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*Research Note*

## **Structural Growth and Development of Livestock Sector in North-Eastern Karnataka – An Economic Analysis<sup>§</sup>**

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### **Abstract**

The growth trends in the livestock sector have been analyzed for Karnataka's four divisions, viz. Gulbarga, Belgaum, Mysore and Bangalore, by using livestock census data of the state for the years 1977, 1983, 1990, 1997, 2003 and 2007. To explore the factors determining the growth of livestock sector, the Cobb Douglas function has been fitted. To study production of milk, meat and eggs in the state, data have been collected for the period 1995-96 to 2011-12. The cattle and buffalo population has depicted a declining trend, which in turn has affected production of milk, beef and carabeef in the state. The study has observed that poultry population and adoption of improved hen for egg production have tremendously increased across all the divisions in the state. The growth in the population of goat and sheep has been meagre. The production of pork has been highest, while mutton and chevon production has registered a dismal growth. The factors identified to limit the growth of livestock sector in the state include shortage of feed and fodder, inadequate breeding and reproduction, inadequate healthcare centres, poor public expenditure, poor flow of credit and lack of livestock insurance. The study has suggested some policy implications also.

**Key words:** Livestock population, meat production, milk production, Cobb Douglas function, Karnataka

**JEL Classification:** Q01, Q10, Q18, R11

### **Introduction**

Today, the economic contribution of livestock sector is more than of crop and fisheries sector. In 2010-11, livestock generated outputs worth ₹ 3,40,500 crore (current prices) which accounted for 26 per cent of the agricultural GDP and five per cent of the national GDP (Mahapatra, 2012). The livestock sector registered a growth of 3.6 per cent which was 1.5-times higher than of the crop sector. The consumption of livestock

products such as milk, eggs and meat, is increasing in the country due to rise in income of rural and urban population. The milk production which hovered around 20 Mt in 1960s, increased to 128 Mt in 2011-12. Between 1980-81 and 2011-12, the egg production has increased from 10 billion to 66.5 billion and meat production from 0.1 Mt to 5.51 Mt

Livestock is an important source of income for smallholders and the landless households. Evidence shows that smallholders obtain nearly half of their income from livestock (Shukla and Brahmankar, 1999; Birthal *et al.*, 2006). The animals are important natural assets for the poor and can be easily liquidated for cash during emergency. Almost 67 per cent of small and marginal and landless farmers together control 70 per cent of the country's livestock market and are capable

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§ The paper is based on M.Sc. thesis entitled "Structural growth and development of agricultural sector in North-Eastern Karnataka — An economic analysis" submitted by the first author to the University of Agricultural Sciences, Raichur, Karnataka, in June 2013

of producing at lower cost because of availability of sufficient labour with them. With this backdrop, the present study was undertaken to analyze the growth trends in the livestock sector in north-eastern Karnataka in relation to other regions of the state. It has also identified the factors that determine the growth and development of livestock sector in the region. The study is likely to help in developing appropriate measures for enhancing the growth of livestock sector in the region on a sustainable basis.

### Methodology

For the study, Karnataka state was divided into four divisions, Gulbarga, Belgaum, Mysore and Bangalore. In Gulbarga division, the districts selected for the study were: Bidar, Gulbarga, Raichur, Koppal and Bellary. The livestock population data were obtained from Livestock Censuses of Karnataka state for six years, viz. 1977, 1983, 1990, 1997, 2003 and 2007. The livestock production data on milk, meat and eggs were collected for a period of 17 years (1995-96 to 2011-12). The livestock sector was studied at three sub-periods, viz. Period I (1995-96 to 2000-01), Period II (2001-02 to 2011-12) and Overall Period (1995-96 to 2011-12).

The growth trends in livestock sector were analyzed by computing the inter census percentage growth over the previous census. To explore the factors determining the growth of livestock sector, the Cobb Douglas production function in the following form was used:

$$\ln Y = \ln a + a_1 \ln X_1 + a_2 \ln X_2 + \dots + a_8 \ln X_8 + U$$

where, Y denotes production of livestock (meat, milk or egg);  $X_1, \dots, X_8$ , are variables;  $a_1, a_2, \dots, a_8$  are the respective partial regression coefficients; and U is the random error-term.

