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HOLY COWS OR CASH COWS?

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ABSTRACT

In a recent paper, Anagol, Etang and Karlan (2013) consider the income generated by these owning a cow or a buffalo in two districts of Uttar Pradesh, India. The net profit generated ignoring labour costs, gives rise to a small positive rate of return. Once any reasonable estimate of labour costs is added to costs, the rate of return is a large negative number. The authors conclude that households holding this type of assets do not behave according to the tenets of capitalism. A variety of explanations, typically appealing to religious or cultural factors have been invoked for such a puzzling fact.

In this note, we point to a simple explanation that is fully consistent with rational behaviour on the part of Indian farmers. In computing the return on cows and buffaloes, the authors used data from a single year. Cows are assets whose return varies through time. In drought years, when fodder is scarce and expensive, milk production is lower and profits are low. In non-drought years, when fodder is abundant and cheaper, milk production is higher and profits can be considerably higher. The return on cows and buffaloes, like that of many stocks traded on Wall Street, is positive in some years and negative in others. We report evidence from three years of data on the return on cows and buffaloes in the district of Anantapur and show that in one of the three years returns are very high, while in drought years they are similar to the figures obtained by Anagol, Etang and Karlan (2013).

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1. Introduction.

In a recent paper, Anagol, Etang and Karlan (2013)[2] (AEK henceforth) have called attention to an apparent puzzle. According to these authors, the fact that many households in India own cows and buffaloes contradicts one of the basic tenets of capitalism. The argument is quite simple. The authors consider the income generated by these assets, mainly the revenue obtained from selling the milk that is produced but also other outputs, such as dung, and compare it to the costs that are incurred to generate such income (mainly fodder, but also health costs). Given the value of the animals, the net profit generated ignoring completely labour costs, gives rise to a small positive rate of return. Once any reasonable estimate of labour costs is added to the calculation, the rate of return is a large negative number. The authors therefore conclude that the households holding this type of assets do not behave according to the tenets of capitalism.

The paper has received some attention; the newspaper the Economist wrote about it and Daron Acemoglu and James Robinson (2013), who discussed it in their blog, ask: "What could explain such irrational economic practices?". A variety of explanations, typically appealing to religious or cultural factors have been invoked for such a puzzling behaviour.

In this note, we would like to point out to a much simpler explanation that, surprisingly, has not been mentioned in the discussions that have followed the circulation of the paper and that is fully consistent with rational behaviour on the part of Indian farmers. In computing the return on cows and buffaloes, the authors used data from a single time period. They considered 300 cows and 384 buffaloes in two districts of the region of Uttar Pradesh, India in 2007. While each individual cow and buffalo is, arguably, a single asset, averaging across the returns of many of them *in a single year* does not yield the average return on cows and buffaloes. Cows and buffaloes are assets whose return varies through time. Moreover, the return on different cows and buffaloes is strongly correlated over time. In drought years, when fodder is scarce and more expensive, milk production is lower and profits are low. In non-drought years, when fodder is abundant and cheaper, milk production is higher and profits can be considerably higher. Therefore, the return on cows and buffaloes, like that of many stocks traded on Wall Street, is positive in some years and negative in others. The fact that in a given year the observed return on a risky asset is negative could certainly not be used as a contradiction 'of one of the basic tenets of capitalism'.

Of course the statement in the previous paragraph should be supported by some evidence that, for some time periods, the return to cows and buffaloes is positive and possibly high. In what follows, we use some detailed data from the district of Anantapur to do exactly that. We have detailed data on about 1,000 households in 60 villages in the district of Anantapur in Andhra Pradesh. For these households we have detailed data on

[2] In this note we cite primarily AEK's 2013 NBER working paper, which reports average returns to the investment. We will also from time to time refer to their more recent 2014 version of the paper, where the authors switched to reporting medians along with some other smaller changes. If a reference is specific to one of these versions, we make this clear by referencing with the date of the publication, otherwise we will refer to AEK without year.

animal ownership and, if they own a cow and buffalo, detail data on milk production, milk prices, as well as costs associated with the generating this income, including health costs, fodder costs, and so on.

