

Evans School Policy Analysis and Research (EPAR)

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SECTION E: Livestock and Livestock By-Products

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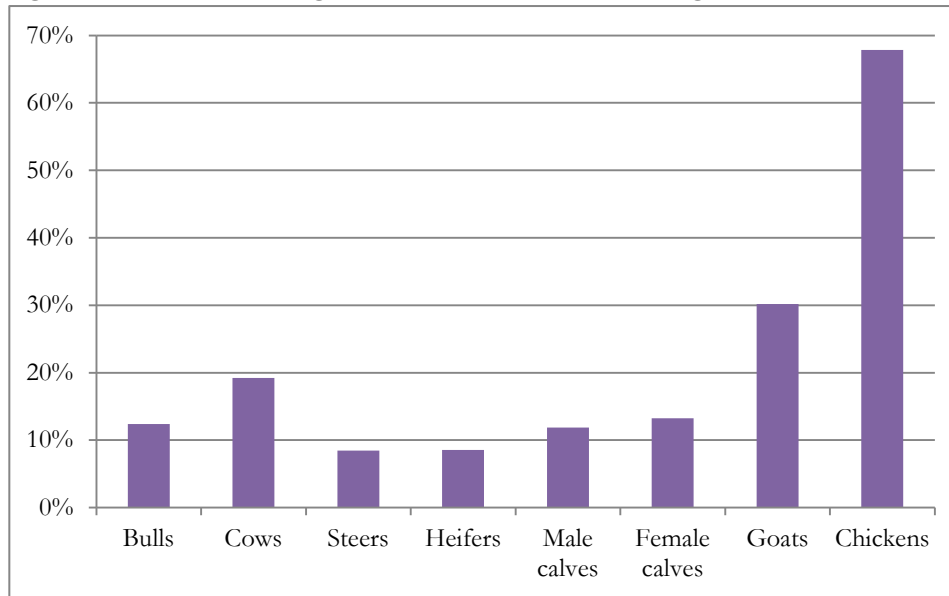
Section Highlights

- Twenty-three percent of all agricultural households owned some type of cattle (bulls, cows, steers, heifers, male calves, and/or female calves), compared to 30% of households that owned goats and 68% of households that owned chickens.
- Of those households that own cattle, the mean is 10.25 cattle per household.
- Relatively few households reported selling live animals: 19% of bull owning households sold bulls, 11% of cow owning households sold cows, 34% of goat owning households sold goats, and 41% of chicken owning households sold chickens.
- For all livestock varieties, male-headed households were more likely to own animals than female-headed households, and owned a higher mean number of animals.
- The Northern zone reported the highest ownership levels of cattle, with 47% of agricultural households owning cattle, and of those households, the mean was 9.7 cattle per household.
- The Northern zone also reported the highest ownership levels of goats, with 48% of agricultural households owning goats, and the mean for those households was 9.3 goats per household.
- The Eastern zone had the lowest cattle ownership (2%) and goat ownership (7%), however the sample sizes are insufficient (less than 30) to provide means.
- The Western zone reported the highest ownership levels of chickens, with 75% of households owning chickens, and the mean for those households was 10.8 chickens per household.
- Zanzibar reported the lowest chicken ownership, only 30% of households owned chickens, but of those households, the mean was the highest, at 24.8 chickens per household.
- Chicken owning households were most likely to lose one or more chickens to disease (66%, compared to 15% of bull owning households).
- However, the average value lost per year for households losing chickens to disease was \$23.91, compared to \$299.19 for households losing bulls to disease.
- Fifty-two percent of households owning bulls vaccinated some or all of their bulls, compared to 14% of households owning chickens that vaccinated some or all of their chickens.
- For livestock by-products, 52% of agricultural households reported producing traditional eggs, while 13% reported producing traditional cow milk, 2% reported producing improved cow milk and 0.5% reported producing improved eggs.
- Of households that produced each particular by-product, only 21% reported selling traditional cow milk, compared to 56% that reported selling improved cow milk. The median value of sales was higher for improved cow milk (\$240/year) than it was for traditional cow milk (\$150/year).
- A higher proportion of male-headed households than female-headed households produced both traditional cow milk and eggs, while a slightly higher (though not statistically significant) proportion of female-headed households produced improved cow milk and eggs.
- The Northern zone had the highest proportion of traditional and improved cow milk producing households (28% and 9% respectively).

Livestock: Basic Descriptives

Figure 1 shows the proportion of all agricultural households (n=2482) that owned the different priority livestock (*Did this household own any [ANIMAL] in the last 12 months?*). Aggregating all types of cattle (bulls, cows, steers, heifers, male calves, and female calves) together, 23% of all agricultural households owned cattle, compared to 30% of households that owned goats and 68% that owned chickens (see *Appendix A* for chart of all proportions and confidence intervals).

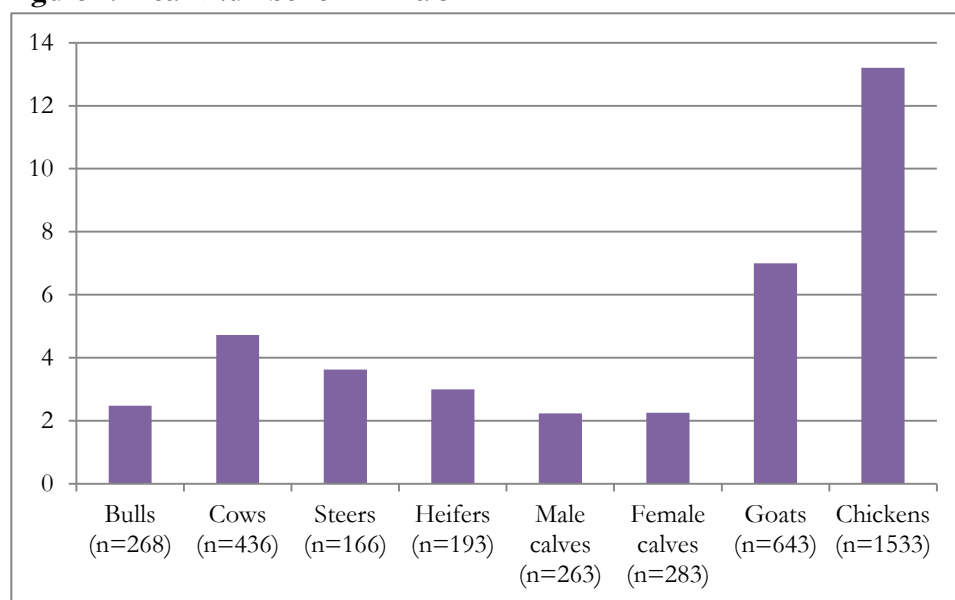
Figure 1: Proportion of Agricultural Households Owning Livestock



**Question s10aq2*

Of households that owned a particular animal, *Figure 2* shows the mean number of animals owned per household (*Number of [ANIMAL] owned on October 1 2008*). While households that owned cows tended to own more animals than households that owned other types of cattle, if all cattle are aggregated, the average cattle owning household owned 10.25 animals (see *Appendix A*).

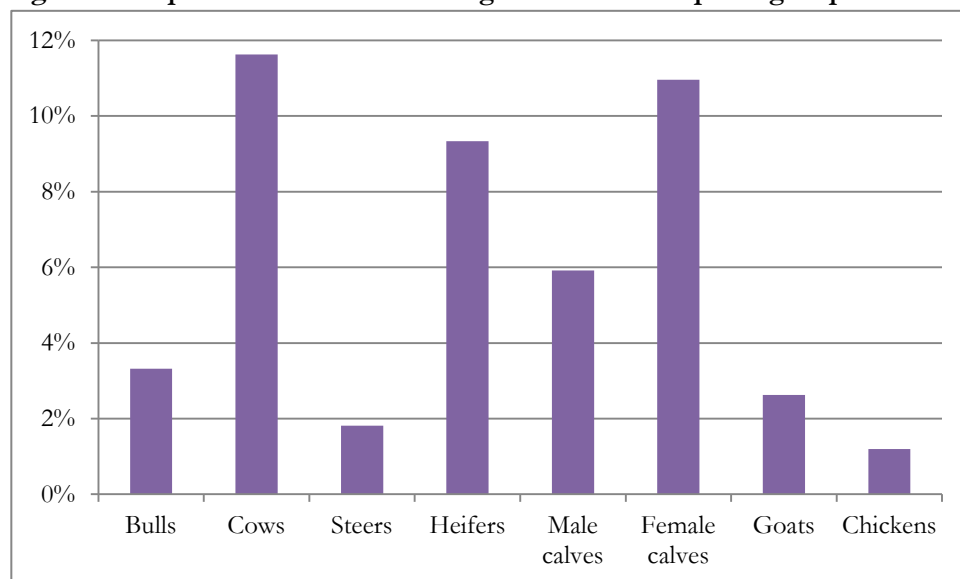
Figure 2: Mean Number of Animals



*Question s10aq3

Figure 3 below shows the proportion of households that owned improved variety animals, of households that owned that particular animal. For example, of households that owned cows, 12% reported owning improved variety cows. Similarly, 9% of households that owned heifers owned improved varieties, and 11% of households that owned female calves owned improved varieties. The proportions in the figure below were calculated using the survey questions *How many improved beef [ANIMAL] does this household currently own?* and *How many improved dairy [ANIMAL] does this household currently own?* For estimated proportions of the other animals and confidence intervals, see *Appendix A*.

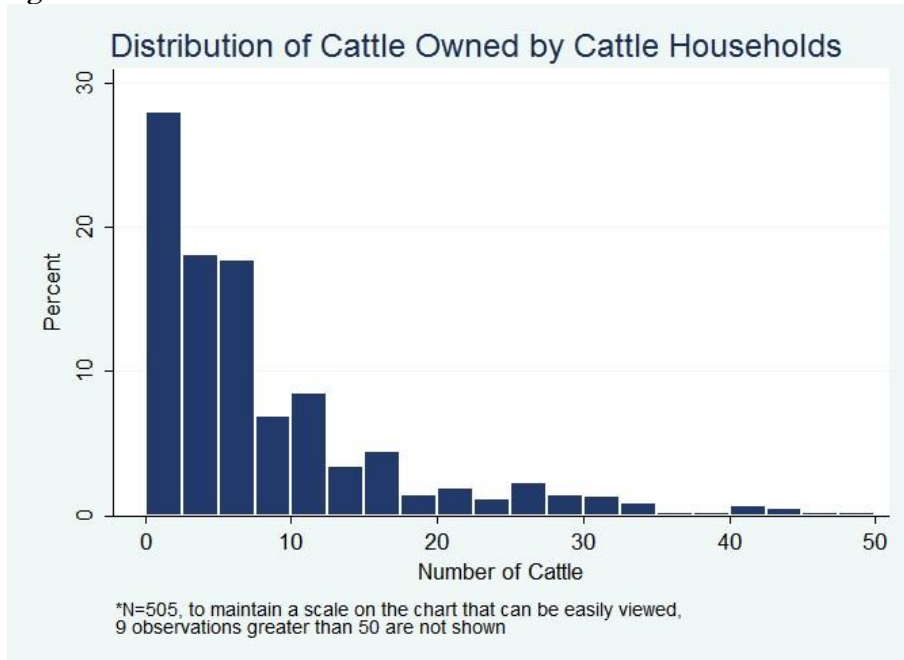
Figure 3: Proportion of Animal Owning Households Reporting Improved Varieties



*Questions s10aq4_2 & s10aq4_3

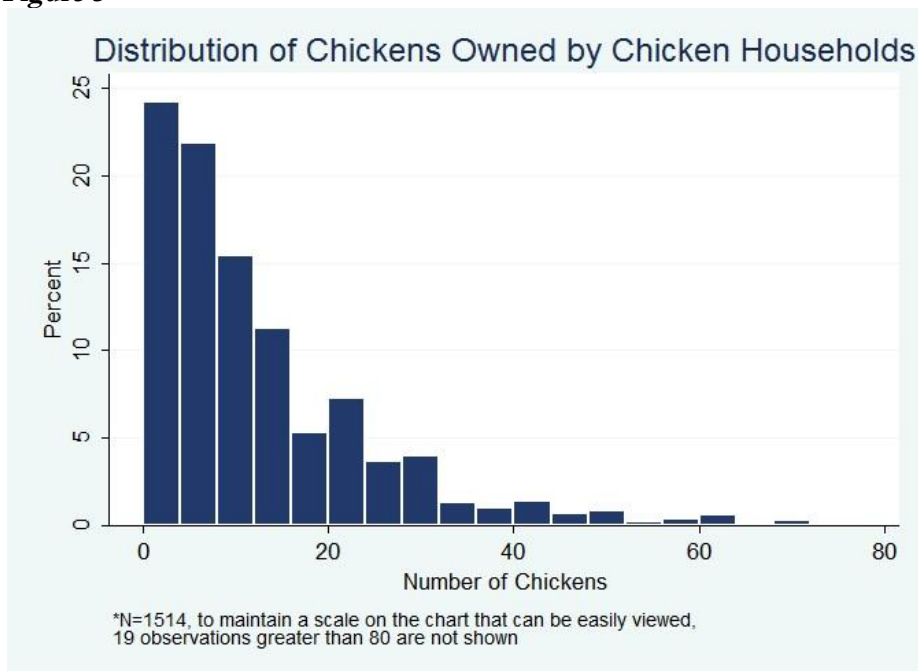
The figures below provide the distribution for total number of cattle, chickens, and goats owned per household. While the mean number of cattle owned was 10.25, the distribution is skewed with 72% of households owning 10 or less cattle. Similarly, the mean number of chickens was 13.2, but 65% of households reported owning 13 or less chickens. The mean number of goats was 7, and 70% of households owned 7 or less goats. Therefore, in all cases, the mean number of animals owned is greater than the median.