The variables for the different sectors are presented below:

#### Meat Production

Y = Meat production (tonnes)

$X_1$  = Number of veterinary institutions ('00)

$X_2$  = Area under permanent pastures & grazing lands (ha)

$X_3$  = Total institutional credit to agriculture & allied sector (lakh ₹)

$X_4$  = Area under cereals (ha)

$X_5$  = Number of registered slaughter houses ('00)

$X_6$  = Total animals slaughtered (No. in lakhs)

#### Milk Production

Y = Milk production (tonnes)

$X_1$  = Rainfall (mm)

$X_2$  = Area under permanent pastures & grazing lands (ha)

$X_3$  = Total institutional credit to agriculture & allied sectors (lakh ₹)

$X_4$  = Area under cereals (ha)

$X_5$  = Number of crossbred cows ('00)

$X_6$  = Number of female buffalos ('00)

$X_7$  = Number of artificial insemination centres ('00)

#### Egg Production

Y = Egg production (tonnes)

$X_1$  = Number of layers (No. in lakh)

$X_2$  = Number of veterinary institution ('00)

$X_3$  = Total institutional credit to agriculture & allied sector (lakh ₹)

$X_4$  = Maize production ('000 kg)

$X_5$  = Poultry birds vaccinated ('000)

$X_6$  = Number of regulated markets ('00).

### Results and Discussion

#### Trends in Livestock Population and Production of Milk, Meat and Eggs

The inter-census percentage growth in livestock population is presented in Table 1. A perusal of Table 1 revealed that poultry population exhibited a tremendous and consistently- rising growth across different divisions during the six censuses. Across different divisions, the Gulbarga division registered the highest growth in poultry population — 45.9 per cent during period I (1977-83), 41.9 per cent during period II (1983-90), 109.7 per cent during period III (1990-97), 50.2 per cent during period IV (1997-03) and 52.4 per cent during period V (2003-07). The growth trends for cattle and buffaloes population showed a positive but declining trend. These results are in agreement with the findings of Selvakumar (1996), Birthal *et al.* (2006),

and Jabir (2007). The declining trend in cattle population was the result of non-availability of fodder due to persistent occurrence of droughts, deterioration of grazing lands and reduction in cultivable lands, high cost of maintenance of bullocks and increased farm mechanization in the state. Division-wise, the growth in goat and sheep population showed a declining trend across the different censuses. In Gulbarga division, goat population registered a growth of -13.9 per cent during period II and -8.1 per cent during period IV, while sheep population grew at the rate of 6.2 per cent during period II and -6.9 per cent during period IV (Table 1).

The growth rates in milk and egg production division-wise as well as across the state are presented in Table 2. Milk production in the state was highest (7.1%) during period I (1995-96 to 2000-01). However, it tremendously declined to 0.6 per cent per annum during period II (2001-02 to 2011-12). A similar trend has been observed across all the divisions, except the Mysore division which showed an improvement in milk production. The impressive growth in milk production during period I could be attributed to the extended effects of large-scale implementation of Operation Flood programme in phase III, from 1985 to 1996. However, several droughts experienced in the state in the latter period had a negative impact on the growth of milk production. Cows' milk production exhibited a better growth than of buffaloes across the divisions and the state as a whole. During the entire study period (1995-96 to 2011-12), cow milk production registered a significant growth rate of 2.8 per cent per annum while buffalo milk production registered a growth of -0.8 per cent. This was the result of improvement in the breed of cattle through cross breeding with exotic germplasm such as Friesian.

At the state level (Table 2), the egg production was higher of improved hens (6.9%) than desi hens (-3.7%) for the overall study period (1995-96 to 2011-12). The Gulbarga division registered the highest growth in egg production of improved hens (13.7%) as well as in total egg production (11.78%). A similar trend in egg production was observed across the other divisions.

