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FACTORS AFFECTING THE ECONOMIC LOSSES DUE TO LIVESTOCK DISEASES: A CASE STUDY OF DISTRICT FAISALABAD

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There are several issues limiting the expansion of livestock sector of Pakistan, and depriving farmers of their dairy incomes. Livestock diseases is one factor which get scant policy attention. The present paper attempts to investigate important factors which affect the economic losses due to livestock diseases. The study was conducted in five Tehsils of district Faisalabad using primary data collected from 150 livestock farmers. A log-linear regression model was fitted to delineate the factors influencing economic losses due to livestock diseases. The results revealed that number of affected animals at a farm, number of days of illness of an animal, nutrition cost, vaccination cost, and occurrence of Foot and Mouth Disease are important variables which influence the economic losses due to diseases. Number of affected animals, longevity of disease period, and occurrence of FMD in particular increase the economic losses while expenditures on nutrition and vaccination reduce economic losses. Carefully designed policy options which take into account above mentioned variable may improve the performance of livestock sector.

Keywords: Economic losses, livestock diseases, log-linear regression model, cattles

INTRODUCTION

Livestock, as a subsector of agriculture, plays a vital role in the development of economy of the country. The sector has 55.91 percent share in the agriculture value added, 11.8 percent in national GDP, and grew by 3.99 percent in 2013-14 (GoP, 2014). Livestock is the primary activity, along with the crop husbandry, in rural areas of country. Almost 33-36 million people are directly and/or indirectly connected with the livestock sector. Most farm families have 2-3 cattle or buffaloes and 5-6 sheep and goats; 20-25 percent of their income is obtained from these animals (Bilal, 2004).

Punjab is plays an important role in the economy of Pakistan due to its flourishing agricultural sector. Agriculture contributes about 28 percent in the GDP of the province, and employs 44 percent of the province's population. About 75 percent of Punjab's population is involved in some way in the livestock sector, which is not surprising because small ruminants and animals have become a part of the household's food basket. Animals are also secure source of income for the cash starved farmers to finance their emergency expenditures (PDP, 2009). So, this sector is critically important for the well-being of majority of households in rural Punjab. About 73% of the country's milk production comes from Punjab, while Sindh contributes about 23 percent; the rest comes from various other provinces (Hashami *et al*., 2007).

About 50% of world's animal population is residing in Asia. There are many factors which make the future of livestock products decisive. Defectively designed animals breeding strategies, existence of trans-boundary diseases, and poor veterinary services are some of the factors threatening the livestock production in coming years (Bosan, 2003).

At present, most of the farmers in Punjab are rearing their animals both for home consumption and commercial use. Mixed farming is practiced commonly in Punjab. Almost every farmer practices crop agriculture activities along with dairy farming. For small farmers, livestock is the main source of traction, store of wealth, organic manure, and means of transport.

Although Pakistan is a principal milk producer in the world, it is still importing milk to fulfill domestic demand. The value of imported milk, and its related products, was $134.4 million in 2011-12 and $112.4 million in 2012-13 (GoP, 2013). For various reasons, a high portion of milk produced is used at the farm level and does not enter the dairy industry (Burki *et al*., 2005). About 55 percent of milk is consumed fresh.

The population of Pakistan is increasing significantly. It is increasing at the rate of 1.57 percent annually; higher than China and India (0.49 and 1.34 percent respectively) (CIA, 2011). The population is increasing faster than the rate of milk production. Production of milk does not meet the per capita milk demand of 176.3 liter per person per year (Saleem and Ashfaq, 2009). Increasing demand for food, coupled with the deficient per capita availability of milk and meat, has put stress on the prices of these goods. The higher prices of dairy products hurt the consumers and their per capita food consumption.