Figure 4



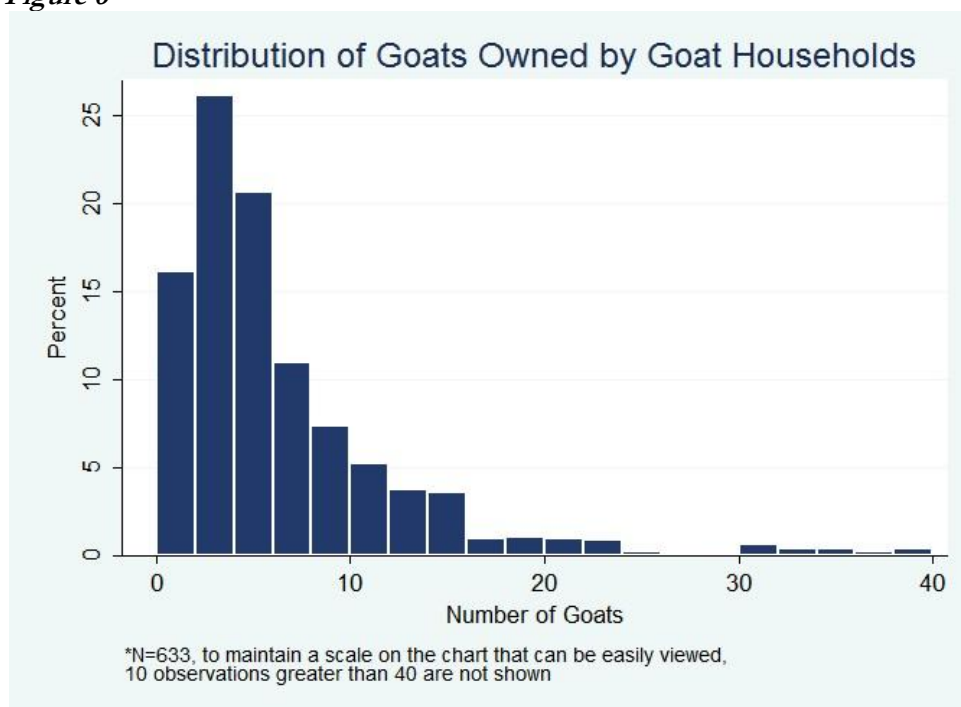
**Question s10aq3*

Figure 5



**Question s10aq3*

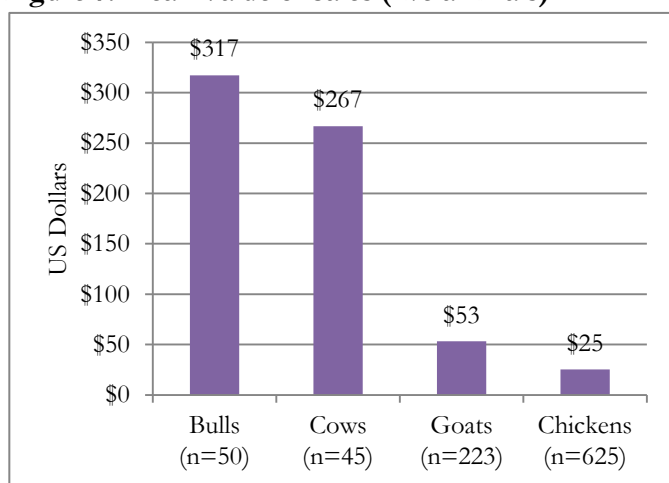
Figure 6



**Question s10aq3*

To measure livestock sales, the survey asked *What was the total value of sales?* in the past 12 months. Of households that sold bulls, cows, goats and chickens, the mean value of their sales is shown in *Figure 7*. A minority of households reported sales: only 19% of bull owning households sold bulls, 11% of cow owning households sold cows, 34% of goat owning households sold goats, and 41% of chicken owning households sold chickens. There were insufficient observations to show data for steers, heifers, male calves, and female calves. The full chart with confidence intervals and numbers of observations is shown in *Appendix A*.

Figure 7: Mean Value of Sales (live animals)



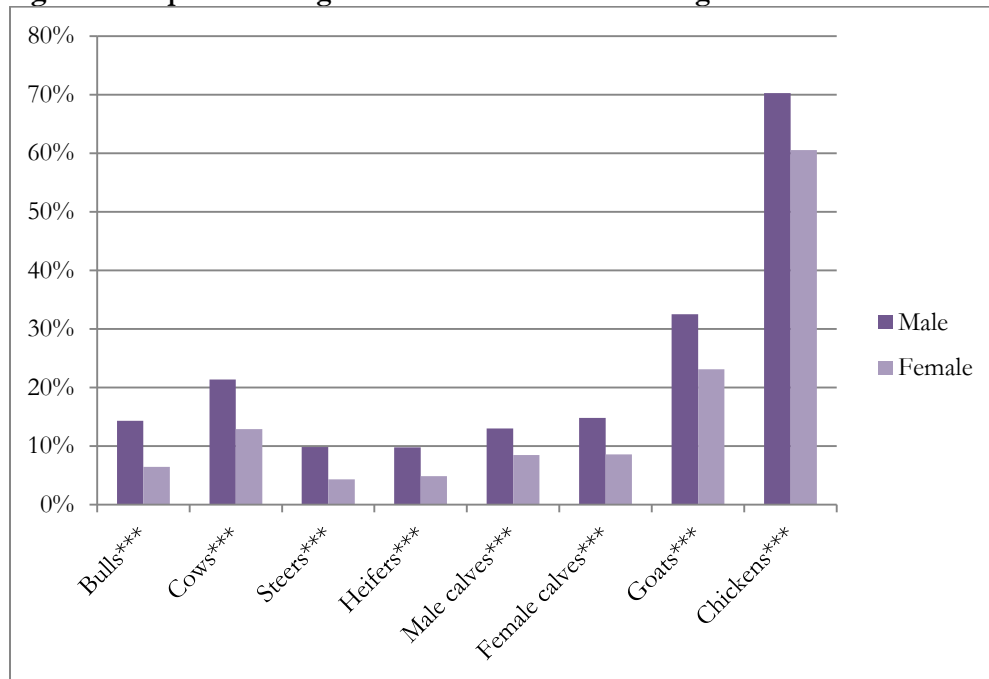
+Insufficient observations to calculate reliable estimates for steers, heifers, male calves, and female calves.

**Question s10aq9*

Livestock: Male- versus Female-Headed Households

Figure 8 shows the proportion of agricultural households owning livestock by the gender of the head of household. Of the 2482 agricultural households, the total number of female-headed households surveyed was 599, or approximately 24%. For all animals, the difference between the proportion of male-headed households and female-headed households was significant at the .01 level, and in all cases, male-headed households were more likely to own animals than female-headed households. If aggregated, 25% of male-headed agricultural households owned some type of cattle, compared to 14% of female-headed agricultural households (see *Appendix B*).

Figure 8: Proportion of Agricultural Households Owning Livestock

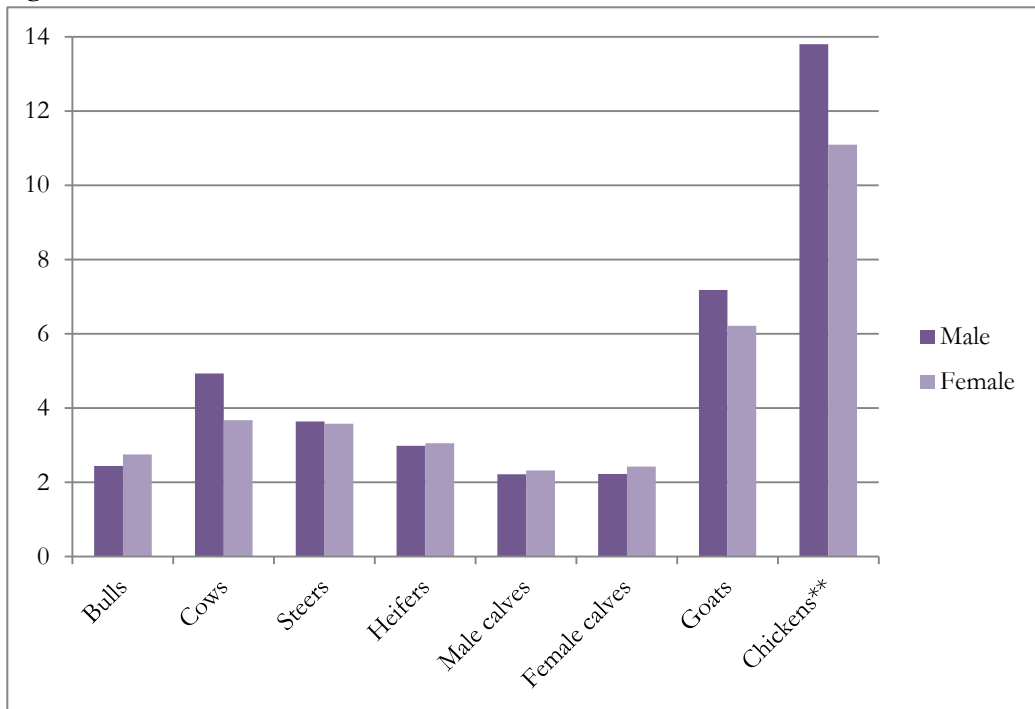


***Statistically significant at the .01 level

*Question s10aq2

Figure 9 shows the mean number of animals owned by male-headed versus female-headed households. Although male-headed households were statistically significantly more likely to own livestock than female-headed households, across households that did own livestock, the average number of animals was not statistically significantly different between men and women. If all types of cattle were aggregated, male-headed households owned an average of 10.49 animals and female-headed households owned an average of 9.58 animals (see *Appendix B* for confidence intervals and significance levels).

Figure 9: Mean Number of Animals Owned

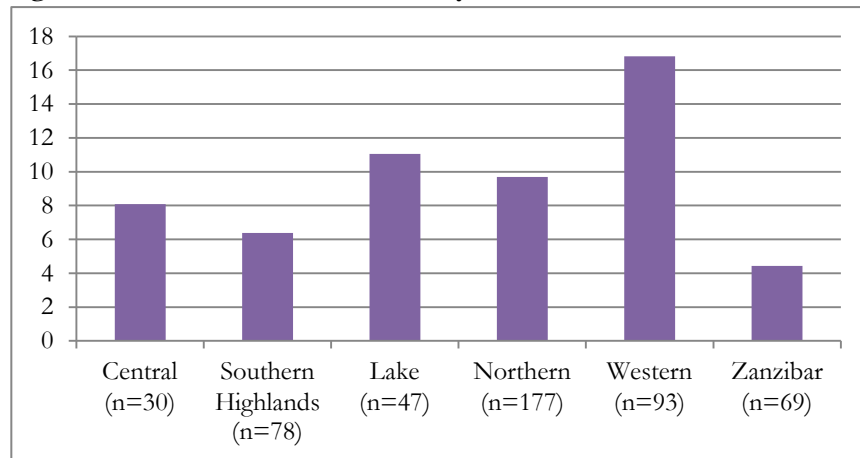


**Question s10aq3*

Livestock: Across Zones

The mean number of all cattle owned by administrative zone is shown in *Figure 10* below. While cattle households in the Western zone owned an average of 16.8 animals, only 28% of agricultural households in that region owned any cattle. In contrast, in the Northern zone 47% of agricultural households owned cattle, but of those households, the average number was lower, at 9.7 animals (see *Appendix C* for proportions of households owning each animal by zone).

Figure 10: Mean Number of Cattle by Zone

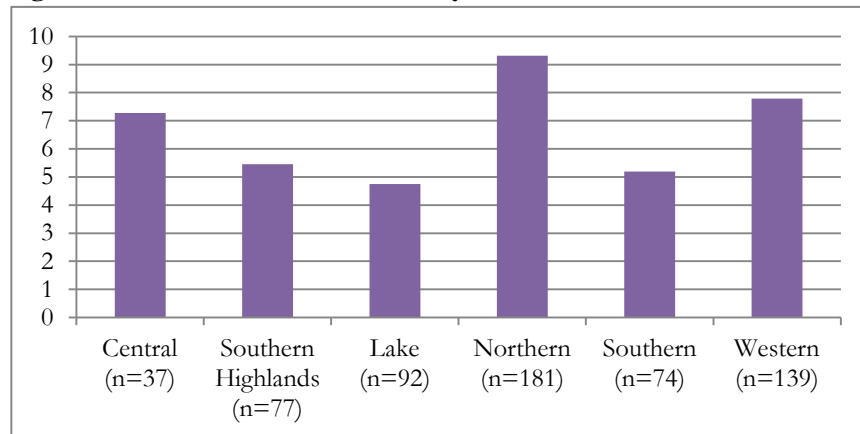


+Insufficient observations to calculate reliable estimates for Eastern and Southern zones.

*Question s10aq3

While more households owned goats than cattle (30% and 23% respectively at the national level), households that owned goats tended to own fewer goats. The highest levels of goat ownership were found in the Northern zone, where 48% of all households owned goats. Households in the Northern zone also owned the highest average number of goats (9.3).