The growth rates in meat production of different livestock division-wise as well as across the state are presented in Table 3. At the state level, pork production registered the highest growth (8.07%), followed by beef (1.87%) and mutton (1.83%), while only marginal growth was registered for chevon (0.74%) production

**Table 1. Division-wise inter-Livestock Censuses change in livestock population in Karnataka**

Live-stock	(Percentage change)																																							
	Gulbarga division								Belgaum division								Mysore division								Bangalore division								Karnataka state							
	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V	Per-iod I	Per-iod II	Per-iod III	Per-iod IV	Per-iod V										
Cattle	30.9	-5.1	2.3	-6.8	9.1	3.1	-8.3	3.2	-9.7	13.2	-12.2	11.5	3.2	-9.3	9.7	4.5	-12.7	13.7	-17.5	6.5	10.4	-9.9	6.4	-11.4	9.4															
Buffalo	27.8	18.2	9.7	-1.4	11.1	6.95	10.6	14.9	-1.4	18.9	7.84	10.6	-10.2	-17.8	-9.0	10.6	6.2	14.9	-17.9	-3.3	11.3	10.7	8.2	-7.9	7.5															
Sheep	28.7	6.2	62.9	-6.9	51.3	3.75	2.1	93.5	1.9	-15.8	-5.89	-0.9	13.1	-8.9	20.7	3.1	-7.1	85.8	-16.9	6.1	5.62	-1.3	69.3	-9.1	31.4															
Goats	43.0	-13.9	58.7	-8.1	35.1	-12.6	-5.1	14.7	-0.9	34.5	22.2	-6.3	-2.6	-4.2	23.1	65.2	-27.7	27.6	-16.9	20.3	34.2	-14.5	25.3	-7.9	36.9															
Poultry	45.9	41.9	109.7	50.2	52.4	10.3	31.3	48.3	-3.1	30.4	24.3	13.4	-21.7	46.9	95.9	26.8	42.2	29.4	11.9	69.5	-	-	25.6	-	24															
Pigs	-	-	83.2	-12	5.3	-	-	113.2	1.3	-22.2	-	-	-10.5	-4.7	-49.7	-	-	4.7	10.8	-64	-	-	33.4	-1.82	-31.8															

Notes: Period I: 1977-83; Period II: 1983-90; Period III: 1990-97; Period IV: 1997-03; Period V: 2003-07

**Table 2. Division-wise compound annual growth rates in milk and egg production in Karnataka**

Livestock and their products	Gulbarga			Belgaum			Mysore			Bangalore			Karnataka			(Per cent/ annum)
	Period I	Period II	Overall period	Period I	Period II	Overall period	Period I	Period II	Overall period	Period I	Period II	Overall period	Period I	Period II	Overall period	
Milk production																
Cattle	8.6*	2.2*	1.3 <sup>NS</sup>	9.7*	4.9*	3.3*	8.7*	5.5*	4.6*	6.9*	0.23 <sup>NS</sup>	1.5*	8.1*	2.9*	2.8*	
Buffalo	9.5*	1.4 <sup>NS</sup>	0.9 <sup>NS</sup>	8.6*	1.04 <sup>NS</sup>	1.1 <sup>NS</sup>	-1.5 <sup>NS</sup>	-0.9 <sup>NS</sup>	-3.4*	3.5*	-2.2 <sup>NS</sup>	-3.1*	5.6*	0.06 <sup>NS</sup>	-0.8 <sup>NS</sup>	
Total milk	13.1*	0.4 <sup>NS</sup>	0.79 <sup>NS</sup>	12.8*	0.9 <sup>NS</sup>	1.23 <sup>NS</sup>	4.3 <sup>NS</sup>	3.1*	2.55*	4.5 <sup>NS</sup>	-1.5 <sup>NS</sup>	-0.58 <sup>NS</sup>	7.1*	0.6 <sup>NS</sup>	2.08*	
Egg production																
Desi hens	8.1*	11.8*	5.5*	4.9*	-7.6*	-5.7*	3.4 <sup>NS</sup>	-7.0*	-6.0*	-1.7 <sup>NS</sup>	-1.2 <sup>NS</sup>	-6.2*	2.2 <sup>NS</sup>	-0.7 <sup>NS</sup>	-3.7*	
Improved hens	9.2*	11.7*	13.7*	24.9*	12.1*	10.4*	0.9 <sup>NS</sup>	9.1*	2.9*	2.5 <sup>NS</sup>	8.7*	1.02 <sup>NS</sup>	6.9*	10.4*	6.9*	
Total eggs	5*	11.7*	11.78*	16.4*	3.7 <sup>NS</sup>	4.19*	3.5*	0.5 <sup>NS</sup>	-0.49 <sup>NS</sup>	4.9*	2.8 <sup>NS</sup>	-1.03 <sup>NS</sup>	5.2*	5.4*	3.27*	

