

## Research Article



# Development of Livestock and Productivity of Labour in Pakistan: An Empirical Work

Muhammad Shahid<sup>1\*</sup>, Mehmood Shah<sup>2</sup>, Adiq Kiani<sup>3</sup> and Farhat Parveen<sup>4</sup>

<sup>1</sup>Head of Department of Economics at Govt. Post Graduate College Bhakkar Punjab, Pakistan; <sup>2</sup>Chairman Department of Economics Gomal University Dera Ismail Khan, Pakistan; <sup>3</sup>Associate professor Department of Economics, Federal Urdu University of Arts Science and Technology, Islamabad, Pakistan; <sup>4</sup>Government College for Woman Darya Khan, Pakistan.

**Abstract** | This study examined the agriculture particularly livestock sector which is considered the fundamental and back bone of any economy of the world. In the season of draught and a crop failure, the only sector which generates incomes and financial support for agricultural sector. This research paper debates on livestock implications in raising labour productivity by taking time series data from 1984 to 2017 and Auto Regressive Distributive lag model (ARDL) has been applied to conclude the results. The other econometric test CUSUM and CUSUM sum of square were conducted to check the stability of the model. The results of the study reveal statistically significant positive impact of livestock and on labour productivity while the role of Govt. fixed capital and inflation are insignificant. This comprehensive research will support the govt. in formulating policies on livestock to labour productivity of the economy.

**Received** | August 27, 2018; **Accepted** | February 05, 2019; **Published** | May 21, 2019

**\*Correspondence** | Shahid Amir, Head of Department of Economics at Govt. Post Graduate College Bhakkar Punjab, Pakistan; **Email:** shahidamir77@gmail.com

**Citation** | Shahid, M., M. Shah, A. Kiani and F. Parveen. 2019. Development of livestock and productivity of labor in Pakistan: an empirical work. *Sarhad Journal of Agriculture*, 35(2): 647-653.

**DOI** | <http://dx.doi.org/10.17582/journal.sja/2019/35.2.647.653>

**Keywords** | Livestock, Human development index, Government fixed capital, Inflation rate, Governance

## Introduction

The livestock has emerged as income raising and generating sector for more than 70 % population of the rural area in a multidimensional way. It shares 11% to Gross Domestic production and 58.9 % contributes the agriculture sector and 11.1 percent to GDP IN 2017-18. In the last two decades it has progressed 5.6 % more than the growth rate of over all agriculture sector. Livestock in the agriculture sector has the potential to tackle seasonal fluctuations, deficiency of inputs and shocks of failure crops. The advantages of this sector in producing crops, preparing of soil, supplying of food, employment opportunities and others benefits beyond of this (Birthal and Ali, 2005).

Labour productivity is defined as the amount of total goods and services produced by labour in an hour and growth of labour productivity the workers to produce more quantity of output for a specific number of times. There are four major determinants of labour productivity investment, investment in physical capital, new technology and human capital (Shawn Sprague). Livestock is animals like sheep, goat, horses, hens, camels, asses, cattle, cow and buffalo. They are kept on farm houses and produce sources of meat, milk, skin, hair, wool, bones, fats, eggs, hair and many other matters for crops. But in the modern age livestock field is diversified in to two sub sectors the first Dairy Farm Sector and second is Poultry Sector. In the world Pakistan's position is 3rd in milk producing countries the most prominent ranking

in milk processing and dairy products. The major contributors of milk and milk products are cows and buffaloes [PES, 2014-15](#).

This sector produces an additional food in the form of meat, mutton, butter, milk, dry milk, cream, egg, fish, poultry, ice cream and many other products of dairy and raises the efficiency of labour productivity in rural areas. Further it encourages goods and services income of farm and poultry products caused additional employment of economy. By selling of livestock and its products they can purchase instruments and inputs like tractor, thresher, trolley, harvesters, Tube well, fertilizers, pesticide and innovative seeds which can increase not only sustainability and productivity of rural labour but also raise the productivity of agriculture sector. It also supplies organic manure, draught power and facilitates crop sector by providing hides, fibers, bones, blood and skin to the manufacturing sector. Conservation of the environment is made possible with the help of livestock sector. The supplements of livestock sector income in the form of crop production and absorb fluctuations when a crop is a failure. This sector creates a continuous stream of income and employment and minimizes seasonality in livelihood patterns particularly for the rural down trodden poor people ([Birthahn et al., 2005](#)).