Our data are, in some respects less and in others more detailed than those by AEK. For example, we have milk yield information only for the so-called full and lean lactation periods, whereas AEK collected information on 0-3, 3-6, 6-9 and 9-10 months after calving. On the other hand, we have more detailed information on the fraction of milk produced that is consumed within the household, or on losses other than veterinarian fees that the household incurs when the animal falls ill. But the main difference and advantage relative to AEK's data is that we have data on three years, 2008, 2009 and 2012. Moreover, conditions in those three years are very different. Two of those years are drought years, while the third year is a good year in terms of rain and, therefore, agriculture incomes. Whilst three years are probably not enough to compute an estimate of the 'average' return on cows and buffaloes that is precise enough to be meaningful, the fact that we have both 'good' and 'bad' years can be used to illustrate the point that what AEK call the 'average' return changes dramatically from one year to the next.

For the drought years, we obtain results that are remarkably similar to those obtained by AEK: the return on cows and buffalos is a small positive number when ignoring labour costs and a large negative number when taking into account labour costs. This fact was noted in Augsburg (2010). However, when we consider the non-drought year, the return is a high positive number. This result is mainly driven by two factors. First, fodder prices are considerably lower. Second, milk production, possibly driven by the better nutrition the animals can enjoy, is remarkably higher.

The conclusion we draw from our simple exercise is not, necessarily, that the asset holding behaviour of Indian poor farmer is optimal. Cows and buffaloes are certainly risky assets. And the information we have on their returns is not sufficient to fully characterize the stochastic properties of their returns. However, the statement that 'the continued existence of cows contradicts one of the basic tenets of capitalisms' is unjustified.

The rest of this note is organized as follows. In section 2, we describe our data. In Section 3, we present our computation of returns and compare to the results obtained by AEK. Section 4 concludes.

2. Data.

The district of Anantapur is the largest of the 23 districts of Andhra Pradesh, in South India and lies in an area which is characterised by scarce rainfall, poor soil conditions and frequent droughts. The survey we use was collected, in collaboration with the Micro Finance institution BASIX, in 64 villages in Anantapur, where BASIX operated or planned to operate. The data were collected as part of an evaluation of a product offered by BASIX which consisted of a loan to purchase a buffalo or cow to start the production

of dairy products, coupled with a life insurance for the animal. The households selected into the survey were either BASIX clients or potential clients and were among the poorest households in the district.

A total of 1,041 households were selected in 2008 and an extensive survey collected information on a wide range of variables, including livestock ownership and detailed data on milk production and use, on costs connected with the dairy production and, more generally, about household income, consumption and socio-economic variables.

The same households were contacted again in 2009. Of the original 1041 households, 951 were re-interviewed with very similar survey instruments. A final survey was conducted in 2012 in which 885 households were re-contacted.

Given the purpose of the data collections, much emphasis was given to information on livestock ownership, the income it generates and the costs connected to the ownership and managements of the animals. The surveys also contain information on subjective expectations on income, both from dairy and non dairy sources, which we have used in Attanasio and Augsburg (2013).

We present some summary statistics for the three surveys in Table 1[3]. Of the household surveyed, 61% owns livestock in 2008. This percentage goes down to 43% in 2009 and to 36% in 2012. Conditional on ownership of livestock, over 90% of households owns a female animal, to be used for the production of milk, which is either sold, consumed within the household, or, typically, both.

While ownership rates go down over time, the number of animals owned conditional on ownership is roughly stable and, if anything goes up (to 4.66) in 2012. Of these, more than half are female animals.

Table 1:Animals owned by households

	R1-2008		R2-2009		R3-2012	
	No	%	No	%	No	%
HHs that own livestock	638	0.613	411	0.432	316	0.357
HHs that own female livestock (conditional)	585	0.917	379	0.922	295	0.934
HHs that own only buffalos (conditional)	463	0.726	257	0.625	150	0.475
HHs that own only cows (conditional)	69	0.108	60	0.146	37	0.117
No of livestock owned by HH (if owned)	3.5		3.93		4.66	
No of female livestock owned by HH (if owned)	1.7		2.42		2.66	

Given the ownership rates and the number of animals owned, we have data on 585 cows or female buffaloes in 2008, 379 in 2009 and 295 in 2012. To make our estimates comparable to those of AEK, we concentrate on households that own either only cows or only buffalos, reducing the number of observations slightly. Our results are not affected by this choice. These compare to the 684 cows and buffaloes anaylzed by AEK.