Notes: Period I: 1995-96 to 2000-01; Period II: 2001-02 to 2011-12; Overall Period: 1995-96 to 2011-12

\*denotes significance at 5 per cent level; NS= Non-significant

**Table 3. Division-wise annual compound growth rates in meat production of different livestock in Karnataka**

Meat production	Gulbarga			Belgaum			Mysore			Bangalore			Karnataka		
	Period		Overall period	Period		Overall period	Period		Overall period	Period		Overall period	Period		Overall period
	I	II		I	II		I	II		I	II		I	II	
Cattle (beef)	-9.6 <sup>NS</sup>	-3.56 <sup>NS</sup>	0.29 <sup>NS</sup>	15.7*	-7.69*	3.71 <sup>NS</sup>	27.9 <sup>NS</sup>	-11.1*	0.15 <sup>NS</sup>	3.31 <sup>NS</sup>	3.27 <sup>NS</sup>	2.26*	5.46*	-1.94 <sup>NS</sup>	1.87*
Buffalo (carabeef)	-2.10 <sup>NS</sup>	2.7 <sup>NS</sup>	6*	22.7*	2.61 <sup>NS</sup>	11.59*	-6.31 <sup>NS</sup>	3.26 <sup>NS</sup>	-2.95 <sup>NS</sup>	0.45 <sup>NS</sup>	-5.33 <sup>NS</sup>	-7.32*	3.53 <sup>NS</sup>	0.36 <sup>NS</sup>	1.08 <sup>NS</sup>
Sheep (mutton)	-4.0 <sup>NS</sup>	1.24 <sup>NS</sup>	-2.59*	5.9*	1.28 <sup>NS</sup>	-3.25*	18.1*	2.14 <sup>NS</sup>	2.82*	0.32 <sup>NS</sup>	4.64*	3.54*	4.0*	3.3*	1.83*
Goats (chevon)	-4.21*	0.072 <sup>NS</sup>	-6.54*	-1.97 <sup>NS</sup>	-5.87 <sup>NS</sup>	-7.35*	10.9*	2.68 <sup>NS</sup>	3.62*	0.27 <sup>NS</sup>	7.12*	4.37*	1.25 <sup>NS</sup>	3.06*	0.74 <sup>NS</sup>
Pig (pork)	-8.56 <sup>NS</sup>	2.07 <sup>NS</sup>	-7.4*	7.35 <sup>NS</sup>	-3.22 <sup>NS</sup>	-1.86 <sup>NS</sup>	22.3 <sup>NS</sup>	3.0 <sup>NS</sup>	10.3*	3.16 <sup>NS</sup>	1.7 <sup>NS</sup>	9.87*	6.74*	1.74 <sup>NS</sup>	8.07*
Total meat production	-5.8 <sup>NS</sup>	-0.5 <sup>NS</sup>	-0.9 <sup>NS</sup>	5.2*	1.4 <sup>NS</sup>	2.55 <sup>NS</sup>	17.3*	3 <sup>NS</sup>	6.29*	1.8 <sup>NS</sup>	6.4*	5.3*	4.1*	2.3*	2.54*

Notes: Period I: 1995-96 to 2000-01; Period II: 2001-02 to 2011-12; Overall Period: 1995-96 to 2011-12

\*denotes significance at 5 per cent level; NS= Non-significant



during the entire study period (1995-96 to 2011-12). The pork production was highest at 6.74 per cent per annum during period I (1995-96 to 2000-01), however, during period II (2001-02 to 2011-12), mutton production was highest at 3.3 per cent. The impressive growth in pork production was due to introduction of the large white Yorkshire breed which is very prolific and has large carcass weight.