## Dynamics of Livestock

### Dairy sector

The economic survey of Pakistan 2017-18 the current statistics and the numerical statistical data of different species has emerged the cattle the most prominent population with million, the 2nd position of buffalo position at 38.8 million and sheep, goat, camel, horses, asses, mules are at 30.5, 74.1, 1.1, 0.4, and 5.3 respectively during 2017-18. The cattle species has climbed up from 36.9 million in 2011-12 to 46.1 million in 2017-18. There has been increased in the total numbers of bovine by more than 3% and the percentage increase in the population of ovine is 2.13 during 2017-18 in the country while the other livestock is smaller in growth in percentage. In milk production and consumption of the Pakistan's position is 3rd in the world. The numerical measurement of milk production was 38690 tons in 2011-12 and 46682 tons during 2017-18. The percentage rise in production of milk has been 3.24 shown by [Table 1](#).

**Table 1:** *Estimated milk and meat production (000Tones)*

Species	2015-16	2016-17	2017-18
(Milk gross production	54328	56080	57890
Cow	19412	20143	20903
Buffalo	33137	34122	35136
Sheep	39	39	40
Goat	867	891	915
Camel	873	885	896
Milk (human consumption)	43818	45227	46682
Cow	15529	16115	16722
Buffalo	26510	27298	28109
Sheep	39	39	40

Source: *Economic Survey (various issues)*

**Table 2:** *Estimated milk and meat production (000Nos)/ Million Nos*

Species	2015-16	2016-17	2017-18
Eggs	16188	17083	18037
Hides	15886	16421	16974
Cattle	8111	8416	8734
Buffalo	7669	7897	8131
Camel	106	108	109
Skin	54278	55526	56805
Sheep skin	11264	11397	11532
Goat skin	27073	27807	28560

Source: *Ministry National Food Security & Research (various issues)*

## Model Specification and Data Source

$$PLPW = \beta_0 + \beta_1 LSI + \beta_2 GDPGR + \beta_3 GINI + \beta_4 HCR + \beta_5 FDI + \varepsilon_i$$

PLPW = Productivity of labour per Worker

LSI = Livestock index to measure the Livestock production in the form of Dairy sector and Poultry sector.

GDPGR = Gross Domestic Production Growth Rate

GINI = GINI Coefficient to measure unequal Distribution of Income.

HCR= Head Count Ratio is used to measure the Poverty.

FDI= Foreign Direct Investment Inflow

### Data source

The dataset was taken from 1984 to 2017 from World Development Indicator and Economic survey of Pakistan.

### Stationary order

The stationary order of all variables was checked

through E-views software and found that some variables are at a level I (0) and the others are at first difference I (1), but none of the variable is second difference. But the compulsory condition for ARDL econometric technique was no variable should be at 2nd difference.

### Co-integration

To analyse the short-run and long-run relationship among productivity of labour per worker, livestock, human development index, gross fixed capital, inflation and governance are presented research ARDL model of equation (1) by following (Pesaran and Pesaran, 1997) and (Pesaran and Shin, 1999), as

$$\begin{aligned} & \sum_{i=0}^N \alpha_2 \Delta LSI_{t-i} + N \sum_{i=0}^N \alpha_3 \Delta GDPGR_{t-i} + \sum_{i=0}^N \alpha_4 \Delta GINI_{t-i} + \sum_{i=0}^N \alpha_5 \Delta HCR_{t-i} \\ & + \sum_{i=0}^N \alpha_6 \Delta FDI_{t-i} \Delta PLPW_t \\ & = \alpha_0 + \sum_{i=1}^N \alpha_1 \Delta PLPW_{t-i} + \beta_1 PLPW_{t-1} + \beta_2 LSI_{t-1} + \beta_3 \log GDPGR_{t-1} \\ & + \beta_4 GINI_{t-1} + \beta_5 HCR_{t-1} + \beta_6 FDI_{t-1} + \mu \dots \dots \dots (1) \end{aligned}$$

The first step in ARDL approach to co-integration the long-run relationship among variables was checked by F-statistic.

$$\begin{aligned} \Delta PLPW &= \alpha_0 + \sum_{i=1}^N \alpha_1 \Delta PLPW_{t-i} \\ & + \sum_{i=0}^N \alpha_2 \Delta LSI_{t-i} + \sum_{i=0}^N \alpha_3 \Delta GDPGR_{t-i} + \sum_{i=0}^N \alpha_4 \Delta GINI_{t-i} \\ & + \sum_{i=0}^N \alpha_5 \Delta HCR_{t-i} + \sum_{i=0}^N \alpha_6 \Delta FDI_{t-i} + \mu_t \dots \dots \dots (2) \end{aligned}$$

For error correction mechanism the first Lag of the level for each variable was included in the equation (2).