There are many factors inhibiting the growth of livestock sector of Pakistan. These factors range from policy issues to ground level realities including rapid deterioration of

rangelands, poor nutrition practices, poor marketing systems, inadequacy of extension services, and insufficient resources. Losses due to livestock diseases are one cause of low milk production and farm incomes. There are many fatal diseases in Pakistan including Foot and Mouth Disease (FMD), Hemorrhagic Septicemia (HS), Bovine Viral Diarrhea (BVD) and black quarter. Farmers do not regularly vaccinate their animals against these fatal diseases regularly which lower dairy production. Every third cow/buffalo suffers from mastitis, greatly contributing to loss of milk production. Parasites such as ticks are also lowering the production of the sector (Saleem and Ashfaq, 2009).

The consequences of livestock diseases are generally seen as direct impacts only but, in reality, they can be quite complex. The diseases affect the productivity of animals and deprive the farmers of dairy earnings. Morbidity due to diseases is responsible for short term, and long term, product losses. These losses are economically more important than as compared to mortality (Husnain and Usmani, 2006). Livestock diseases also cause the loss of income from other activities which require the use of animals, such as, farming, transportation, and tourism etc. The welfare losses related to animal diseases are caused due to suboptimal use of scarce resources in the instance of diseases.

Within this background, the present study examines four different diseases with an aim to investigate the factors affecting the economic losses caused by these diseases. The main focus of the study in on the diseases mastitis, Parturient Hemoglobinuria, FMD and tick infestation. The results of studies conducted in Pakistan, and in other countries, show that diseases selected in current study have important economic consequences. In the United States, an annual loss of $1 billion is caused to dairy industry by subclinical mastitis, which is the most economically important type of mastitis because of its chronic effects (Ott, 1999). An annual loss of $35 billion is caused by this disease globally (Ratafia, 1987). Nine percent of total mortality in buffaloes in Pakistan, and five percent of total mortality in cows, is due to Parturient Hemoglobinuria. This disease causes an estimated annual loss of Rs. 490.2 million in buffaloes and Rs. 153.1 million in cows in Punjab province (DPE, 1996).). Due to the severity of its economic impacts, and the nature of the virus, FMD is also the most important disease which affects the trade of animals and related products throughout the world (Arzt *et al*., 2011a,b). The economic losses caused by ticks and tick-borne diseases are estimated to have an annual value of as much as $18 billion (deCastro, 1997). In Brazil alone, cattle ticks cause annual losses as high as $2 billion (Grisi *et al*., 2002). The annual losses caused by external parasites to the US beef cattle industry amount to $2.4 billion (Tolleson *et al*., 2007)

MATERIAL AND METHODS

***Selection of the study area, sample size, and data collection*:** The study was conducted in district Faisalabad. It is a mixed cropping zone where wheat, rice, cotton, sugarcane, and maize are all grown. All types of fodder varieties are also cultivated as animal feed. The population of cattle and buffaloes in district Faisalabad is 461 thousands and 1148 thousands, respectively (PBS, 2006).

All five *tehsils* of the district were selected for survey. From each *tehsil,* three villages were selected at random. After that, 10 livestock farmers were selected randomly from each village. Following this technique, a total of 150 livestock farmers were included in the final sample (Table 1). As it was observed that farming activities are similar in other localities of the district; therefore, it was assumed that the results could be generalized for the whole district.

Random sampling was used because in random sampling, the nature of population is defined and all members have an equal chance of selection (Marshall, 1996). In this way, probability of obtaining biased data can be minimized.

Table 1. Name of *tehsils* and villages included in the study.

Tehsil names	Village names/Number	No. of respondents
Faisalabad	Gaffaabad	10
	Gharee	10
	Chakaira	10
Samundri	Laadian/213G.B.	10
	GujarPind/217G.B.	10
	Bhulpar	10
Tandlianwala	456G.B.	10
	Paareeh	10
	Kanjwaani/541G.B.	10
Jaranwala	Ambalian	10
	RodalaaMandi	10
	28G.B.	10
ChakJhumra	KamalPur/133R.B.	10
	ChootiKaraari/190R.B.	10
	SultanNaghar	10
Total		150

Data was collected through structured questionnaires which were modified after pre-testing in the field. The farmers' response was then transferred to computer programs (Microsoft Excel, SPSS), and the livestock farmers were categorized into three groups, small, medium, and large livestock farmers, before starting the analysis. Livestock farmers having 1-3, 4-6, and greater than 6 adult dairy animals are considered small, medium, and large livestock farmers, respectively, with an assumption that these animals affect overall farm production levels. Moaeen and Babar, 2006 used a similar basis to categorize livestock farmers.