[3] We note that all monetary values we present in this paper are adjusted for inflation. We use figures from: http://www.global-rates.com/economic-indicators/inflation/2008.aspx.

Cow ownership is less common than buffalo ownership in the district of Anantapur, which implies that our estimates for cows are based on a much smaller sample than that for buffalos. The primary reasons for this preference are exceptionally hostile conditions for agriculture and animal husbandry, the primary culprits being scarce and volatile rainfall and limited irrigation facilities, which lead to frequent droughts and scarce fodder. Buffalos typically cope better under such conditions than cows, although they are both being sensitive to heat stress and to changes in nutrition. These factors lead to a lesser frequency of breeding, which again leads to lower milk yields and hence lower returns to the investment.

Our first round of data was collected during a period of below average temperatures and above average rains, whereas the opposite holds true for the second and third survey round. Table A1 in the Appendix provides district rainfall data for Anantapur over the years 2007-2012[4]. We highlight the months previous to the survey and it can be seen that prior to the first survey round, departures of rainfall from the long period averages of rainfall for the district were positive, while they were negative for the second and third survey round we conducted.

Information we could obtain for the AEK's study area is less detailed, but point to below average rainfall and high distress during the time their data was collected. Average rainfall in the two study districts Sitapur and Lakhimpur Keri are reported at 1,042 and 1,067mm annually, whereas the realized rainfall in 2007 was 885 and 863mm. Possibly more importantly, these averages are likely to hide extreme variation: both an extreme heat-wave and a cold-wave are reported in 2007, which lead to a number of deaths, some of which in Sitapur district[5].

3. Returns on livestock.

To estimate the rate of return on cows and buffaloes, we perform an exercise which is very similar to that performed by AEK and by Augsburg (2009). Although the data is very rich indeed, we need to make assumptions on a number of variables to estimate both revenues and costs. Although some assumptions are slightly different from those used by AEK because of the nature of our data, as we discuss below, these slightly different procedures do not explain the difference in the rate of profit in 2008 relative to what we get in 2009 and 2012 and to what AEK calculates. In the first year of our survey, profits are much higher than in our second and third round of data, when our figures are similar to those in AEK, not just in terms of total revenue but also in terms of its component.

[4] Data was obtained online from the India Metrological Department (http://www.imd.gov.in/section/hydro/distrainfall/webrain/andhra/anantapur.txt and http://archive.is/be3q, last accessed on March 30th 2014).
[5] http://nidm.gov.in/PDF/DU/2007/June/12-06-07.pdf, last accessed 20 March 2014.

In what follows, we first explain the way revenues and costs are imputed and how our assumptions differ from AEK. We then provide our estimates for each of the three years considered.

3.1. Revenues and costs: assumptions.

In Table 2, we summarize the main assumptions that are needed to compute revenues and costs in our survey and how they compare to those used by AEK. We will refer to them in our description of data below and whenever relevant for our estimations. The Table also provides summary statistics for the relevant variables for all survey rounds with our data and for AEK's sample.

3.1.1. Revenues

The revenues a poor households gets from owning a cow or a female buffaloes come mainly from three sources. First and foremost there is the milk produced, which is then either sold or consumed within the household. Second, there is the value of calves that are born following the insemination of the animal. In many cases, the farmers do not realize any revenue from the sale of the calves[6], but in some cases they do. Third, there is the revenue from the sale of dung, which can be used as fuel. Unfortunately, our data does not provide information on returns from dung sale separately, but households were asked about income from selling milk and other by-products (such as dung) combined.

We estimate revenues generated through milk production based on two components: (1) households report in the income section their yearly return from selling milk, and (2) we estimate the value of home consumed milk based on a) the amount of milk produced, b) the price of milk the household receives per litre of milk sold, and c) the percentage of produced milk that members of the household consumes themselves.