Figure 11: Mean Number of Goats by Zone

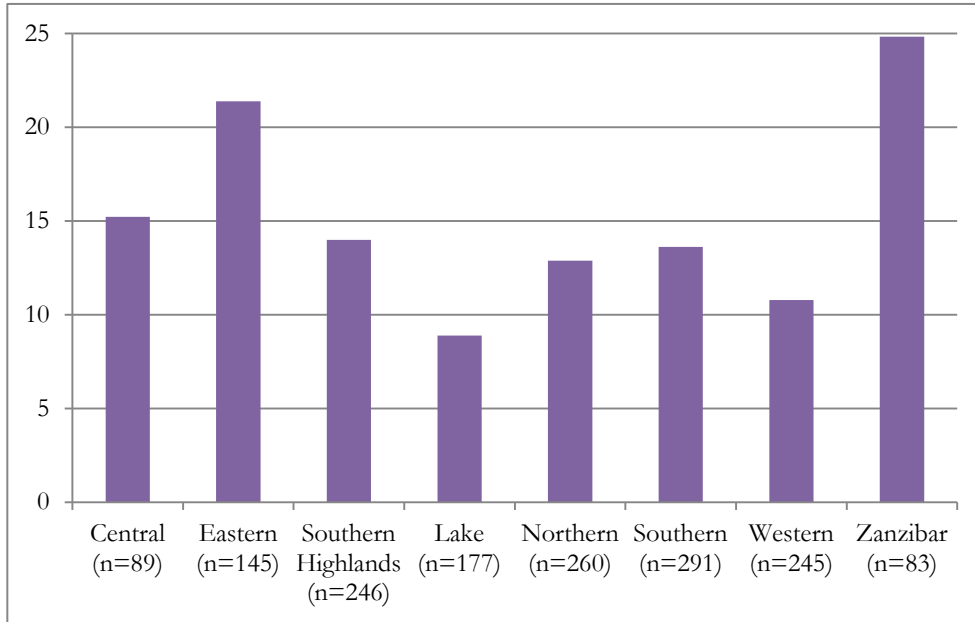


+Insufficient observations to calculate reliable estimates for Eastern zone and Zanzibar.

*Question s10aq3

Chickens were the most commonly owned animals in Tanzania, with 68% of agricultural households reporting owning at least one. With the exception of Zanzibar (which had an ownership level of 30%), ownership of chickens was fairly evenly distributed, ranging from 57% of agricultural households in the Eastern zone to 75% in the Western zone.¹ However, the mean number of chickens owned ranged from approximately 9 in the Lake zone to 21 and 25 in the Eastern zone and Zanzibar respectively. In contrast, the Eastern zone had the lowest ownership of cattle, with only 2% of agricultural households owning any type of cattle. For all data on proportions of households and mean number of animals owned by zone, see *Appendix C*.

Figure 12: Mean Number of Chickens by Zone



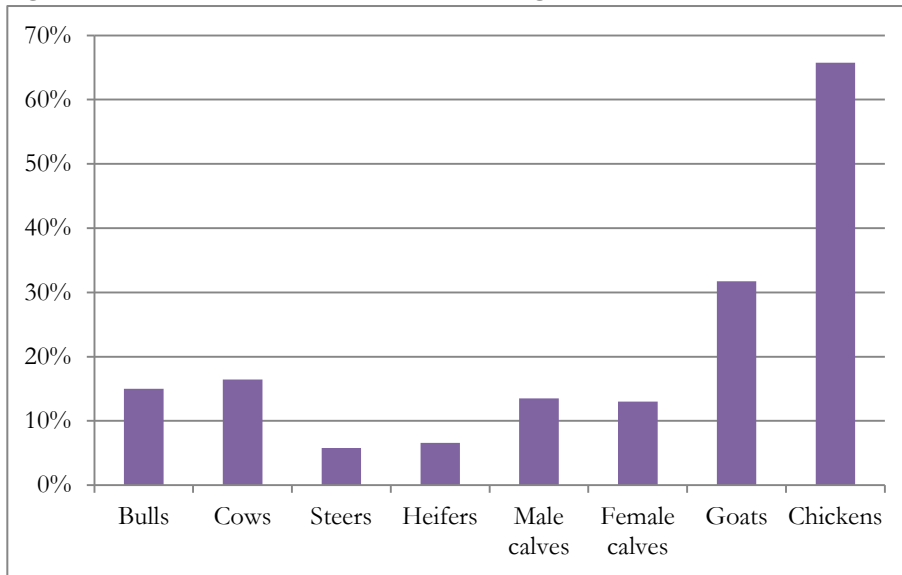
**Question s10aq3*

¹ All proportions of agricultural households owning livestock are significant at the .01 level.

Livestock: Disease

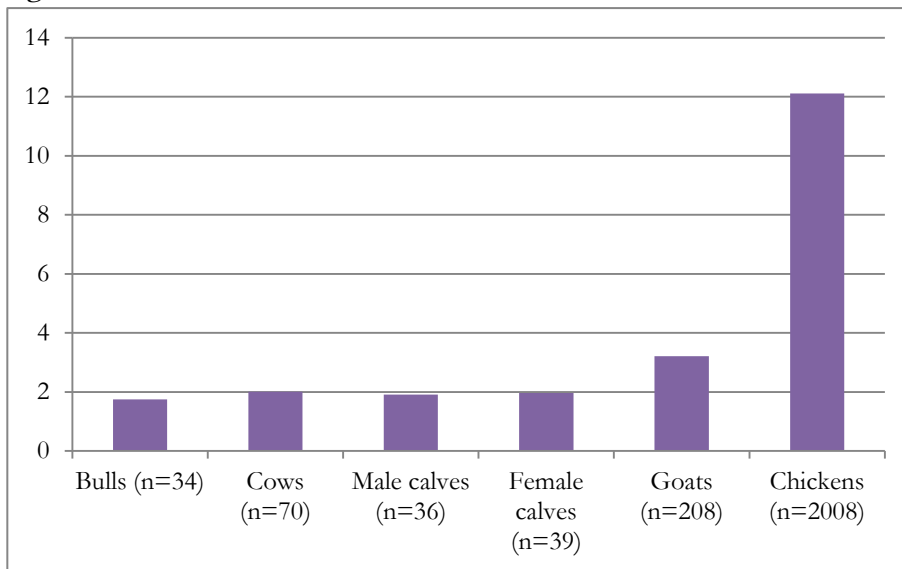
Of households that owned a particular type of animal, the proportion that lost that animal to disease and the average number of animals lost are shown in *Figure 13* and *Figure 14* below. Sixty-six percent of households that owned chickens lost one or more chickens to disease, and of those households, the average loss was 12.12 chickens per year. Only 15% lost bulls to disease, and on average those households lost 1.75 bulls per year. Livestock lost to disease were measured with the questions *Have you lost any [ANIMAL] to DISEASE in the past 12 months?* and *How many [ANIMAL] have you lost to DISEASE in the past 12 months?*

Figure 13: Proportion of Households Losing Animal to Disease



**Question s10aq19*

Figure 14: Mean Number of Animals Lost to Disease

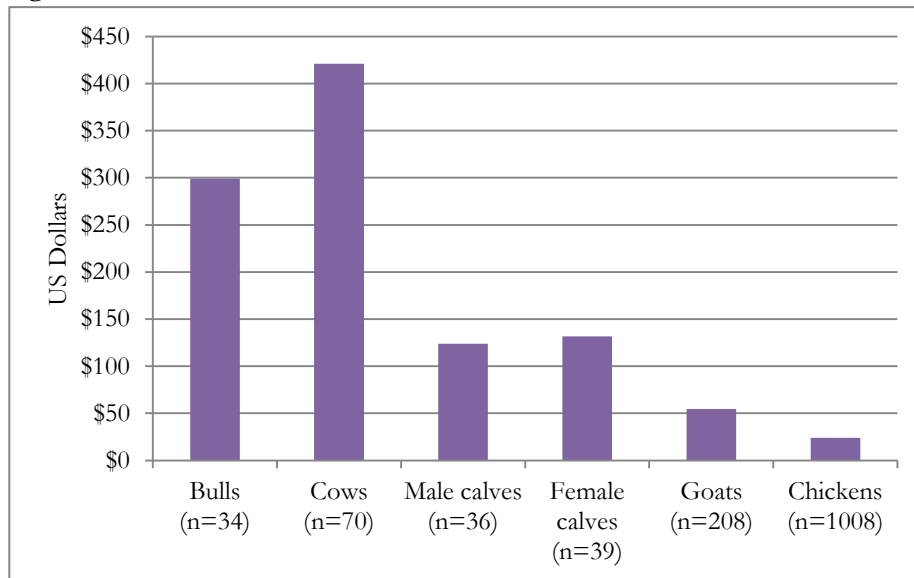


+Insufficient observations to calculate reliable estimates for steers and heifers.

**Question s10aq20*

Though chickens were most frequently lost to disease, *Figure 15* below compares the value of losses across livestock. Of households that lost chickens, the average value lost per year was \$23.91, while for households losing bulls, the average loss was \$299.19 per year. The value lost is determined from, *What was the value of these [ANIMAL]s lost to disease?*

Figure 15: Mean Value of Animals Lost to Disease

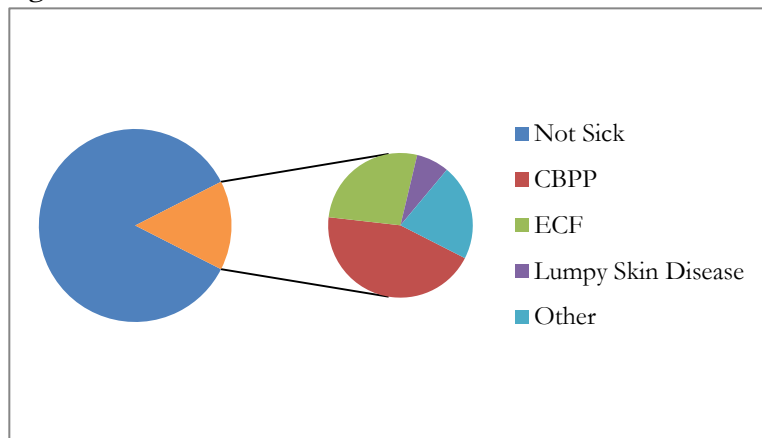


+Insufficient observations to calculate reliable estimates for steers and heifers.

*Question s10aq21

Of the 15% of households with diseased bulls, *Figure 16* shows that 44% of those suffered from CBPP, 27% from ECF, and 7% from Lumpy Skin Disease (*What kind of diseases did [ANIMAL] suffer in the past 12 months?*).

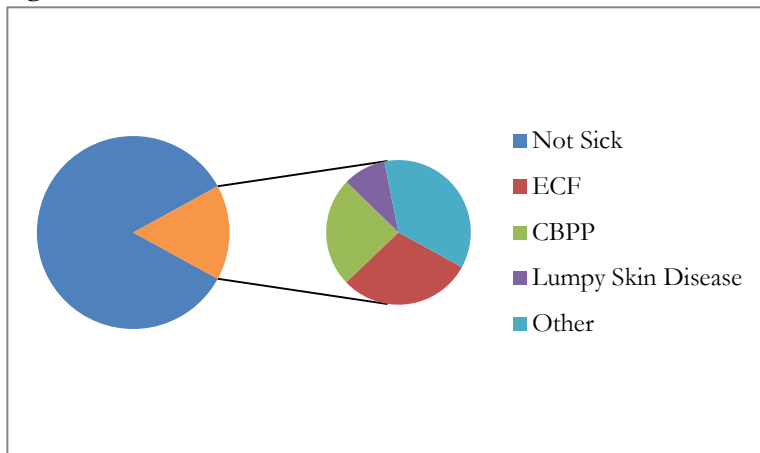
Figure 16: Households with Diseased Bulls



*Question s10aq25

Similarly, of the 16% of households with diseased cows, *Figure 17* shows that 30% of those suffered from ECF, 24% from CBPP, and 10% from Lumpy Skin Disease.

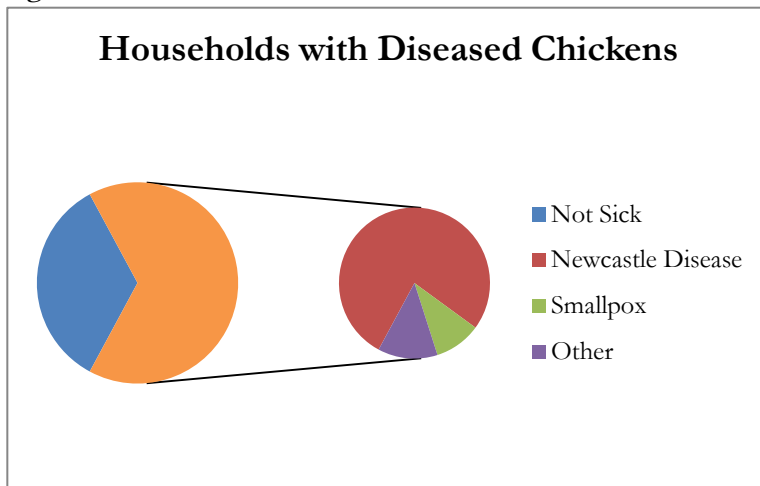
Figure 17: Households with Diseased Cows



**Question s10aq25*

Figure 18 shows that, of the 68% of households with diseased chickens, 77% suffered from Newcastle Disease, and 10% from Smallpox.