***Factors affecting the economic losses due to diseases*:** A Log-linear model of the following form was fitted to study the factors influencing economic losses per affected farm. One attractive feature of a log-linear model is that the slope coefficients ('s) measure the elasticity of *Y* with respect to *X's* (Gujrati, 2003). The specific form of the model used is given below:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_1 D_1 + \varepsilon$$

Independent variables

X_1 = livestock farming experience

X_2 = Years of Schooling

X_3 = No. of animals affected by the disease

X_4 = No. of days of illness

X_5 = Nutrition cost (Rs.)

X_6 = Vaccination cost (Rs.)

D_1 = 1 for FMD, 0 otherwise

β_0 is constant, 's are elasticity measures i.e. percentage change in *Y* with respect to percentage change in *X,* and ε is the random error.Senthilkumar and Thirunavukkarasu (2010) also found similar type of variables affecting the economic losses.

RESULTS AND DISCUSSION

***Socioeconomic characteristics of livestock farmers*:** Table 2 provides the summary of socioeconomic characteristics of the respondents. The farmers in the study area are about42 years old with an average farming experience of about 18 years. Education level of the farmers is generally low in study area; on average they have 6.71 years of regular schooling. The family size of respondents is proportional to farm size, which is an interesting finding. This is due to increased percentage of farm households living in extended families as farm size increases.

Table 2. Socioeconomic characteristics of respondents.

General information	Farm Size Groups			
	Small farmers	Medium farmers	Large farmers	Overall
Age	42.38	42.94	40.81	42.07
Livestock Farming Experience	18.97	19.00	18.50	18.85
Schooling Years	6.54	7.47	6.36	6.71
Family Members	7.74	9.19	11.29	9.08

Characteristics of Livestock Farms:

***Number of farms in the sample*:** Livestock farmers are categorized as small, medium, and large farmers, depending upon the number of adult livestock heads they own (Table 3). Almost half of the farmers in the sample are small farmers while medium and large farmers each constitute about one fourth of the total sample. The selection of farmers was random, and the fact that most of the selected farmers are small illustrates that majority of the livestock farming community in the area consist of small farmers.

Table 3. Number of farms in the sample.

Farmer's categories	Frequency	Percentage
Small Farmers	72.00	48.00
Medium Farmers	36.00	24.00
Large Farmers	42.00	28.00
Total	150.00	100.00

***Animal's inventory of the respondents*:** Table 4 shows average numbers of the animals kept by livestock farmers. The farm size categories were determined number of adult buffaloes and adult cows; other animals are included for more context. The average numbers of adult buffaloes are 5.79 and average number of adult cows was 1.95. Khan and Usmani (2005) also found similar average number of adult buffaloes (4.2) and cattle (1.7) kept by livestock farmers of NWFP (currently KPK) province of Pakistan. The numbers of animals at large farms are higher; a natural outcome.

Table 4. Animal inventory of livestock farmers.

Animals	Farm size groups			
	Small farmers	Medium farmers	Large farmers	Overall
Adult Buffalos	1.31	3.53	15.40	5.79
Adult Cows	0.64	1.47	4.62	1.95
Adult Goats	0.92	1.89	3.60	2.45
Heifer Buffalos	0.69	1.56	3.69	1.74
Heifer Cows	0.29	0.69	1.93	0.85
Young Goats	0.08	0.50	1.44	1.07
Bulls	0.57	1.11	1.19	0.87
Calves	1.28	2.92	9.48	3.97
Buck	0.35	0.67	1.26	0.68

***Lactation period of animals*:** Table 5 reveals the average lactation periods of buffaloes and cows are about 234 days and 257 days, respectively. It is observed that the lactation period of the cows was high as compared to the buffaloes which could make them more productive animals. Afzal *et al.* (2005) found that the average lactation length of Nili-Ravi buffaloes was 178±49 days in herd of Nili-Ravi buffaloes maintained at Livestock Research Station of National Agricultural Research Center, Islamabad.