To estimate milk production we use information reported by the households about the number of months during which the animals are lactating. The answers average to 7.9 in 2008 and 2012 and only 6.5 in 2009. These seem very different from the 10 months assumed by AEK. However, these authors later assume that there are only 265 days in a year in which milk is produced; which does not differ much from what we get from respondents. As for the amount of milk produced, AEK split the milking cycle into four periods where milk production peaks in the second cycle. Buffaloes, for example, produce on average 3.57 litres per day in the first period, 4.09 in the second, 2.95 in the third and 0.85 in the fourth and last part of the cycle. Our survey provides information only on two parts of the cycle: the full and the lean period. We assume that the full period covers $3/4^{th}$ of the lactation cycle reported by the household and the lean period $1/4^{th}$. Our survey also contains information on the quantity of milk produced in the full and lean periods. Average number of litres produced in the full season compare roughly to the first and second lactation periods of AEK and average litres produced in the lean period compare to their third and (shorter) fourth periods.

[6] Informal interviews with respondents revealed that it is very common to leave calves to die as benefits from going to the market and selling the animal, or raising them until they can bread are not perceived to outweigh the costs of doing so.

Table 2: Summary Statistics (Mean and Standard Deviation) and Assumptions

	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3)	(4)	(5)
	Our data						AEK data		Notes / Assumptions
	Cows			Buffalos			Cows	Buffalos	
	2008	2009	2012	2008	2009	2012			
Animal Value (Self-Reported)	12,706	11,931	9,628	12,897	11,502	13,997	2,286	8,707	
	(8,352.5)	(7,061.4)	(7,978.8)	(6,612.6)	(4,036.6)	(8,100.9)	(1680.4)	(4740.8)	
Age (Years)							5.5	5.7	This variable was unfortunately not collected. Informal discussions would support though that the average age is comparable to that reported by AEK.
							(2.5)	(2.7)	
Dung Cakes Per Day							4.2	4.9	This was not collected in our data (not common in ATP?)
							(1.7)	(2.0)	
Calves Expected in Rest of Life							4.3	4.9	
							(2.0)	(2.2)	
Number of Vet Trips in Past Year	0.7	1.0	1.1	0.8	1.1	0.7	0.8	0.9	
	(0.742)	(0.898)	(2.024)	(1.005)	(0.847)	(0.935)	(0.9)	(1.0)	
Average cost per visit (Rs.)	436.1	642.1	274.9	431.7	439.0	143.4			
	(510.2)	(743.7)	(597.3)	(593.7)	(488.7)	(276.1)			
Average additional cost incurred per visit (Rs.)	745.6	355.4	694.3	1,405.5	408.5	2,344.6			
	(688.6)	(211.1)	(384.6)	(1,812.8)	(248.5)	(1,125.3)			
Survey Daily Cost of Fodder When Milking (Rs.)							35.2	38.2	Our surveys did not distinguis between fodder costs when milking and when dry. We do however have information on typical monthly costs for different types of fodders. We also have information on what percentage of fodder is collected. We assume that collected fodder would be priced the same as bought to calculate its value. This is likely to be a conservative assumption.
	15.2	27.5	36.5	13.6	15.7	24.1	(26.6)	(30.1)	
Survey Daily Cost of Fodder When Dry (Rs.)	(8.77)	(24.69)	(35.62)	(9.71)	(14.26)	(21.87)	28.8	34.3	
							(18.7)	(35.2)	
Feeding Guide Daily Cost of Fodder When Milking (Rs.)							20.8	27.9	
							0.0	0.0	
Feeding Guide Daily Cost of Fodder When Dry (Rs.)							16.3	21.2	
							0.0	0.0	
Daily Labor Hours				3.19			3.0	3.3	
				(1.97)			(1.5)	(1.5)	
No of months animals produce milk	8.0	6.1	7.8	7.9	6.3	7.7	10.0		
	(1.30)	(2.03)	(2.24)	(1.57)	(2.45)	(2.31)			
Litres of milk produced per day - full season:	4.9	3.4	3.6	4.7	4.3	3.3			
	(3.55)	(2.13)	(2.08)	(2.63)	(2.45)	(2.18)			
Litres of milk produced per day - lean season:	2.5	2.2	1.6	2.6	2.6	1.5			
	(2.03)	(1.40)	(1.03)	(1.82)	(1.58)	(1.06)			
Litres of milk produced per day -avg over lactation period:	3.8	2.9	2.7	3.4	3.8	2.5	2.54	3.27	We assume that the full season lasts for 3/4 of the lactation period and the lean season for 1/4.
	(4.38)	(4.54)	(3.31)	(4.03)	(4.67)	(5.05)			
litres milk amount 1: 0-3 months (90days)							2.86	3.57	
litres milk amount 2: 3-6 months (90days)							3.26	4.09	
litres milk amount 3: 6-9 months (90days)							2.22	2.95	
litres milk amount 3: 9-10 months (60days)							0.46	0.85	
Price per litre of milk (Rs.)	6.8	9.3	11.6	9.1	11.5	15.0			
	(4.59)	(4.49)	(6.19)	(3.62)	(4.04)	(4.98)	10		
Observations	60	42	37	406	178	150	295	367	