Figure 18: Households with Diseased Chickens



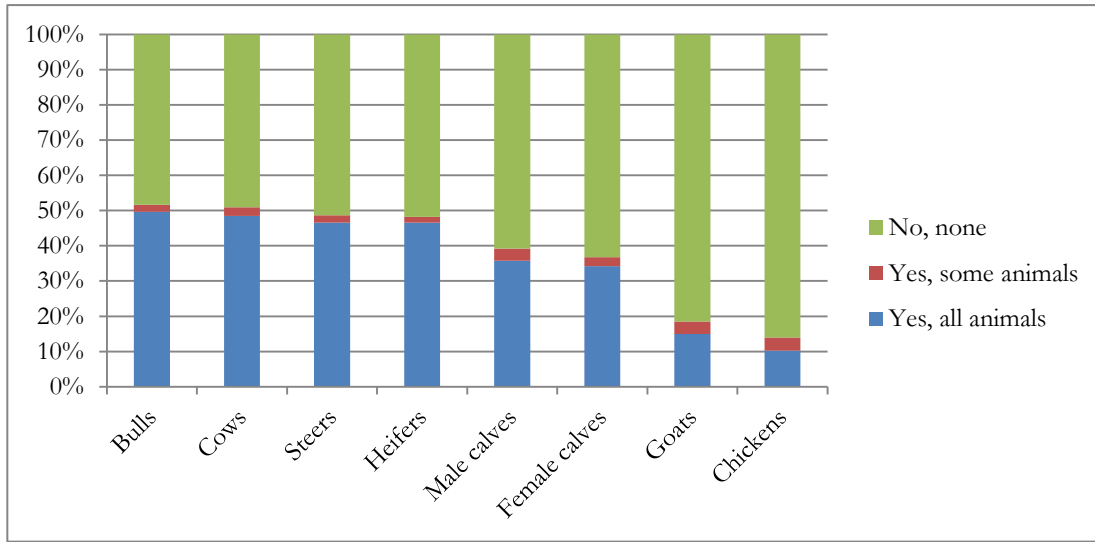
**Question s10aq25*

For additional data on disease suffered by livestock, see *Appendix D*.

Livestock: Vaccines

The figure below shows the proportion of households that vaccinated their livestock (*Are your [ANIMAL] vaccinated?*). While households with bulls and cows were less likely to have animals suffering disease than households with chickens, a total of 52% of households with bulls, 51% of households with cows, and only 14% of households with chickens, vaccinated some or all of those animals.

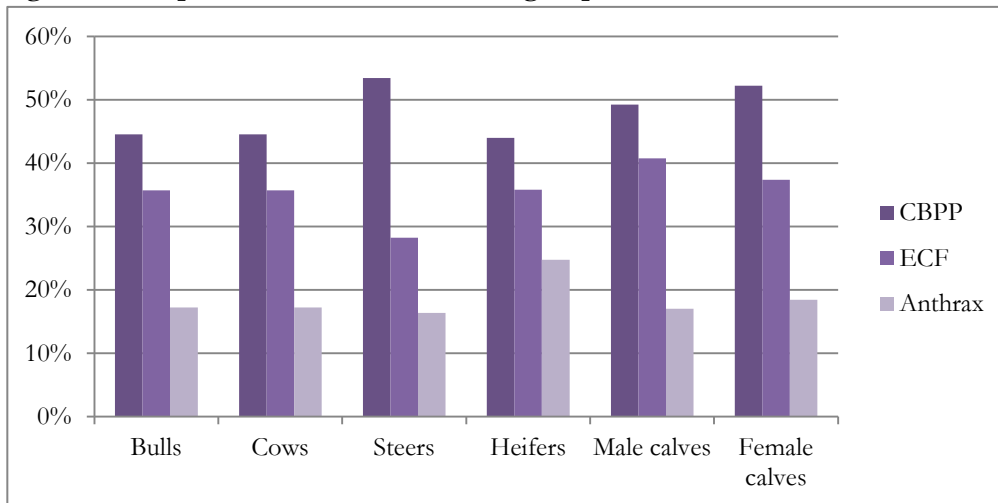
Figure 19: Proportion of Households that Vaccinate Livestock



**Question s10aq26*

For the various types of cattle, the top three vaccines used by households that vaccinated cattle were CBPP, ECF, and Anthrax (*Figure 20*). While the proportions of households using the vaccine vary for each animal, CBPP was the most common vaccine, followed by ECF and Anthrax (*Against which diseases did you vaccinate your [ANIMAL]?*).

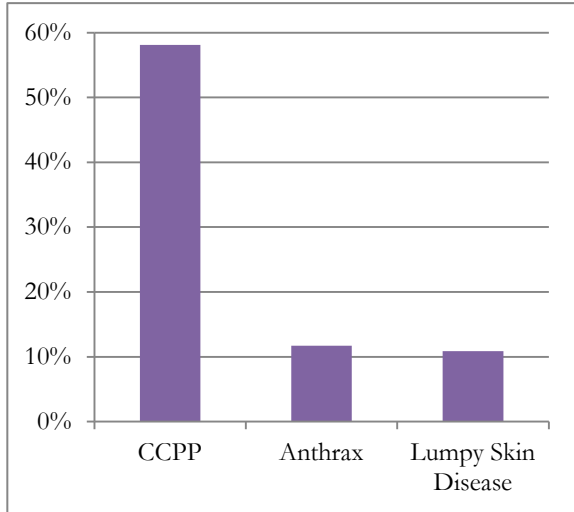
Figure 20: Proportion of Households Using Top Three Vaccines for Cattle



**Question s10aq28*

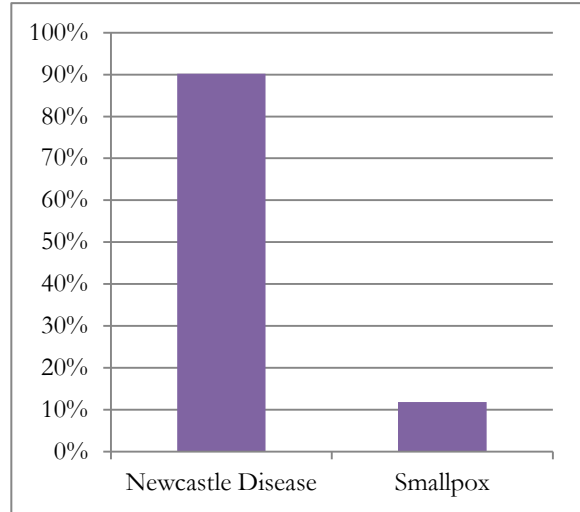
Figure 21 and Figure 22 show the proportion of households that used the top vaccines for goats and chickens. Goats were most commonly vaccinated against CCPP, Anthrax, and Lumpy Skin Disease, while chickens were vaccinated against Newcastle Disease and Smallpox.

Figure 21: Proportion of Households Using Top Three Vaccines for Goats



*Question s10aq28

Figure 22: Proportion of Households Using Top Two Vaccines for Chickens



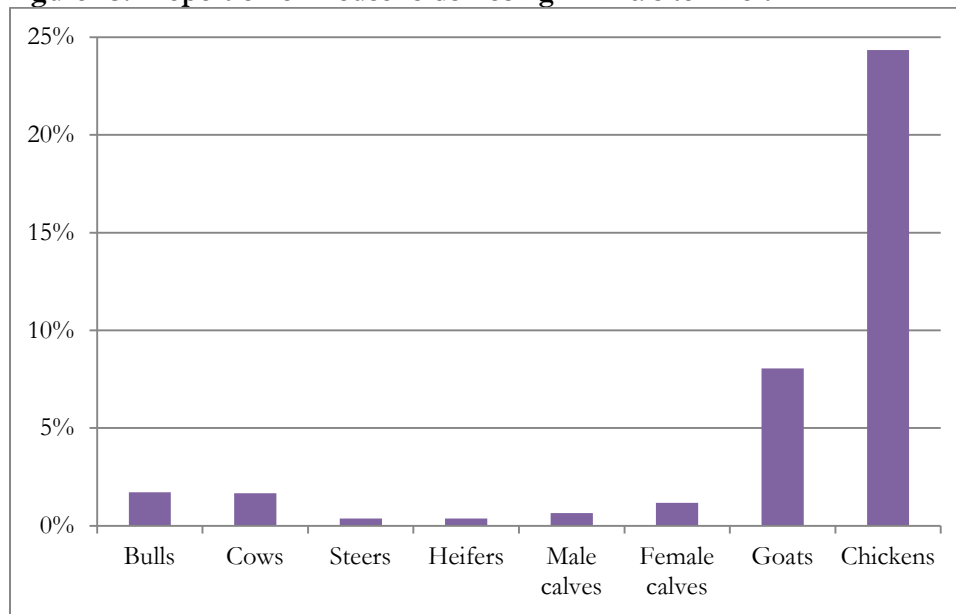
*Question s10aq28

For additional data on livestock vaccination, see *Appendix E*.

Livestock: Theft

The proportion of households losing animals to theft (*Have you lost any [ANIMAL] to THEFT in the past 12 months?*) was relatively low compared to the proportion of households losing animals to disease. For example, 15% of households lost bulls to disease, while only 1.7% lost bulls to theft. Sixty-six percent of households lost chickens to disease while only 24.3% of households lost chickens to theft.

Figure 23: Proportion of Households Losing Animals to Theft



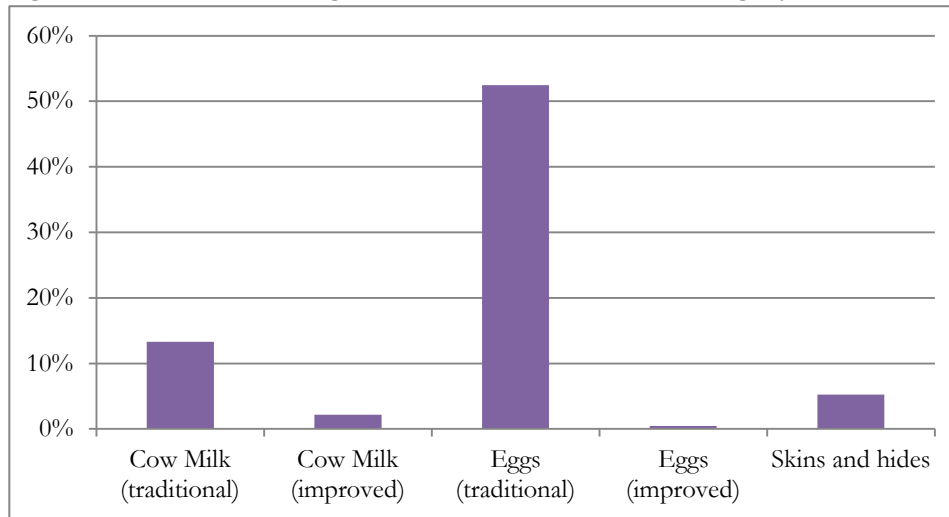
**Question s10aq22*

Question s10aq23 follows up with, *How many [ANIMAL] have you lost to THEFT in the past 12 months?* Of households that lost chickens to theft (n=402), they lost on average 5.57 chickens, compared to an average of 12.12 chickens lost to disease. Households that lost goats to theft (n=51) lost a mean of 2.13 animals, while households losing goats to disease lost a mean of 3.21. Due to the low number of observations for households losing livestock to theft, further analysis is limited. Data are available in *Appendix F*.

Livestock By-Products: Basic Descriptives

Figure 24 shows the proportion of all agricultural households (n=2482) that produce livestock by-products (*Did your household produce any [PRODUCT] in the last 12 months?*).

Figure 24: Proportion of Agricultural Households Producing By-Products

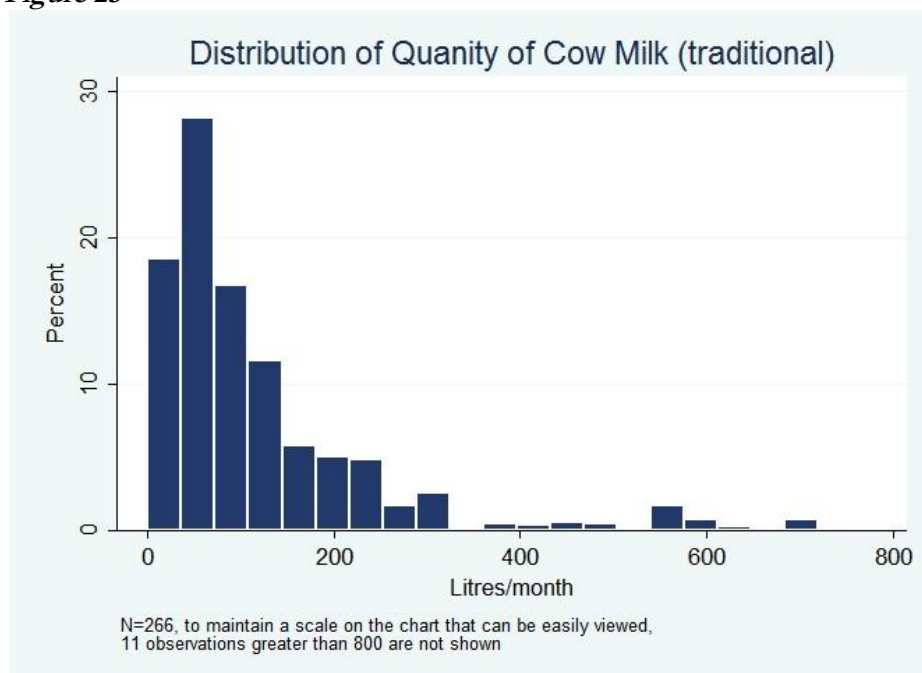


**Question s10bq1*

The three figures below show the distribution of quantity produced for households that produced the by-product. The survey asks for how many months the by-product was produced and *During these months, what was the average quantity of [PRODUCT] produced per month?* Of households producing traditional cow milk, the mean quantity was 231 litres/month (n=277)², a number boosted by a few large producers. The median quantity produced per month was 90 litres and 82% of households produced less than 240 litres/month.