***Source of breeding service*:** The type of breeding is very important in terms of having more productive animals with superior genetic potential. Table 6 shows that the farmers are doing artificial insemination more often in cows (about 58%) as compared to buffaloes (about 12 percent). This difference could be attributed to easy availability of sire of buffaloes, and farmers' perception about artificial insemination being more useful for cows than buffaloes, in terms of milk productivity. The farmers are also doing artificial

insemination in cows for taking a good quality bull which could be used for sporting activities. Across different farm sizes, small farmers are mostly found to be opting for natural insemination in cows which could be due to their lack of interest in artificial insemination, and also because artificial insemination is an expensive method. Small farmers are found to inseminate their animals through bulls which are available for them at free of cost from neighbors or friends.

Table 5. Milking period of animals.

Animals	Farm Size Groups			
	Small farmers	Medium farmers	Large farmers	Overall
Buffalo	232.89	233.33	236.43	234.11
Cow	259.69	246.88	260.57	256.65

Table 6. Source of breeding services.

Source	Farm Size Groups			
	Small farmers	Medium farmers	Large farmers	overall
Buffaloes				
Artificial	10.91	13.72	9.09	11.72
Natural	89.09	86.28	90.91	88.28
Cows				
Artificial	43.33	64.1	68.42	57.95
Natural	56.67	35.9	31.58	42.05

***Drinking water source for animals*:** Table 7 shows that most of the farmers are using motor pump as a water source for their animals. In farm size comparison, more large farmers were using motor pumps as a water source than other farm size groups. A high percentage of small farmers (about 29 percent) are using hand pumps for watering their animals, as compared to other farm size groups. This could be due to subsistence nature of small livestock farms, as they seldom manage to acquire the necessary capital for such equipment.

Table 7. Drinking water source for animals(Percent).

Water source	Farm size groups			
	Small farmers	Medium farmers	Large farmers	overall
Canal	0.00	5.26	0.00	2.01
Hand pump	28.57	14.04	22.73	22.15
Motor pump	48.57	50.00	57.89	52.35
Canal + Motor pump	8.57	14.04	13.64	11.41
Water course / Tube well	14.29	8.77	13.64	12.08

***Area of animal farms*:** Table 8 reveals that the average area of the animal farms is about 21 *Marlas*. In farm size comparison, large farmers have a farm size of about 38 *Marlas* which is comparatively higher than small and medium farmers. This could be due to more space needed for higher number of animals.

Table 8.Area of animal farms(Marla).

	Farm size groups			
	Small farmers	Medium farmers	Large farmers	Overall
Area	9.54	21.96	38.13	20.60

***Factors affecting the economic losses due to diseases*:** A log linear regression model was fitted using the possible predisposing factors to explain the variations in economic losses due to livestock diseases. The relationship between dependent variable (economic losses in Rupees) and independent variables (framing experience, schooling, number of affected animals, numbers of days of illness, nutrition cost, vaccination cost, and dummy for FMD) was estimated by using the log linear model; suggested by scatter diagram of dependent variable and all independent variables.

Regression results (Table 9) show that the number of affected animals, number of days of illness, nutrition cost, and vaccination cost are the significant factors affecting the economic losses due to diseases.

Table 9. Regression coefficients of Log-linear model used to analyze factors affecting economic losses due to diseases.