Notes: The Table shows summary statistics (means and stadard deviations) for a number of relevant variables. Columns (1) and (2) us our survey data and report statisctis for households that own only buffalos or only cows respectively, showing information for all three survey rounds. All variables in Rupee values adjusted to 2008 values. Columns (3) and (4) show numbers reported in AEK (2014).

The second assumption we need to make to estimate the value of home consumed milk is on the price the households would receive for the milk. Here we simply assume that they would receive the same price as they do for the milk they actually sell. For households that only consume their milk and for which we therefore do not have prices, we use village averages.[7]

Our average prices range from Rs. 6.8 to Rs 15, depending on the animal type and year of study and include the value of Rs 10 used by AEK. The variations are likely to be driven by market demand, our data showing lower prices in the "good" year and higher prices in the "bad" years.

Our data also provides information about households' typical income from milk selling. We report the average income in the year previous to the survey and the reported typical income in Table 3 below. It can be seen that typical income does vary but is more stable than realized income. Further, typical income is below last year's income in the "good" year (2008) and above in the "Bad" years 2009 and 2012.

Table 3: Average income from dairy (typical and last year's)

	2008	2009	2012
	Cows (mean)		
Total last year (income section)	13,574	3,345	8,579
Typical last year (monthly from livestock section*12)	11,167	10,204	14,695
	Buffalos (mean)		
Total last year (income section)	13,732	5,048	9,782
Typical last year (monthly from livestock section*12)	11,040	9,598	14,361

Note: The Table shows average summary statistics for total income from dairy in the year previous to the survey round (which includes income from selling milks as well as other by-products, such as dung) and typical income from selling milk (i.e. excluding income from other by-products). Values in 2009 and 2012 are adjusted for inflation.

3.1.2. Costs

The main source of costs is fodder. Contrary to AEK we use fodder costs reported by the household in our returns estimates. AEK have detailed information on the amounts households spent on different types of feed. However, due to concerns of over and under-reporting, they prefer to use estimates from feeding guidelines obtained through a

[7] We note that this assumption is a conservative one to make, potentially underestimating the value of home consumed milk. The reason for this is that it is common practise in the study area to "water-down" milk before selling it. Given that the price of milk paid to a household typically depends on the fat percentage of the milk the price households report they are paid would reflect the lower fat percentage due to the water added. Households report on the other hand the number of litres they consume of the *produced* milk, i.e. non-watered down milk. Since we do not have detailed information on how much water is added to the milk before selling it, we cannot credibly adjust the price for home consumed milk and prefer to report conservative return estimates. This issue is likely to be stronger in 2008, when testing of fat percentages was still less commonly done in the study areas (in 2008, ~5% of respondents report that their milk is tested by their buyer, which increased to ~80% in 2009). No numbers are available for 2012). Regular testing of the milk reduces the incentive to add water to the milk.

fodder company[8] in their 2013 WP version and various online sources in their 2014 WP version. Their rationale behind this practice is that these provide more conservative estimates. We do not consider this to be a good assumption to make given that milk yield is highly influenced by feeding, introducing a mismatch between the fodder costs and the information on returns. We instead use information from direct questions to the respondents on amounts spent on different types of fodder and percentage of fodder collected. By making the conservative assumption that collected fodder is priced the same as bought fodder, we impute a value to the collected one. As we will see, the cost of fodder varies considerably over the years in our sample.

In addition to fodder, we have data on health costs, which include the cost of insemination. AEK separate these costs. Finally, unlike AEK, we have information on additional costs the household incurs from the animal falling hill (and possibly dying).