### Factors Affecting Growth of Livestock Sector

The coefficients of the factors affecting growth of livestock sector in terms of production of milk, meat and eggs are presented in Table 4. The regression analysis revealed that in Gulbarga division (Table 4), rainfall (0.18), area under cereals (2.07), crossbred female cattle population (0.29) and number of artificial insemination centres (0.24) significantly influenced the milk production. From this linkage, it could be inferred that milk production increases when improved breeds, financial support and strong linkages between dairy farming and crop production are formed by way of supplying crop bi-products as feeds.

The regression analysis (Table 4) also revealed that extent of pastures and grazing lands (28.6) was the single significant factor contributing to meat production

in Gulbarga division, while the number of registered slaughter houses (0.23) and area under cereals (4.97) were the major significant factors influencing meat production in Mysore division. In Bangalore division, meat production was significantly influenced by the number of registered slaughter houses (6.54) and access to institutional credit to agriculture and allied sectors (0.004).

Introduction of improved breeds, viz. Rhode Island Red and White Leg horn, improved maize production, farmers' motivation for additional income, adequate technical assistance, as well as little land resource requirement for poultry rearing spurred the improved hen egg production, as reported by Birthal *et al.* (2006). Egg production (Table 4) across the divisions was significantly determined by the number of layers and maize production. The regression coefficients for the number of layers were 0.86, 0.27, 0.82 and 0.82 for Gulbarga, Belgaum, Mysore and Bangalore divisions, respectively. Hence, the farmers need to be provided improved hen chicks at a reasonable price and investment in feed development and veterinary healthcare centers needs to be stepped up for enhancing egg production.

**Table 4. Factors affecting growth of the livestock sector in the different divisions of Karnataka state**

Variable	Gulbarga	Belgaum	Mysore	Bangalore
<b>Milk production</b>				
Intercept	37.3 (2.96)	-3.59 -0.49	903.4 1.65	11.3 (1.36)
X <sub>1</sub> = Rainfall (mm)	0.18* (0.08)	0.06 (0.28)	0.10* (0.02)	0.23 (1.01)
X <sub>2</sub> = Fodder (ha)	0.03 (0.86)	0.13 (1.47)	-0.01 (-1.59)	0.07 (0.47)
X <sub>3</sub> = Total institutional credit to Agriculture and allied sectors (lakh ₹)	0.12 (1.65)	0.17* (0.08)	0.02 (1.16)	-0.01 (-0.25)
X <sub>4</sub> = Area under cereals (ha)	2.07* (1.03)	0.57 (1.05)	0.06 (0.46)	-0.34 (-0.65)
X <sub>5</sub> = Crossbred female cattle population ('00)	0.29* (0.14)	0.19 (0.76)	0.08* (0.038)	-0.22 (-1.52)
X <sub>6</sub> = Female buffalo population ('00)	0.22 (1.02)	0.11 (0.33)	-0.06 (-2.00)	0.063 0.34
X <sub>7</sub> = Number of artificial insemination ('00)	0.24* (0.11)	0.13 (1.03)	0.045 (2.02)	0.11 (0.73)
R <sup>2</sup>	0.82	0.68	0.93	0.34
				Contd...