² Three improbably high outliers were removed from this calculation, prior to which the mean was 489 litres/month.

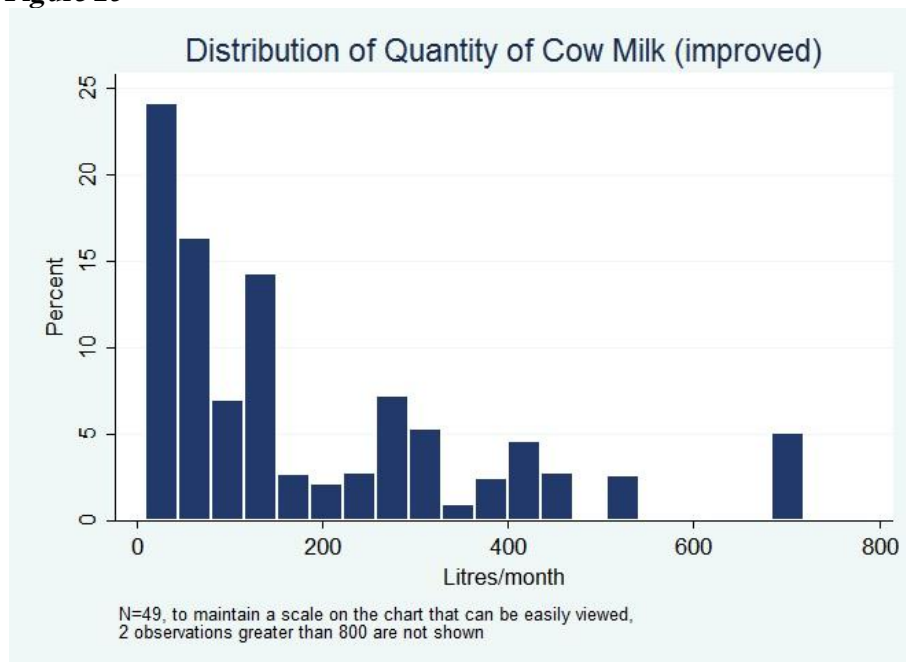
Figure 25



**Questions s10bq2 & s10bq3*

The mean quantity of improved cow milk produced per month by production households was 209 litres.³ However, the median quantity produced was 120 litres/month, compared to 90 litres/month for traditional milk. Sixty-one percent of households produced less than 210 litres/month.

Figure 26

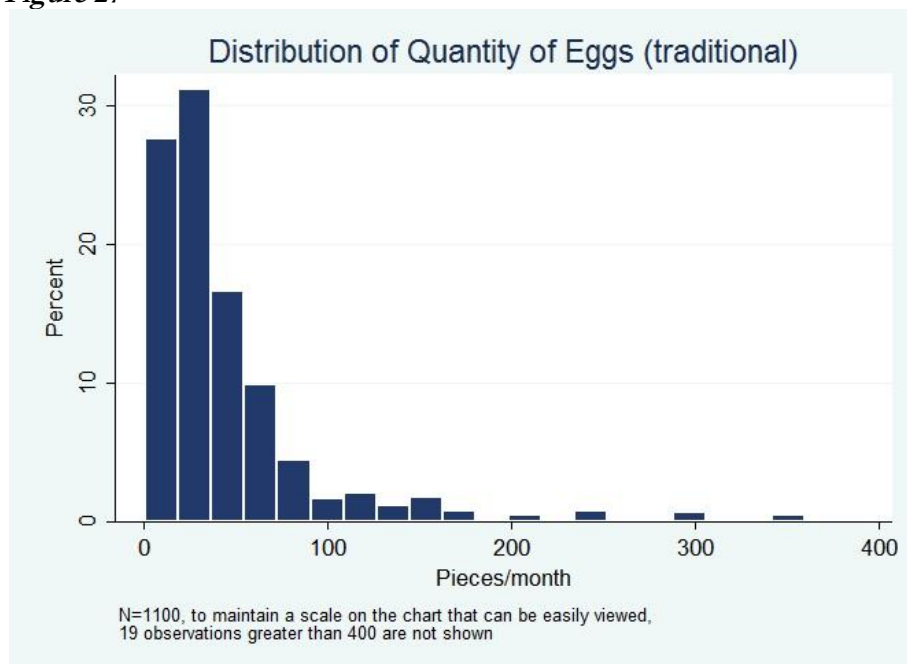


**Questions s10bq2 & s10bq3*

³ One improbably high outlier was removed from the improved cow milk quantities, reducing the mean from 272 to 209 litres/month.

The mean quantity of traditional eggs produced per household producing those eggs was 51 eggs/month,⁴ while the median was 30 eggs/month and 74% of households reported producing less than 51 eggs/month.

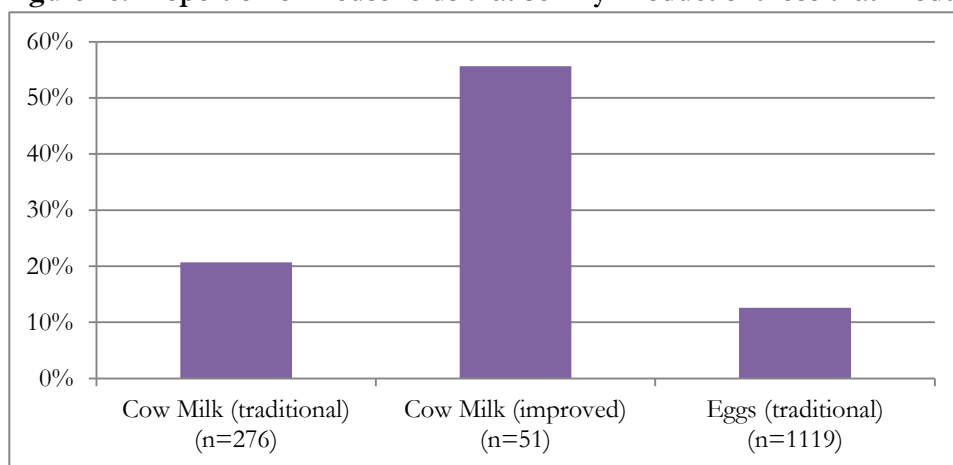
Figure 27



**Questions s10bq2 & s10bq3*

Of households that produced by-products, *Figure 28* shows the proportion that sold them. Only 21% of traditional cow milk producing households reported selling any milk, while 56% of improved cow milk producing households reported selling their by-product (*Did you sell any of the [PRODUCT] that you produced in the last 12 months?*).

Figure 28: Proportion of Households that Sell By-Product of those that Produce Them



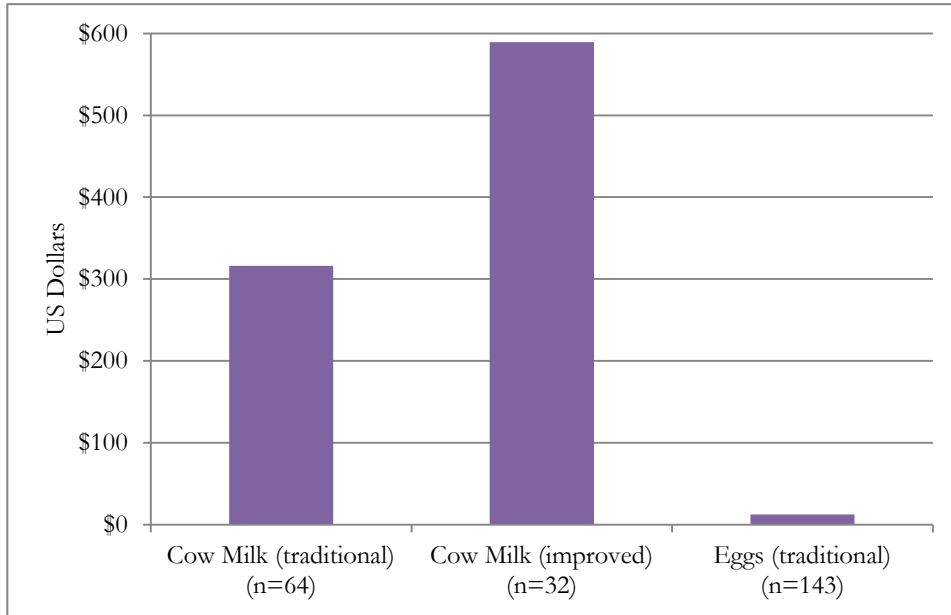
+Insufficient observations to calculate reliable estimates for Eggs (improved).

**Question s10bq4*

⁴ Nine improbably high outliers were removed from the traditional eggs quantity, reducing the mean from 59 to 51 eggs/month.

Of those households that reported selling their by-product, the figure below shows the mean value of sales reported over the past year for cow milk (traditional and improved) and traditional eggs (*What was the total value of sales of [PRODUCT] in the last 12 months?*). The median value of sales was \$150 for traditional cow milk, \$240 for improved cow milk and \$4.50 for traditional eggs.

Figure 29: Mean Value of Sales Over Past Year



+Insufficient observations to calculate reliable estimates for Eggs (improved).

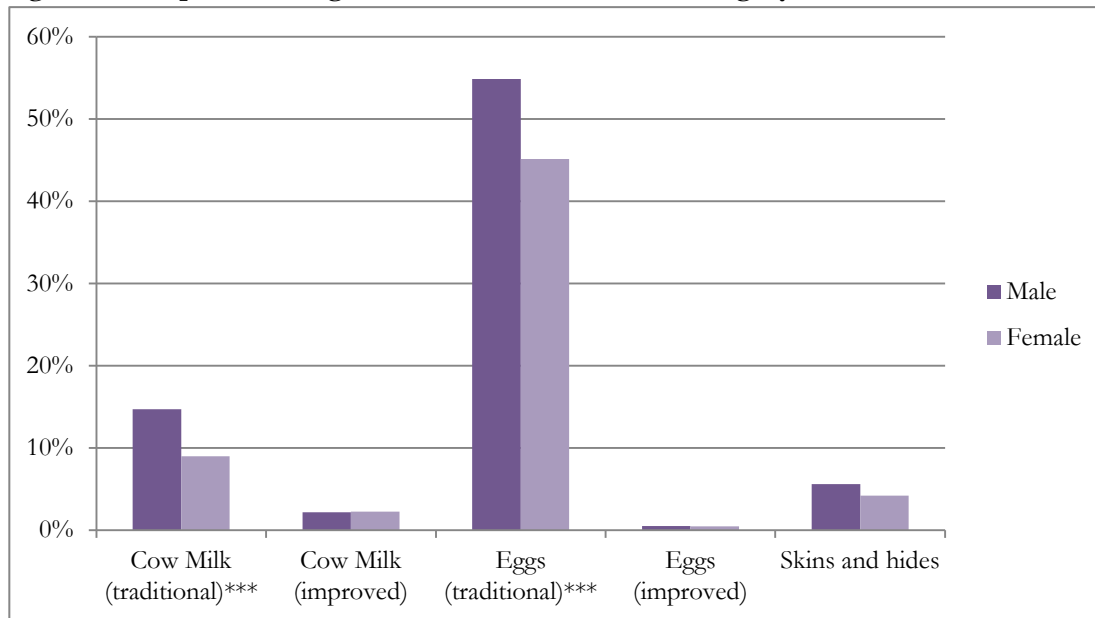
*Question s10bq6

See *Appendix H* for further details and confidence intervals.

Livestock By-Products: Male- versus Female-Headed Households

Figure 30 below shows the proportion of agricultural households producing by-products comparing male- and female-headed households. The difference is statistically significant for both traditional cow milk and traditional egg production, but not for improved varieties or skins and hides.⁵

Figure 30: Proportion of Agricultural Households Producing By-Products



* Statistically significant at the .10 level

** Statistically significant at the .05 level

*** Statistically significant at the .01 level

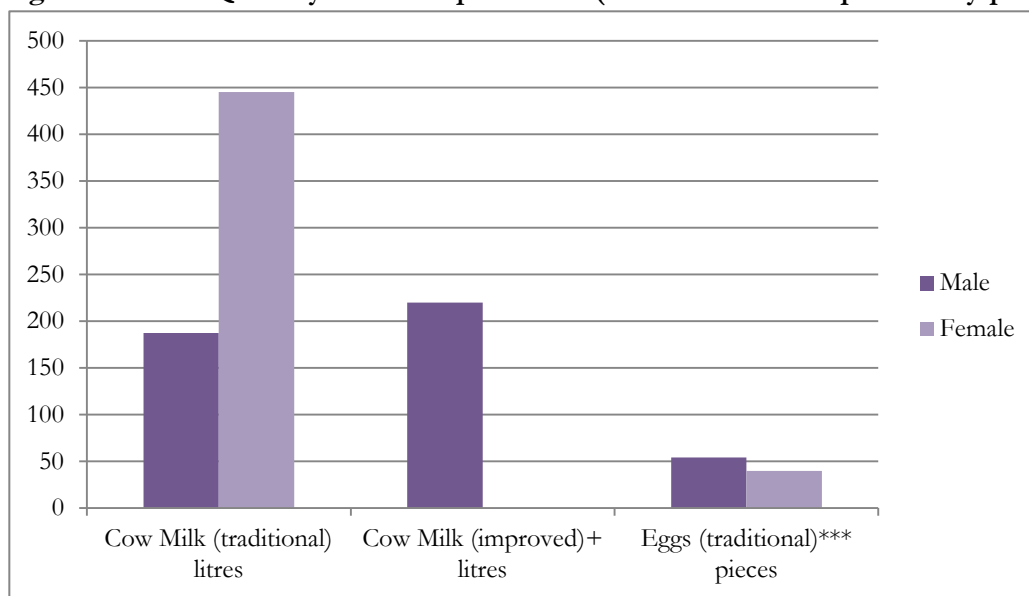
*Question s10bq1

The mean by-product quantity produced per month, for producing households, is shown in Figure 31 for male- and female-headed households. Traditional eggs are the only category for which the difference is statistically significant.⁶ See Appendix I for further details, p-values, and confidence intervals for the male and female comparisons.