As AEK, we have direct data on the value of livestock (both cows and buffaloes) in the villages in each of the years of our survey and use that to compute the rates of return. One drawback of our data however is that we do not have the age of the animals owned. We are therefore not able to estimate appreciation/depreciation of the animal value over the year. These is however a relatively minor sources of cost, so that their neglect is unlikely to introduce significant biases. We nevertheless report our estimates without this cost as well as assuming averages reported by AEK.

The final cost component relates to labour cost. Similarly to AEK, our third survey round asks about the hours spent caring for the animal per day. We follow their approach of assuming that hours spent on the sample animal is equal to the total hours spent on animals owned divided by the number of animals owned. Our sample households spend on average 3.1 hours taking care of their animals, which is closely in line with the average three hours caretaking time of AEK.

Table 4: Costs per hour of labour

			Daily wage	Hourly wage (8hrs)	Average wage
R1:	2008	male:	90	9.375	6.6
		female:	60		
		minor (calculated):	30	3.75	
R2:	2009	male:	109	11.96	8.4
		female:	83		
		minor (calculated):	38	4.78	
R3:	2012	male:	120	12.3	7.9
		female:	77		
		minor (calculated):	28	3.52	
AEK	2007	adult (male and female):	64	8	5.6
		minor:	26	3	

Note: Average village daily wages are reported, 2009 and 2012 values, as well as AEK numbers are adjusted for inflation. Hourly wages are calculated based on the assumption of 8hr working days.

[8] In the 2013 WP version, They use the so-called Kisan Company methodology, a company that produces feed, to validate their fodder costs. When calculating fodder costs through this method, AEK find that both cows and buffaloes are generally profitable.

We obtain our estimates of the cost per hour of labour from village level surveys conducted in each of the three survey years. The procedure we follow is similar to that used by AEK and we report our averages in Table 4. While we have wages split for male and female workers, our surveys do not provide information on wages for minors. Given that report that also minors share the work of taking care of the animal to an equal extent, we estimate the wage for minors based on the adult to minor wage ration of AEK. We then proceed as AEK and take the average of the wage for adults and for minor.

3.2. Estimates of rates of returns.

Table 5 and 6 report our computations for the average rate of returns on holding cows and buffaloes respectively and compare them to the figures reported by AEK. Each table reports five columns: the first three refer to our survey in 2008, 2009 and 2012, while the last one reports the data in AEK for comparison[9]. The first panel of the tables refers to the value of the animals; the second to revenues and the third. The last two panels report rates of returns, first using only our data and assumptions and then using information on appreciation/depreciation and labour costs from AEK.

Table 5: Rates of returns - Buffaloes

	(1)	(2)	(3)	(4)
		Buffaloes		AEK (adj)
	2008	2009	2012	2007
Animal value	8,902	8,739	12,255	10,978
Value of milk and other by-products	14,903	6,623	12,352	
Milk value				10,374
Dung value				1,925
Calf value	115		20	1,293
Total Revenue	15,019	6,623	12,372	13,592
Fodder cost	4,946	5,745	8,779	12,030
Veterinary Cost (incl. insemmination)	630	594	259	
Veterinary costs				179
Insemination Cost				109
Other losses due to sick animal	1,056	226	813	
Labour Costs	6,228	7,945	8,182	5,630
Total Cost - excl labour	6,632	6,549	9,851	12,318
Total Cost - incl labour	12,860	14,494	17,364	17,948
Profits - excl labour	8,387	74	2,521	1,274
Profits - incl labour	2,159	-7,871	-4,993	-4,356
Rate of returns (%) - excl labour	**94**	**1**	**21**	**12**
Rate of returns (%) - incl labour	**24**	**-90**	**-41**	**-40**
Using AEK values for labour costs and excluding other losses:				
Rate of returns (%) - excl labour	**106**	**3**	**27**	
Rate of returns (%) - incl labour	**43**	**-61**	**-13**	

Note: Columns (1)-(3) report our computations for the average rate of returns on holding buffaloes, column (4) reports figures of AEK.The first panel of the tables refers to revenues and to the value of the animals; the second to revenues and the third the cost and the third to the rate of return. The last two panels report rates of returns, first using only our data and assumptions and then using information on appreciation/depreciation and labour costs from AEK. All values are adjusted for inflation, using 2008 as the base year.

[9] Note that we adjust their 2007 values for inflation to make them comparable to our estimates.