**Table 4. Factors affecting growth of the livestock sector in the different divisions of Karnataka state — *Contd...***

Variable	Gulbarga	Belgaum	Mysore	Bangalore
<b>Meat production</b>				
Intercept	-354.1 (-2.55)	66.47 (0.32)	-119.5 (-1.45)	144081.3 (1.92)
X <sub>1</sub> = Number of veterinary institutions ('00)	0.87 (1.93)	1.32 (0.98)	0.84 (1.48)	-45.2 (-0.44)
X <sub>2</sub> = Pasture & grazing land (ha)	28.6* (2.72)	-5.61 (-0.31)	3.55 (0.61)	-0.18 (-1.42)
X <sub>3</sub> = Total institutional credit to Agriculture and allied sectors (lakh ₹)	0.059 (0.37)	-0.31 (-0.86)	0.12 (0.53)	0.004* (0.0002)
X <sub>4</sub> = Area under cereals (ha)	2.56 (1.31)	0.14 (0.05)	4.97* (2.30)	-0.004 (-0.12)
X <sub>5</sub> = Registered slaughter houses ('00)	0.05 (1.44)	-0.002 (-0.014)	0.23* (0.11)	6.54* (2.90)
X <sub>6</sub> = Total animals slaughtered (number in lakhs)	-0.12 (-0.80)	-0.40 (-0.93)	-0.06 (-0.37)	0.001 (1.12)
X <sub>7</sub> = Number of calves born ('000)	-0.13 (-0.71)	0.38 (0.65)	1.12 (1.60)	0.301 (1.45)
R <sup>2</sup>	0.59	0.31	0.88	0.79
<b>Egg Production</b>				
Intercept	1.71 (0.31)	-9.43 (-0.52)	7.74 (1.09)	-2.62 (-0.26)
X <sub>1</sub> = Number of layers (lakhs)	0.86* (0.39)	0.27 1.26	0.82* (0.38)	0.82* (0.40)
X <sub>2</sub> = Number of veterinary institution ('00)	-0.08 -0.24	-0.12 (-0.14)	-0.26 (-0.58)	0.36 (0.43)
X <sub>3</sub> = Total institutional credit to agriculture and allied sectors (lakh ₹)	0.19 (0.91)	0.21 (0.93)	0.14 (0.71)	-0.01 (-0.11)
X <sub>4</sub> = Maize production ('000 kg)	0.17* (0.08)	0.05 (0.14)	0.50* (0.22)	0.19 (0.66)
X <sub>5</sub> = Poultry birds vaccinated ('000)	-0.01 (-0.02)	3.09 (0.94)	0.22 (0.21)	0.61 (0.37)
X <sub>6</sub> = Number of regulated markets ('00)	-0.12 (-0.72)	-0.26 (-0.41)	-0.16 (-0.96)	0.014 (0.048)
R <sup>2</sup>	0.94	0.53	0.62	0.75

Note: Figures within the parentheses indicate standard error

\*Denotes significance at 5 per cent level; NS = Non-significant

## Conclusions and Policy Implications

Animals are natural capital which can be easily reproduced and acts as insurance against income shocks of crop failure and natural calamities. At present, livestock is the fastest growing sector in the economy vis-a-vis crop and fisheries sectors. In the north-eastern Karnataka region and Karnataka state as a whole, the poultry population has increased tremendously and

consistently across different livestock censuses, while the percentage growth in other livestock, though positive, has shown a declining trend. With regard to livestock production, the production of eggs by improved hens has grown better than by desi hens. The production of pork has been highest across the state while mutton and chevon production has registered a dismal growth. Declining trends have been observed

in milk production. However, production of cow milk has been higher than of buffalo milk in the state.

The livestock sector in north-eastern Karnataka and Karnataka as a whole is influenced by a wide range of factors but not limited to policy. The factors limiting the growth of livestock sector include deficiency in feed and fodder availability, inadequate breeding and reproduction, inadequate healthcare centres, poor public expenditure, poor credit flow, and lack of livestock insurance. Therefore, the study has suggested the following policy implications:

- Increase availability of feed and fodder, development of grazing lands, upgradation of local breeds, and improvement in livestock healthcare.
- Ensure timely supply of quality chicks at a reasonable price and encourage farmers to take up improved hens.
- Ensure easy access to institutional credit facilities to livestock farmers.
- Strengthen dairy co-operatives in the state for the overall development of the livestock sector.

### Acknowledgement

The authors are thankful to the anonymous referee for the constructive suggestions which helped in improving the presentation of paper.

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Received: February, 2014; Accepted May, 2014