⁵ Cow milk (traditional) p-value=0.0016 and eggs (traditional) p-value=0.0005

⁶ P-value=0.0005

Figure 31: Mean Quantity Produced per Month (of households that produce by-product)



* Statistically significant at the .10 level

*Questions s10bq2 & s10bq3

**Statistically significant at the .05 level

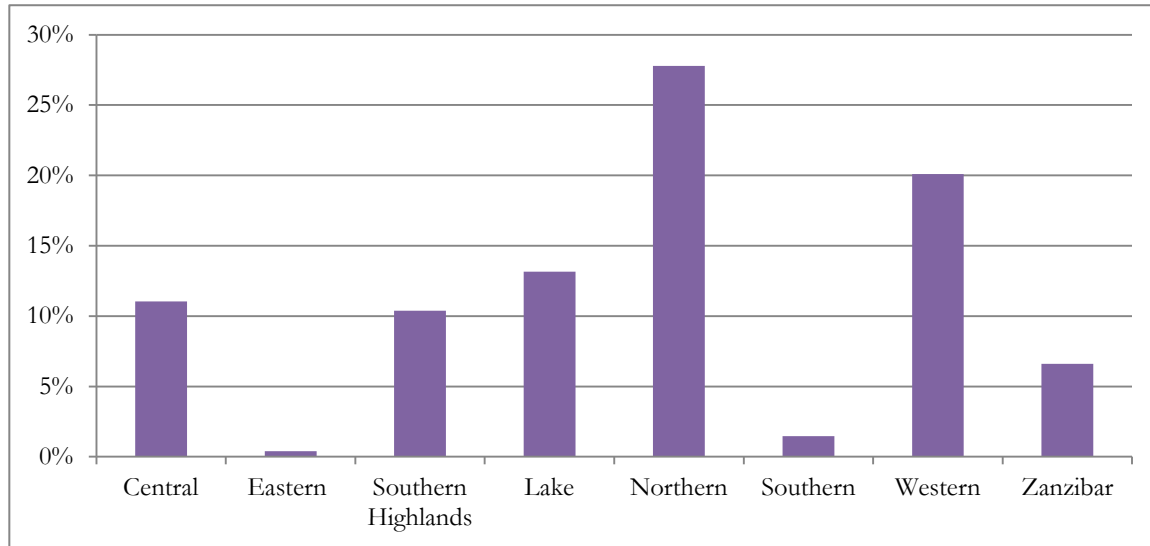
***Statistically significant at the .01 level

+Insufficient observations to calculate reliable estimates for cow milk (improved) for female-headed households, eggs (improved) and skins and hides.

Livestock By-Products: Across Zones

Figure 32 shows the proportion of all agricultural households (n=2482) that produced traditional cow milk, by administrative zone. The difference in production was statistically significant at the .01 level across zones.

Figure 32: Proportion of Agricultural Households Producing Cow Milk (traditional)***

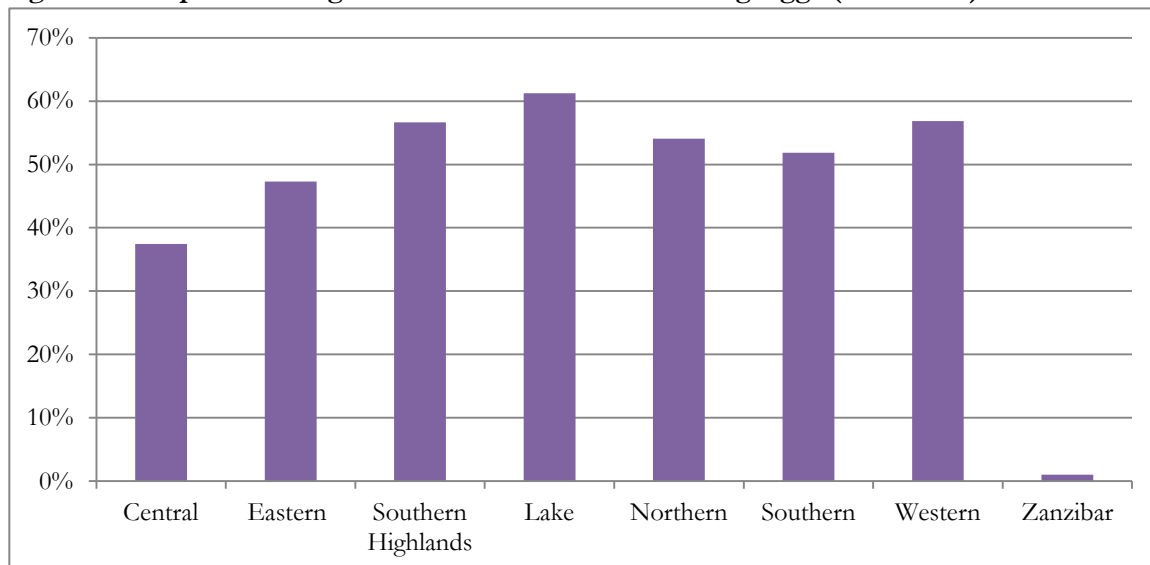


***Statistically significant at the .01 level

*Question s10bq1

Similarly, Figure 33 shows the proportion of agricultural households that produced traditional eggs by zone, once again the difference is statistically significant at the .01 level. See Appendix J for further details and confidence intervals for zonal analysis.

Figure 33: Proportion of Agricultural Households Producing Eggs (traditional)***



***Statistically significant at the .01 level

*Question s10bq1

Appendix A Livestock: Basic Descriptives

Proportion of Agricultural Households Owning Livestock (n=2482)			
Animal	Proportion	95% C.I.	
Total Cattle	23%	[20%, 25%]	
Bulls	12%	[11%, 14%]	
Cows	19%	[17%, 21%]	
Steers	8%	[7%, 10%]	
Heifers	9%	[7%, 10%]	
Male calves	12%	[10%, 14%]	
Female calves	13%	[11%, 15%]	
Goats	30%	[28%, 33%]	
Chickens	68%	[66%, 70%]	

Mean Number of Animals Owned (of households that own animal)			
Animal	Mean	95% C.I.	Number of Observations
Total Cattle	10.35	[8.49, 12.2]	514
Bulls	2.48	[2.15, 2.81]	268
Cows	4.72	[3.57, 5.88]	436
Steers	3.63	[3.12, 4.14]	166
Heifers	2.99	[2.48, 3.51]	193
Male calves	2.24	[1.83, 2.64]	263
Female calves	2.26	[1.74, 2.78]	283
Goats	7.00	[5.93, 8.07]	643
Chickens	13.20	[12.17, 14.24]	1533

Mean Value of Sales Over Past Year			
Animal	Mean (USD)	95% C.I.	Number of Observations
Bulls	\$317.24	[206.77, 427.71]	50
Cows	\$266.84	[198.98, 334.7]	45
Steers	\$353.56	[255.91, 451.21]	27
Heifers	\$220.41	[122.06, 318.76]	22
Male calves	\$220.06	[112.53, 327.59]	13
Female calves	\$205.05	[83.13, 326.98]	8
Goats	\$53.13	[44.36, 61.9]	223
Chickens	\$25.48	[17.88, 33.08]	625

Proportion of Animal Owning Households Reporting Improved Varieties				
Animal	Proportion	95% C.I.		Number of Observations
Bulls	3%	[1%, 6%]		268
Cows	12%	[7%, 16%]		436
Steers	2%	[0%, 4%]		166
Heifers	9%	[4%, 14%]		193
Male calves	6%	[2%, 9%]		263
Female calves	11%	[7%, 15%]		283
Goats	3%	[1%, 4%]		643
Chickens	1%	[1%, 2%]		1533

Mean Number of Animals Owned (of households owning that breed type)					
Animal	Breed Type	Mean	95% C.I.		Number of Observations
Bulls	Indigenous	2.56	[2.18, 2.94]		244
	Improved Meat	1.00	-		6
	Improved Dairy	1.00	-		6
Cows	Indigenous	5.03	[3.92, 6.15]		374
	Improved Meat	5.52	[0.23, 10.8]		3
	Improved Dairy	1.57	[1.24, 1.9]		55
Steers	Indigenous	3.85	[3.32, 4.37]		159
	Improved Meat	2.25	[0.47, 4.02]		3
	Improved Dairy	-	-		0
Heifers	Indigenous	3.19	[2.61, 3.77]		168
	Improved Meat	1.00	-		6
	Improved Dairy	1.41	[1.03, 1.79]		14
Male calves	Indigenous	2.84	[2.3, 3.38]		232
	Improved Meat	1.39	[0.87, 1.91]		7
	Improved Dairy	1.00	-		14
Female calves	Indigenous	2.78	[2.16, 3.4]		244
	Improved Meat	1.30	[0.8, 1.8]		4
	Improved Dairy	1.29	[1.08, 1.5]		30
Goats	Indigenous	7.23	[6.08, 8.37]		612
	Improved Meat	-	-		0
	Improved Dairy	8.44	[-2.05, 18.93]		18
Chickens	Indigenous	10.82	[10.14, 11.5]		1458
	Improved Meat	26.17	[6.78, 45.56]		23
	Improved Dairy	-	-		0

Appendix B Livestock: Male- versus Female-Headed Households

Proportion of Agricultural Households Owning Livestock (n=2482), by Head of Household (male-headed n=1883; female-headed n=599)					
Animal	Head of Household	Proportion	95% C.I.	Wald test P-value	
Total Cattle	Male	25%	[23%, 28%]	n/a	
	Female	14%	[11%, 18%]		
Bulls	Male	14%	[12%, 16%]	0.000	
	Female	6%	[4%, 9%]		
Cows	Male	21%	[19%, 24%]	0.000	
	Female	13%	[9%, 16%]		
Steers	Male	10%	[8%, 12%]	0.000	
	Female	4%	[2%, 6%]		
Heifers	Male	10%	[8%, 11%]	0.000	
	Female	5%	[3%, 7%]		
Male calves	Male	13%	[11%, 15%]	0.011	
	Female	8%	[5%, 12%]		
Female calves	Male	15%	[13%, 17%]	0.000	
	Female	9%	[5%, 12%]		
Goats	Male	33%	[30%, 35%]	0.000	
	Female	23%	[19%, 27%]		
Chickens	Male	70%	[68%, 73%]	0.000	
	Female	61%	[56%, 65%]		

Mean Number of Animals Owned by Head of Household (of households that own animal)						
Animal	Head of Household	Mean	95% C.I.	Number of Observations	Wald test P-value	
Total Cattle	Male	10.49	[8.47, 12.51]	436	n/a	
	Female	9.58	[6.18, 12.98]	78		
Bulls	Male	2.44	[2.08, 2.81]	235	0.3817	
	Female	2.75	[2.16, 3.35]	33		
Cows	Male	4.93	[3.6, 6.27]	364	0.125	
	Female	3.67	[2.55, 4.8]	72		
Steers	Male	3.64	[3.13, 4.14]	146	0.952	
	Female	3.58	[1.73, 5.43]	21		
Heifers	Male	2.98	[2.43, 3.54]	169	0.9034	
	Female	3.06	[1.99, 4.12]	25		
Male calves	Male	2.22	[1.79, 2.65]	221	0.8303	
	Female	2.32	[1.42, 3.22]	44		
Female calves	Male	2.23	[1.65, 2.8]	238	0.7123	
	Female	2.42	[1.51, 3.33]	47		
Goats	Male	7.18	[5.97, 8.39]	524	0.2725	
	Female	6.21	[4.71, 7.72]	122		
Chickens	Male	13.80	[12.63, 14.96]	1201	0.0161	
	Female	11.09	[9.14, 13.04]	335		

Appendix C Livestock: Across Zones

Proportion of Agricultural Households Owning Livestock, by Zone (n=2482)				
Animal	Zone	Proportion	95% C.I.	Wald test P-value
Total Cattle	Central	21%	[13%, 29%]	n/a
	Eastern	2%	[0%, 4%]	
	Southern Highlands	23%	[16%, 29%]	
	Lake	19%	[12%, 26%]	
	Northern	47%	[39%, 55%]	
	Southern	3%	[1%, 5%]	
	Western	28%	[21%, 35%]	
	Zanzibar	25%	[20%, 30%]	
Bulls	Central	14%	[9%, 19%]	0.000
	Eastern	1%	[0%, 2%]	
	Southern Highlands	9%	[5%, 13%]	
	Lake	9%	[5%, 13%]	
	Northern	23%	[17%, 29%]	
	Southern	1%	[0%, 2%]	
	Western	22%	[16%, 28%]	
	Zanzibar	10%	[5%, 14%]	
Cows	Central	17%	[10%, 23%]	0.000
	Eastern	2%	[0%, 4%]	
	Southern Highlands	17%	[12%, 22%]	
	Lake	17%	[11%, 24%]	
	Northern	41%	[34%, 49%]	
	Southern	2%	[0%, 4%]	
	Western	25%	[18%, 31%]	
	Zanzibar	22%	[16%, 27%]	
Steers	Central	14%	[7%, 20%]	0.000
	Eastern	0%		
	Southern Highlands	10%	[5%, 15%]	
	Lake	8%	[3%, 13%]	
	Northern	8%	[5%, 12%]	
	Southern	0%		
	Western	17%	[10%, 24%]	
	Zanzibar	0%	[0%, 1%]	
Heifers	Central	3%	[0%, 6%]	0.000
	Eastern	1%	[0%, 2%]	
	Southern Highlands	5%	[3%, 7%]	
	Lake	10%	[5%, 15%]	
	Northern	17%	[12%, 22%]	
	Southern	0%	[0%, 1%]	
	Western	15%	[10%, 21%]	
	Zanzibar	10%	[6%, 13%]	
Male calves	Central	12%	[6%, 17%]	0.000
	Eastern	0%	[0%, 0%]	