Starting with Table 5, which refers to buffaloes, we notice that the value of buffaloes is relatively stable over our three survey years, averaging at around Rs 8,500 per animal. This value is slightly lower but close to the one reported by AEK, where the average buffaloe has a value of Rs.9,800.

Turning to returns from owning a buffalo, we find that AEK's figure on value of milk produced and value of selling dung lies with Rs. 9,718 close to our 2012 estimate of Rs. 10,542. In 2009, households report a considerable lower return, which is primarily driven by a shorter lactation period in that year as well as increased percentage of home consumption. In 2008, instead, the value of milk sold and consumed is much higher, because of longer lactation periods and higher yields during lactation. As mentioned above, our estimates for the total revenue include a modest amount derived from the sale of the calves, while the AEK estimates of the dung sales.

Turning to costs, the second panel in Table 5 shows that our health costs are noticeably higher when compared to the figure reported by AEK. AEKs combined vet and insemination costs in 2007 are Rs 261, while our households report combined costs of Rs. 514, Rs. 650 and Rs. 444 in the three survey years respectively. We can further see variation in other costs incurred when the animal falls ill, which can include death, over the study years. These additional costs are relatively low in 2009 at Rs. 295 on average, but they rise to Rs. 1,852 in 2012. AEK do not report on such other losses.

The fodder costs reported by AEKs lie between our estimates of 2009 and 2012. Their households spend on average Rs. 11,113 per buffaloe whereas our households spent Rs. 13,339 in 2012 and Rs. 10,029 in 2009. However, when we consider 2008, we notice that our estimates of fodder costs are much lower, reflecting the much smaller price of fodder in that year as well as more abundant opportunities to collect quality fodder and let animals graze.

In terms of labour costs, we note that labour costs increase over time, even with adjustments for inflation. Overall, wages in our study area seem to be higher than in AEK's leading to higher wage labour costs in all three survey rounds..

Finally, given these figures, we are ready to compute profits and rates of return (RoRs), with and without considering labour costs, which we report in the second last panel of the Table. AEKs rationale for excluding labour costs is that they do not have information on multi tasking and can therefore not assess its importance. Since multi-tasking might reduce the effective costs of labour they also report RoR estimates excluding this cost item. For comparability, we do the same.

We further report RoRs, where we i) exclude other losses when the animal fell ill (a cost item AEK does not account for) and ii) use AEKs labour cost estimates. These RoRs are reported in the bottom panel of the Table.

What we see is that our figures for 2012 are very similar to those reported by AEK, who report a positive return of 12% when ignoring labour costs and one of -40 when accounting for labour costs Our estimates lie at 21% without and at -41% with labour costs, and hence remarkably similar. Our estimates in 2009 are lower, with 1% with and -90% without labour costs.

When we consider 2008, however the picture is very different. When ignoring labour costs, the return on holding a cow is a very large 94%. When factoring in our estimates of labour costs this is reduced to a still very respectable 24%. Without the additional losses and AEKs assumptions on labour cost these even increase to 106% without and 43% with labour costs.

When considering average returns of cows (presented in Table 6), we note that our sample of cows is smaller than that of buffaloes, reflecting the fact that conditions in Anantapur are less favourable for cows than for buffaloes. We see this reflected in the average returns being lower on average than for buffaloes. However, the picture of variation in returns over time holds also for our sample of cows. In the two latter survey years we find – as do AEK – negative returns for cows independent of whether labour costs are included or not. In 2012, the return estimates are -57 without labour costs in our sample, compared to -6 in AEKs.

However, in 2008 we see again a sizable positive return at 88% excluding costs of labour and 21% with. Making the estimates again more comparable to AEKs, these values increase to 98% and 37% respectively.

