	25.39	39.41	.47	280
3	14892	16.71	28.02	.30	146
4	15882	14.87	23.51	.22	68
>4	15733	25.20	31.99	.22	33

Note: BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT).

What are the results? Poorer households have lower returns

- Proportionately more poor households raise livestock

- Average herd size is also slightly higher in poorer households

- Wealthier households own better quality livestock

- Returns also increase as we move to higher food expenditure groups

Livestock variables and per capita food expenditure quintiles (2011)

Per capita food exp quintiles	% of HHs with livestock	Average herd size (full sample)	Average herd size (livestock sample)	Average value of total stock (BDT)	Average return (without family L)	Marginal return
Q1	61.58	1.50	2.25	14294	27.57	.56
Q2	44.86	1.04	2.15	14358	28.55	.46
Q3	36.31	0.87	2.19	15139	25.98	.52
Q4	32.20	0.73	2.14	16070	31.12	.64
Q5	30.43	0.75	2.11	18041	32.93	.46

Livestock variables and per capita food expenditure quintiles (2015)

Per capita food exp quintiles	% of HHs with livestock	Average herd size (full sample)	Average herd size (livestock sample)	Average value of total stock (BDT)	Average return (without family L)	Marginal return
Q1	52.04	1.18	2.37	14415	33.03	.37
Q2	42.65	.91	2.17	15655	38.85	.74
Q3	35.52	.79	2.23	15568	36.21	.39
Q4	31.45	.68	2.18	17641	45.68	.44
Q5	24.24	.57	2.34	18787	42.12	.41

Note: BDT means constant 2011 Bangladeshi Taka. (1 USD= 74.2 BDT).

Why returns to livestock primarily positive and high in Bangladesh (and low in India)?

- Indian cattle markets are highly restrictive formally and informally. Indian constitution avoided discussion on cow slaughter and left the issue as a directive to state governments (Article 48). Anagol et al. (2017) studied Uttar Pradesh (very stringent slaughter acts) and Gehrke and Grimm (2018) studied Andhra Pradesh (stringent slaughter acts). Bullocks and cows cannot be traded for slaughter! This turned appreciation to depreciation! Sales of livestock products cannot make up for depreciation, an outcome of Article 48! High breed cattle will solve the puzzle!

- Ambiguity in estimation of appreciation [low in Anagol (3.1% in full sample), high in GnG (-40.0% in full sample), zero in Attanasio and Augsburg (2018). Compare this with 30% for Bangladesh.

- A cow gives milk and meat whereas in India it is transacted only for milk production. India exports mainly buffalo meat.

- Ignored illegal market for cattle (AP/Kerala, Orissa/WB to Bangladesh)

- The negative returns have to be tested in states where slaughtering is legal (eastern states, Kerala, West Bengal)

What are the implications for livestock development in Bangladesh?

- High positive returns imply we should go for livestock development projects (but not buffalo!)

- Poor performance despite high rates of returns is a puzzle for Bangladesh. Supply side constraints (poor quality of the stock, livestock services, milk market, shrinking grazing ground, high fodder costs etc.)

- Absence of economy of scale (but new farms growing on commercial lines)

- If dairying not developed, bullocks will dominate (unlike India!)

- Provide high valued cattle in asset transfer programmes and improve complementary services (veterinary, credit etc.)

- Lack of livestock data (census), important questions absent (male/female, heifers etc.)

Thank you