	Southern Highlands	10%	[6%, 14%]	
	Lake	11%	[7%, 16%]	
	Northern	24%	[18%, 30%]	
	Southern	1%	[0%, 3%]	
	Western	17%	[11%, 22%]	
	Zanzibar	10%	[6%, 14%]	
Female calves	Central	12%	[7%, 17%]	0.000
	Eastern	1%	[0%, 3%]	
	Southern Highlands	10%	[6%, 15%]	
	Lake	13%	[8%, 17%]	
	Northern	27%	[21%, 34%]	
	Southern	1%	[0%, 3%]	
	Western	20%	[14%, 25%]	
	Zanzibar	9%	[5%, 12%]	
Goats	Central	27%	[17%, 36%]	0.000
	Eastern	7%	[3%, 12%]	
	Southern Highlands	22%	[16%, 27%]	
	Lake	36%	[29%, 44%]	
	Northern	48%	[41%, 56%]	
	Southern	17%	[12%, 21%]	
	Western	43%	[37%, 50%]	
	Zanzibar	9%	[5%, 13%]	
Chickens	Central	65%	[57%, 73%]	0.000
	Eastern	57%	[49%, 65%]	
	Southern Highlands	71%	[66%, 77%]	
	Lake	71%	[64%, 77%]	
	Northern	71%	[64%, 77%]	
	Southern	63%	[58%, 69%]	
	Western	75%	[70%, 81%]	
	Zanzibar	30%	[23%, 37%]	

Mean Number of Animals Owned by Zone				
Animal	Zone	Mean	95% C.I.	Number of Observations
Total Cattle	Central	8.09	[5.39, 10.78]	30
	Eastern	4.44	[1.84, 7.04]	7
	Southern Highlands	6.38	[4.53, 8.24]	78
	Lake	11.05	[7.9, 14.19]	47
	Northern	9.70	[5.76, 13.63]	177
	Southern	4.32	[2.64, 6.01]	13
	Western	16.83	[11.8, 21.85]	93
	Zanzibar	4.42	[3.6, 5.25]	69
Bulls	Central	1.84	[1.45, 2.23]	19
	Eastern	1.00	-	3
	Southern Highlands	2.08	[1.41, 2.76]	32
	Lake	2.54	[1.66, 3.41]	23

	Northern	2.47	[1.77, 3.17]	86
	Southern	0.91	[0.36, 1.46]	6
	Western	3.04	[2.39, 3.7]	73
	Zanzibar	1.64	[1.39, 1.9]	26
Cows	Central	3.36	[2.46, 4.26]	23
	Eastern	2.08	[1.25, 2.91]	7
	Southern Highlands	3.17	[2.34, 3.99]	56
	Lake	4.62	[3.42, 5.82]	43
	Northern	4.84	[2.28, 7.4]	155
	Southern	2.29	[1.61, 2.98]	11
	Western	6.86	[3.85, 9.87]	81
	Zanzibar	2.36	[1.94, 2.78]	60
Steers	Central	2.56	[1.49, 3.63]	19
	Eastern			0
	Southern Highlands	2.69	[2.17, 3.21]	35
	Lake	3.37	[2.51, 4.24]	20
	Northern	3.12	[2.25, 3.99]	33
	Southern			0
	Western	5.09	[3.97, 6.22]	58
	Zanzibar	1.00	-	2
Heifers	Central	1.26	[0.81, 1.71]	4
	Eastern	1.75	[1.28, 2.22]	3
	Southern Highlands	2.54	[0.93, 4.15]	18
	Lake	3.50	[2.52, 4.48]	25
	Northern	2.76	[1.88, 3.64]	65
	Southern	2.28	[-0.14, 4.71]	2
	Western	3.44	[2.33, 4.56]	49
	Zanzibar	1.65	[1.32, 1.98]	28
Male calves	Central	1.93	[1.29, 2.57]	16
	Eastern	1.00	-	1
	Southern Highlands	1.66	[1.02, 2.31]	33
	Lake	1.95	[1.38, 2.51]	29
	Northern	2.32	[1.45, 3.19]	92
	Southern	1.61	[0.52, 2.7]	8
	Western	2.89	[1.92, 3.86]	56
	Zanzibar	1.60	[1.19, 2.01]	30
Female calves	Central	2.35	[1.34, 3.37]	17
	Eastern	1.88	[0.21, 3.55]	4
	Southern Highlands	1.60	[1.14, 2.07]	33
	Lake	1.70	[1.01, 2.39]	31
	Northern	2.60	[1.31, 3.9]	103
	Southern	1.68	[0.02, 3.35]	7
	Western	2.55	[1.73, 3.38]	65
	Zanzibar	1.27	[1.01, 1.54]	25
Goats	Central	7.27	[4.48, 10.07]	37

	Eastern	4.19	[1.9, 6.49]	20
	Southern Highlands	5.45	[4.3, 6.6]	77
	Lake	4.75	[3.59, 5.91]	92
	Northern	9.32	[6.36, 12.27]	181
	Southern	5.19	[3.79, 6.6]	74
	Western	7.78	[5.14, 10.43]	139
	Zanzibar	4.00	[3.23, 4.77]	26
Chickens	Central	15.21	[11.94, 18.49]	89
	Eastern	21.38	[14.61, 28.15]	145
	Southern Highlands	13.99	[12.09, 15.89]	246
	Lake	8.89	[7.15, 10.63]	177
	Northern	12.87	[10.77, 14.98]	260
	Southern	13.61	[9.96, 17.25]	291
	Western	10.78	[8.83, 12.73]	245
	Zanzibar	24.82	[16.61, 33.04]	83

Appendix D Livestock: Disease

Proportion of Households Losing Animals to Disease (of households that own animal)				
Animal	Proportion	95% C.I.		Number of Observations
Bulls	15%	[11%, 19%]		268
Cows	16%	[13%, 20%]		436
Steers	6%	[2%, 10%]		166
Heifers	7%	[3%, 10%]		193
Male calves	14%	[9%, 18%]		263
Female calves	13%	[9%, 17%]		283
Goats	32%	[28%, 36%]		643
Chickens	66%	[63%, 69%]		1533

Mean Number of Animals Lost to Disease (of households that lost animal to disease)				
Animal	Mean	95% C.I.		Number of Observations
Bulls	1.75	[1.32, 2.17]		34
Cows	2.01	[1.53, 2.49]		70
Steers	1.67	[0.55, 2.79]		9
Heifers	1.95	[0.87, 3.03]		13
Male calves	1.91	[1.21, 2.6]		36
Female calves	1.97	[1.25, 2.69]		39
Goats	3.21	[2.75, 3.68]		208
Chickens	12.12	[11.29, 12.94]		1008

Mean Value of Animals Lost to Disease				
Animal	Mean (USD)	95% C.I.		Number of Observations
Bulls	\$299.19	[211, 387]		34
Cows	\$421.01	[295, 547]		70
Steers	\$413.62	[128, 699]		9
Heifers	\$287.47	[101, 474]		13
Male calves	\$123.74	[88, 159]		36
Female calves	\$131.81	[83, 180]		39
Goats	\$54.60	[44, 65]		208
Chickens	\$23.91	[21, 26]		1008

Proportion of Households with Animals Suffering from Disease Types				
Animal	Disease	Proportion	95% C.I.	Number of Observations
Bulls	CBPP	44%	[28%, 61%]	34
	ECF	27%	[11%, 42%]	
	Lumpy Skin Disease	7%	[-1%, 16%]	
Cows	ECF	30%	[18%, 42%]	70
	CBPP	24%	[13%, 36%]	
	Lumpy Skin Disease	10%	[2%, 17%]	
Steers	CBPP	32%	[7%, 57%]	9
	ECF	28%	[-2%, 59%]	
	Anthrax	12%	[-11%, 36%]	
Heifers	CBPP	42%	[13%, 72%]	13
	ECF	26%	[0%, 53%]	
	FMD	13%	[-5%, 31%]	
Male calves	CBPP	33%	[15%, 50%]	36
	ECF	21%	[7%, 35%]	
	FMD	7%	[-2%, 16%]	
Female calves	ECF	33%	[16%, 51%]	39
	CBPP	18%	[5%, 31%]	
	FMD	15%	[3%, 26%]	
Goats	CCPP	36%	[28%, 44%]	208
	Lumpy Skin Disease	10%	[6%, 14%]	
	FMD	6%	[3%, 9%]	
Chickens	Newcastle Disease	77%	[74%, 80%]	1008
	Smallpox	10%	[7%, 13%]	

Appendix E Livestock: Vaccines

Proportion of Households that Vaccinate Animal (of households that own animal)				
Animal	Vaccination	Proportion	95% C.I.	Number of Observations
Bulls	Yes, all animals	50%	[42%, 57%]	268
	Yes, some animals	2%	[0%, 4%]	
	No, none	48%	[41%, 56%]	
Cows	Yes, all animals	48%	[42%, 54%]	436
	Yes, some animals	3%	[1%, 4%]	
	No, none	49%	[43%, 55%]	
Steers	Yes, all animals	47%	[37%, 56%]	165
	Yes, some animals	2%	[0%, 5%]	
	No, none	51%	[42%, 61%]	
Heifers	Yes, all animals	47%	[38%, 56%]	193
	Yes, some animals	2%	[0%, 3%]	
	No, none	52%	[43%, 61%]	
Male calves	Yes, all animals	36%	[28%, 43%]	263
	Yes, some animals	3%	[1%, 6%]	
	No, none	61%	[53%, 68%]	
Female calves	Yes, all animals	34%	[28%, 41%]	283
	Yes, some animals	3%	[1%, 4%]	
	No, none	63%	[56%, 70%]	
Goats	Yes, all animals	15%	[12%, 18%]	643
	Yes, some animals	4%	[2%, 5%]	
	No, none	81%	[78%, 85%]	
Chickens	Yes, all animals	10%	[8%, 12%]	1532
	Yes, some animals	4%	[3%, 5%]	
	No, none	86%	[84%, 88%]	

Proportion of Where Households Vaccinate Animals (of households that vaccinate animal)				
Animal	Location of Vaccination	Proportion	95% C.I.	Number of Observations
Bulls	Private Vet Clinic	19%	[12%, 27%]	130
	District Vet Clinic	53%	[43%, 64%]	
	NGO Project	7%	[2%, 11%]	
	Other	20%	[13%, 28%]	
Cows	Private Vet Clinic	20%	[14%, 26%]	206
	District Vet Clinic	57%	[48%, 65%]	
	NGO Project	6%	[2%, 9%]	
	Other	17%	[11%, 23%]	
Steers	Private Vet Clinic	15%	[6%, 23%]	80
	District Vet Clinic	65%	[53%, 76%]	
	NGO Project	9%	[3%, 15%]	
	Other	12%	[5%, 19%]	
Heifers	Private Vet Clinic	25%	[15%, 36%]	86
	District Vet Clinic	45%	[33%, 58%]	

	NGO Project	11%	[4%, 17%]	
	Other	19%	[9%, 28%]	
Male calves	Private Vet Clinic	24%	[15%, 33%]	98
	District Vet Clinic	58%	[47%, 68%]	
	NGO Project	6%	[1%, 11%]	
	Other	12%	[5%, 19%]	
Female calves	Private Vet Clinic	23%	[15%, 32%]	101
	District Vet Clinic	57%	[47%, 67%]	
	NGO Project	7%	[2%, 12%]	
	Other	12%	[6%, 19%]	
Goats	Private Vet Clinic	25%	[17%, 33%]	119
	District Vet Clinic	43%	[32%, 53%]	
	NGO Project	4%	[0%, 8%]	
	Other	29%	[18%, 39%]	
Chickens	Private Vet Clinic	45%	[37%, 53%]	210
	District Vet Clinic	25%	[18%, 32%]	
	NGO Project	4%	[0%, 7%]	
	Other	26%	[19%, 33%]	

Proportion of Households Vaccinating Against Disease Types				
Animal	Vaccine Type	Proportion	95% C.I.	Number of Observations
Bulls	CBPP	49%	[39%, 59%]	130
	ECF	36%	[28%, 45%]	
	Anthrax	16%	[9%, 23%]	
Cows	CBPP	45%	[36%, 53%]	206
	ECF	36%	[28%, 43%]	
	Anthrax	17%	[11%, 23%]	
Steers	CBPP	53%	[41%, 66%]	80
	ECF	28%	[18%, 39%]	
	Anthrax	16%	[7%, 25%]	
Heifers	CBPP	44%	[34%, 54%]	86
	ECF	36%	[24%, 47%]	
	Anthrax	25%	[15%, 34%]	
Male calves	CBPP	49%	[39%, 60%]	98
	ECF	41%	[30%, 51%]	
	Anthrax	17%	[9%, 25%]	
Female calves	CBPP	52%	[42%, 63%]	101
	ECF	37%	[28%, 47%]	
	Anthrax	18%	[10%, 26%]	
Goats	CCPP	58%	[49%, 67%]	119
	Anthrax	12%	[5%, 19%]	
	Lumpy Skin Disease	11%	[5%, 17%]	
Chickens	Newcastle Disease	90%	[86%, 94%]	210
	Smallpox	12%	[7%, 17%]	