Table 6: Rates of returns - Cows

	(1)	(2)	(3)	(4)
		Cows		**AEK (adj)**
	2008	**2009**	**2012**	**2007**
Animal value	9,186	8,027	8,660	9,800
Value of milk and other by-products	14,936	5,025	10,542	
Milk value				8,100
Dung value				1,617
Calf value	92	0	186	1,034
Total Revenue	15,028	5,025	10,729	10,752
Fodder cost	5,539	10,029	13,339	11,113
Veterinary Cost (incl. insemmination)	514	650	444	
Veterinary costs				149
Insemination Cost				112
Other losses due to sick animal	853	295	1,852	
Labour Costs	6,228	7,945	8,182	5,593
Total Cost - excl labour	6,906	10,974	15,636	11,374
Total Cost - incl labour	13,134	18,919	23,150	16,967
Profits - excl labour	8,122	-5,950	-4,907	-622
Profits - incl labour	1,894	-13,895	-12,421	-6,216
Rate of returns (%) - excl labour	**88**	**-74**	**-57**	**-6**
Rate of returns (%) - incl labour	**21**	**-173**	**-143**	**-63**
Using AEK values for labour costs and excluding other losses:				
Rate of returns (%) - excl labour	**98**	**-70**	**-35**	
Rate of returns (%) - incl labour	**37**	**-140**	**-92**	

Note: Columns (1)-(3) report our computations for the average rate of returns on holding cows, column (4) reports figures of AEK.The first panel of the tables refers to revenues and to the value of the animals; the second to revenues and the third the cost and the third to the rate of return. The last two panels report rates of returns, first using only our data and assumptions and then using information on appreciation/depreciation and labour costs from AEK. All values are adjusted for inflation, using 2008 as the base

What makes these years so different? The answer is simple and predictable in an economy like that of Anantapur, which is so dependent on rain. 2008 was a year of abundant rain at the right time of the year, while 2009 was officially declared a year of drought and also 2012 faced large challenges due to below average rain spells. In such drought years fodder is scarce and expensive, cows do not eat much and, as a consequence, produce less milk over a shorter period. Also insemination becomes more difficult, which reduces the likelihood of any milk production, and animals are more prone to diseases and death. The result is a negative and (in the long run unsustainable) return – especially for cows. Buffaloes are slightly better adapted to these conditions, which is reflected in very small but still positive returns throughout these periods (as long as labour costs are not accounted for). Importantly though, the returns experienced in 2009 and 2012 are not long run returns: in a year like 2008 when rains were better than usual, the returns on both cows and buffaloes were healthily positive.

4. Conclusions

In this note we have shown that the proof against the central tenets of capitalism does not hold a closer analysis of data on the return on cows and buffaloes in India. While it is true that in specific years cows and buffaloes yield negative returns, the same is also true of many equities traded in the stock market. We show that in other years, the return on cows and buffaloes can be positive. This is obviously not a proof that the behaviour of Indian farmers about holding livestock is optimal. Neither it means that cows and buffaloes may be held for many other reasons, beside the economic return that they provide. These reasons may include cultural and religious factors, as well as more complex economic incentives related to different types of intertemporal and interpersonal trade. But the economic return can also be a good reason to own a cow.

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Table A1: Anantapur DISTRICT RAINFALL (MM.)

YEAR	JANUARY		FEBRUARY		MARCH		APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	R/F	%DEP.	
2007	0	-100	0	-100	0	-100	1.5	-91	13	-76	171.4	246	63.1	4	119.9	67	182.6	42	115	12	8.1	-76	15.3	55
2008	0	-100	25.2	1160	116.7	2282	0	-100	63	16	61.7	24	108	78	124.2	73	193.7	51	130.3	27	42.1	24	2.2	-78
2009	0.4	-60	0	-100	2.7	-45	6.3	-64	77.5	42	50.8	2	10.2	-83	100.9	41	203.1	58	64	-37	66.6	96	2.8	-72
2010	26.9	2590	0	-100	0	-100	47.1	171	106.2	95	75.1	51	109	80	172.6	141	75	-42	76.4	-25	162.2	378	3.3	-67
2011	0	-100	1.1	-67	0	-100	46.6	147	64.4	14	55.8	1	80.4	25	124.9	68	25.3	-80	79.1	-31	25.9	-27	5.3	-54
2012	0.6	-80	1	-70	5.1	-16	74	292	28.3	-50	16	-71	82.4	28	113.4	52	80.2	-38	72.6	-37	59.4	68	3	-74

http://www.imd.gov.in/section/hydro/distrainfall/webrain/andhra/anantapur.txt

Note : (1) The District Rainfall(mm.)(R/F) shown below are the arithmatic averages of Rainfall of Stations under the District. (2) % Dep. are the Departures of rainfall from the long period averages of rainfall for the District.