Variables	Coeff-icients	Std. Error	t-value	p-value
(Constant)	10.286	1.519	6.773	0.000
Ln (Farming Experience in years)	0.189	0.256	0.739	0.462
Ln(Schooling in years)	-0.101	0.138	-0.732	0.466
Ln No. of affected animals	0.656	0.187	3.501	0.001
Ln Days of illness	0.238	0.124	1.923	0.058
Ln (Nutrition cost in Rs.)	-0.183	0.084	-2.174	0.032
Ln(Vaccination cost in Rs)	-0.217	0.086	-2.527	0.013
FMD dummy	0.569	0.316	1.798	0.076
R^2		0.369		
Adjusted R^2		0.320		
F-Value		7.512		

Dependent variable: Ln (Economic Losses in Rs.)

The coefficient of farming experience is positive; implying that farmers with more farming experience (or aged farmers) have to bear more economic losses. This could be due to the reason that old farmers become somewhat careless, and they are reluctant to use modern methods of disease control. It

was observed during the field survey that using traditional methods of disease control was a common practice in the area. This includes giving spices for treating mastitis, and trotting animals in hot sand for curing the diseases. Although important, ye this coefficient was not statistically significant. Years schooling has a negative impact on losses implying that investing in farmers' education could reduce disease related losses. However, the schooling coefficient was not statistically significant.

The coefficient of number of affected animals is positively significant which implies that economic losses are proportional to scale of farming. The number of days of illness also tends to increase the economic losses as its coefficient is positive and statistically significant. Senthilkumar and Thirunavukkarasu (2010) also found these two variables causing significant economic losses.

Nutrition cost has a significant negative impact on economic losses due to diseases. This implies that spending more on animal nutrition reduces the economic losses due to disease. This could be due to the fact that well-fed animals are less likely to contract a disease there by decreasing economic losses due to disease. FAO (2002) also argues that endemic diseases and poor nutrition are intimately linked.

The cost of vaccination is found to have a negative impact on economic losses. The higher vaccination cost implies a higher frequency of vaccination to their animals which could reduce the incidence of diseases; decreasing their economic losses. Vaccination cost per animal was almost similar for all farmers in the area; therefore, higher vaccination cost per farm means more coverage. Ruegg (2001) also concluded that the preventive measures (vaccination) were more cost effective than treatment of the disease, and it also decreases the economic losses.

The presence of FMD disease in livestock herds shows a significant positive impact on economic losses due to diseases. This could imply that FMD is the most damaging disease in the area, contributing to economic losses. Ashfaq *et al.* (2014) also found that FMD was economically most important disease contributing to economic losses.

The adequacy of model is determined by looking at R^2 and F-value; both are statistically significant (Gujrati, 2003).

***Conclusions and recommendations*:** This study attempts to estimate the impact of various factors on economic losses due to livestock diseases. The socioeconomic characteristics of sample respondents revealed that livestock farming is mainly characterized by small farmers in the area. These farmers lack in education, and the very fact could determine attitude of farmers toward livestock diseases and their treatment. The breeding practices are found to be carried out in traditional way for buffaloes, as most of the farmers are breeding their buffaloes through bulls. The factors such as number of affected animals at a farm, longevity of illness period, nutrition cost, vaccination cost, and dummy for FMD are significantly affecting economic losses due to livestock diseases.

Keeping in view the findings of our study, it is suggested that farmers should be educated about economic importance of livestock diseases. This increased awareness among farmers could motivate them to provide better veterinary care services to their animals, and avoid the economic losses As the higher number of affected animals at farms increase economic losses due to diseases, affected animals should be separated from the herd as some of the diseases are contagious, and other animals may catch them. The affected animals should be provided with specialized veterinary care, as the longevity of disease leads to higher economic losses. Expenditures on nutrition and vaccination reduce economic losses, therefore these aspects could be targeted in the new livestock policy paradigm. FMD, which is also a fatal disease, might be given extra importance in the livestock disease control measures. A good balance of policy options in the light of these results might help in strengthening the livestock sector by reducing the disease related losses.

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