Appendix F Livestock: Theft

Proportion of Households Losing Animals to Theft (of households that own animal)			
Animal	Proportion	95% C.I.	Number of Observations
Bulls	1.7%	[0%, 4%]	268
Cows	1.7%	[0%, 3%]	436
Steers	0.4%	[0%, 1%]	166
Heifers	0.4%	[0%, 1%]	193
Male calves	0.6%	[0%, 2%]	263
Female calves	1.2%	[0%, 2%]	283
Goats	8.0%	[6%, 11%]	643
Chickens	24.3%	[22%, 27%]	1533

Mean Number of Animals Lost to Theft (of households that lost animal to theft)			
Animal	Mean	95% C.I.	Number of Observations
Bulls	1.15	[0.86, 1.44]	4
Cows	2.84	[0.83, 4.85]	6
Steers	2.00	-	1
Heifers	2.00	-	1
Male calves	1.80	[1.35, 2.25]	2
Female calves	1.00	-	3
Goats	2.13	[1.59, 2.68]	51
Chickens	5.57	[4.89, 6.26]	402

Mean Value of Animals Lost to Theft			
Animal	Mean (USD)	95% C.I.	Number of Observations
Bulls	\$253.26	[222, 285]	4
Cows	\$371.37	[273, 469]	5
Steers	\$250.26	-	1
Heifers	\$25.03	-	1
Male calves	\$166.84	-	2
Female calves	\$71.57	[51, 92]	3
Goats	\$50.63	[35, 66]	51
Chickens	\$13.73	[12, 16]	401

Appendix G Livestock: Data Issues

Issue	Description	Number of observations affected	Direction of effect	Magnitude of effect
Possible data entry errors in livestock breed question	1. Bulls listed as “improved dairy” 2. Heifers listed as “improved dairy” 3. Male calves listed as “improved dairy”	1. six observations 2. six observations 3. 14 observations	Increases number of improved dairy cattle	Minimal due to the few number of such observations.
Recall or data entry errors regarding number of animals by breed type	Entries of 99 or 9999 (presumed to be for don’t remember and/or “other”). These observations were recoded as missing so as to avoid skewing the results.	34 observations (across 15 different animal/breed combinations)	Increases mean number of animals due to high values of 99 and 9999.	Despite small number of observations, values of 9999 in particular had a huge impact on the average number of animals per household.
Missing observations for hhid/animal combinations	Not all households had all sixteen observations (one for each animal type). This is presumed to be because they did not have the last animals on the list (eg other) and so the enumerator simply did not fill that line in. These observations were recoded as 0s in order to have the same denominator for all animal types.	17 households	None, as the observations were recoded as 0 to make denominator the same across all animal types.	Minimal as 17 is a small percentage of the total 2482 agricultural households.
Data entry errors in number of animals lost to disease	Several observations where the number of animals lost to disease was far greater (eg by factor of 1000) than the total number of that animal that was owned by the household. These observations were recoded as missing so as to avoid skewing the results.	7 observations (animal level)	Increased the average number of particular animals lost to disease	Despite small number of observations, the values were so large (between 1000 and 5000), that they significantly skewed the average number of animals lost to disease.
Data entry errors in value of animals lost to disease	Some households reported a value but not the actual number lost to disease. These were recoded as missing.	7 observations (household level)	Increased the average value of a particular animal lost to disease	Minimal, due to few number of observations.
Recall or data entry errors regarding what type of diseases a particular animal suffered from over the past 12 months	Entries of 99 (presumed to be for don’t remember and/or “other”). These observations were recoded as missing to avoid skewing the distribution of “type of diseases” suffered by each animal (question S10aq25).	4832 observations (animal and disease levels)		

Lack of clarity regarding response of “not sick” to question on disease type (s10aq25)	In addition to 20 different disease types, respondents could also answer “not sick” to question s10aq25 asking for the disease type suffered by their animals. It is suspected that households could have lost some animals to disease, but not all, they may have responded “not sick” in referring to animals that did not suffer from disease, but listed disease types for those that did suffer. The responses for “not sick” do not equal the responses to question s10aq19 of whether or not a household lost an animal to disease.	2951 observations (animal level)		None, since responses of “not sick” were not analyzed. Whether or not animals were lost to disease was reported at the household level, not the animal level.
Data entry error	S10aq26 is coded as 1=yes all, 2=yes some, 3=no. One observation is coded as “9” and is presumed to missing.	1 observation		Minimal.
Data entry error with 99s in type of vaccine administered	Several observations of missing are coded as 99 and others are coded as “.”; all missing data is standardized and coded as “.”	1242 observations (animal level)		
Survey error	CCPP is listed twice as an option for “what kind of disease did [animal] suffer in the past 12 months?” (s10aq25 questions 1-4, ==4 or ==18)	144 observations of CCPP in total, only 2 coded as s10aq25==18	N/A	N/A, recoded so all observations of CCPP are captured in one variable

Appendix H By-Products: Basic Descriptives

Proportion of Agricultural Households Producing By-Products (n=2482)			
By-product	Proportion	95% C.I.	
Cow Milk (traditional)	13.3%	[11%, 15%]	
Cow Milk (improved)	2.2%	[1%, 3%]	
Eggs (traditional)	52.4%	[50%, 55%]	
Eggs (improved)	0.5%	[0%, 1%]	
Skins and hides	5.3%	[4%, 7%]	

Mean Quantity Produced per Month (of households that produce by-product)				
By-product	Mean	95% C.I.		Number of Observations
Cow Milk (traditional); litres	231	[113, 349]		277
Cow Milk (improved); litres	209	[139, 279]		51
Eggs (traditional); pieces	51	[45, 57]		1119
Eggs (improved); pieces	494	[-32, 1020]		14
Skins and hides; pieces	2	[1, 2]		77

Proportion of Households that Sell By-Product (of households producing by-product)				
By-product	Proportion	95% C.I.		Number of Observations
Cow Milk (traditional)	20.7%	[15%, 26%]		276
Cow Milk (improved)	55.7%	[38%, 73%]		51
Eggs (traditional)	12.6%	[10%, 15%]		1119
Eggs (improved)	24.5%	[2%, 47%]		14
Skins and hides	56.2%	[45%, 67%]		96

Mean Value of Sales Over Past Year (of households selling by-product)				
By-product	Mean (USD)	95% C.I.		Number of Observations
Cow Milk (traditional)	\$316.14	[196, 437]		64
Cow Milk (improved)	\$589.18	[294, 885]		32
Eggs (traditional)	\$12.74	[9, 17]		143
Eggs (improved)	\$1,717.61	[-311, 3746]		5
Skins and hides	\$4.04	[1, 7]		54

Appendix I By-Products: Male- versus Female-Headed Households

Proportion of Agricultural Households Producing By-Products, by Head of Household (n=2482) (male-headed n=1883; female-headed n=599)					
By-product	Head of Household	Proportion	95% C.I.	Wald test P-value	
Cow Milk (traditional)	Male	14.7%	[12%, 17%]	0.002	
	Female	9.0%	[6%, 12%]		
Cow Milk (improved)	Male	2.2%	[1%, 3%]	0.896	
	Female	2.3%	[1%, 4%]		
Eggs (traditional)	Male	54.8%	[52%, 58%]	0.001	
	Female	45.1%	[40%, 50%]		
Eggs (improved)	Male	0.5%	[0%, 1%]	0.941	
	Female	0.5%	[0%, 1%]		
Skins and hides	Male	5.6%	[4%, 7%]	0.229	
	Female	4.2%	[2%, 6%]		

Mean Quantity Produced per Month (of households that produce by-product)					
By-product	Head of Household	Mean	95% C.I.	Number of Observations	Wald test P-value
Cow Milk (traditional); litres	Male	187	[145, 230]	229	0.450
	Female	445	[-224, 1114]	48	
Cow Milk (improved); litres	Male	220	[149, 291]	38	0.526
	Female	178	[49, 306]	13	
Eggs (traditional); pieces	Male	54	[48, 60]	890	0.001
	Female	40	[32, 48]	235	
Eggs (improved); pieces	Male	630	[7, 1253]	11	0.057
	Female	30	[-3, 63]	3	
Skins and hides; pieces	Male	2	[1, 2]	63	0.760
	Female	2	[1, 3]	14	

Appendix J By-Products: Across Zones

Proportion of Agricultural Households Producing By-Products, by Zone					
Animal	Zone	Proportion	95% C.I.	Number of Observations	Wald test P-value
Cow Milk (traditional)	Central	11.0%	[7%, 15%]	15/136	0.000
	Eastern	0.4%	[0%, 1%]	1/308	
	Southern Highlands	10.4%	[5%, 15%]	34/350	
	Lake	13.2%	[7%, 19%]	32/253	
	Northern	27.8%	[21%, 35%]	106/367	
	Southern	1.5%	[0%, 3%]	7/461	
	Western	20.1%	[14%, 27%]	67/324	
	Zanzibar	6.6%	[4%, 10%]	18/283	
Cow Milk (improved)	Central	0.6%	[-1%, 2%]	1/136	0.000
	Eastern	1.7%	[0%, 3%]	6/308	
	Southern Highlands	1.5%	[0%, 3%]	5/350	
	Lake	0		0/253	
	Northern	8.5%	[4%, 13%]	30/367	
	Southern	0.2%	[0%, 1%]	1/461	
	Western	1.1%	[0%, 2%]	3/324	
	Zanzibar	1.8%	[0%, 4%]	6/283	
Eggs (traditional)	Central	37.5%	[26%, 49%]	50/136	0.000
	Eastern	47.3%	[39%, 55%]	116/308	
	Southern Highlands	56.7%	[51%, 63%]	197/350	
	Lake	61.2%	[54%, 69%]	153/253	
	Northern	54.1%	[47%, 61%]	200/367	
	Southern	51.9%	[46%, 58%]	235/461	
	Western	56.9%	[49%, 65%]	179/324	
	Zanzibar	1.0%	[0%, 2%]	4/283	
Eggs (improved)	Central	0		0/136	0.055
	Eastern	1.0%	[0%, 2%]	3/308	
	Southern Highlands	0.6%	[0%, 1%]	2/350	
	Lake	0		0/253	
	Northern	1.2%	[0%, 3%]	4/367	
	Southern	0.4%	[0%, 1%]	3/461	
	Western	0		0/324	
	Zanzibar	0.9%	[0%, 2%]	3/283	
Skins and hides	Central	0.8%	[-1%, 2%]	1/136	0.000
	Eastern	0		0/308	
	Southern Highlands	0.5%	[0%, 1%]	2/350	
	Lake	10.1%	[6%, 15%]	24/253	
	Northern	7.9%	[5%, 10%]	29/367	
	Southern	0.3%	[0%, 1%]	1/461	
	Western	12.8%	[8%, 18%]	39/324	
	Zanzibar	0		0/283	

Appendix K By-Products: Data Issues

Issue	Description	Number of observations affected	Direction of effect	Magnitude of effect
Missing observations for hhid/livestock by-product combinations	One household had a negative response for whether or not they had cow milk (traditional), but missing data for the remaining eight by-product categories. These observations were recoded as 0s in order to have the same denominator for all animal types.	1 household	None, as the observations were recoded as 0 to make denominator the same across all animal types.	Minimal as 1 is a small percentage of the total 2479 agricultural households.
Observations greater than 12 for number of months by-product was produced (s10bq2)	In response to the question of how many months during the past year did the household produce the by-product, there were 48 (of 1636 observations) that were greater than 12. These were re-coded as 12.	48 observations (by-product level)	Would increase the average number of months during which a household produces by-products.	
Possible data entry errors for units of measurement (s10aq3_meat)	Some by-products were coded in more than one unit of measurement. For example, eggs (traditional) were coded as pieces (1126 observations), litres (2 obs) and kilograms (6 obs). Because of the data given for unit in question s10bq5 (how much was sold), the 2 observations for litres were recoded as pieces. While eggs could be coded as kilograms, these observations were improbably high given the number of chickens owned by the household, so were dropped.	32 observations (by-product level)	Unknown	Not overly significant as 32 is a relatively small portion, but nonetheless some of the 32 were dropped from analysis.
Possible data entry errors for quantity produced and/or sold	In 17 cases the quantity of a by-product sold was greater than the quantity produced of that by-product. The difference made in eliminating these observations was insignificant, so they were left in to avoid further decreasing the overall number of observations being analyzed.	17 observations (by-product level)	Varied depending on the by-product	Minimal – none of the mean values for quantity produced were significantly impacted by removing those observations for which quantity sold was greater.
Extreme outliers for quantity produced	The quantity produced (s10bq3_meas) was examined for extreme outliers. The data set was merged with data set 10a in order to calculate a quantity/per animal produced and eliminate improbable outliers. By	14 observations – 3 cow milk (trad) 1 cow milk (imp) 9 eggs (trad)	Overestimated quantity produced	Significant – cow milk (trad) dropped from 489 L/month to 231; Cow milk (imp) dropped from

	eliminating 3 of 280 observations for cow milk (trad), the mean dropped from 489L/month to 231L/month.	1 eggs (imp)		272 L./month to 209; Eggs (trad) dropped from 59 eggs/month to 51; Eggs (imp) dropped from 951 eggs/month to 494.
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