## Interpretation of Empirical Results

**Table 3: Bound Test**

F-Statistic	confidence interval at 95%		confidence interval at 90%	
26.895	3.118	4.557	2.578	3.823

Source: Author's own calculations

The calculated value of F-statistics was 26.895 which are more than lower limit value 3.118 and upper limit

value 4.557 at 95%, and lower limit value 2.578 and upper limit value 3.823 at 90 % confidence interval, confirmed the long run relationship and co- integration among variables. The above value of bound test rejects the null hypothesis (co integration does not exist among variables) and accepts the alternative hypothesis (co integration exists among variables).

The value of R<sup>2</sup> was 0.929 suggested that 0.894 % variation in the model was the result of coefficients

and the other was the result of an error term. The high value of  $R^2$  was the sign of good fit of the model while adjusted  $R^2$  was associated with degree of freedom ( $n-k$ ). The value of Durbin Watson is close to 2, the sign of no autocorrelation. The error terms are not correlated with each other. The higher value F-Statistics is 26.47 confirms the overall significance of the model.

**Table 4: Good Fit Model explanation**

$R^2$	0.929
Adjusted $R^2$	0.894
D.W-Statistics	2.24
F(7,19)	-26.47

**Table 5: Diagnostic Test**

Problem	LM-(P.V)	F- (P.V)
Serial Correlation	(.302)	(.409)
Functional Form	(.836)	(.271)
Normality	(.807)	No applicable
Heteroscedasticity	(.156)	(.143)

**Source:** Author's Estimation

Auto regressive distributive lag model holds all assumptions of OLS. The assumptions of no correlation among explanatory variables, constant variance of error term and no correlation among error term should be clear for efficient modeling and these results can be used in predicting policies and formulation of policies. Auto Regressive Distributive Lag approach confirms all the assumptions of Ordinary Least Square. The Lagrange Multiplier test evaluates the absence of Serial Correlation/auto correlation and Ramsey Reset Test explains the correct functional form. When p-value of the serial correlation, the functional form, normality of LM-version and F-version is higher than 0.1 or 10%, and data is normally distributed without violation of OLS assumptions.

**Table 6: Estimation of the model in long run perspective.**

Variables	Parameters	T-statistic	(P-V)
LSI	10.694	12.137	(.000)
GDPGR	41.82	3.811	(.000)
GINI	57.84	10.123	(.000)
HCR	-4.83	-7.96	(.435)
FDI	.056	3.529	(.002)

**Source:** Author's own calculations

The long run results are the most crucial finding of the model which shows the more importance of the

livestock production index in long run while the other variables GDPGR, GINI, head count ratio and FDI have most valuable coefficient in generating labour productivity in Pakistan.

The one unit increases in livestock production, raises the labour productivity by 1069 units and the one unit rises in GDPGR, expands the labor productivity by 41.82 units while unequal distribution of income raises the labor productivity by 57 units as the poverty decline the labor productivity by 4.83. The FDI effect on labor productivity is insignificant. The livestock production index effect on labor productivity is positive and statistically significant at 1%. While the other control variable GDPGR, GINI and FDI has significant impact on labour productivity.

Brown et al. (1975) purposed stability test for confirmation structural stability of the model in short run variables as well as long run coefficients. Pesaran and Pesaran (1977) employed the test practically, if Cumulative Sum of Recursive Residuals CUSUM line lies in between 5% critical bound limits and the graph of CUSUM sum of square line also lies in between 5% critical bound limits which confirms the absence of breaks of the model and confirms structural stability of the model in short run as well as long run.

**Table 7: Error correction results explanation**

Variables	Parameters	T-statistic	(P-V)
dLSI	3.126	5.052	(.000)
dGDPGR	7.147	3.734	(.001)
dGINI	5.488	1.464	(.156)
dHCR	-1.414	-7.739	(.467)

**Source:** Author's own calculations

The Error correction model analysis of regression conveys the information of short run relationship of coefficients. But here the concept of co integration and ECM becomes more important in error correction model of co integration because it resolves the short run and long run analysis incorporated with help of error correction model. In ARDL model when without stationary variables are regressed they may give spurious results. So this problem can be resolved by taking first difference of the data which confirms the stationary problem of the data. The spurious results of regression may be corrected and meaningful model will be achieved. ARDL technique is attached with unrestricted error correction model.



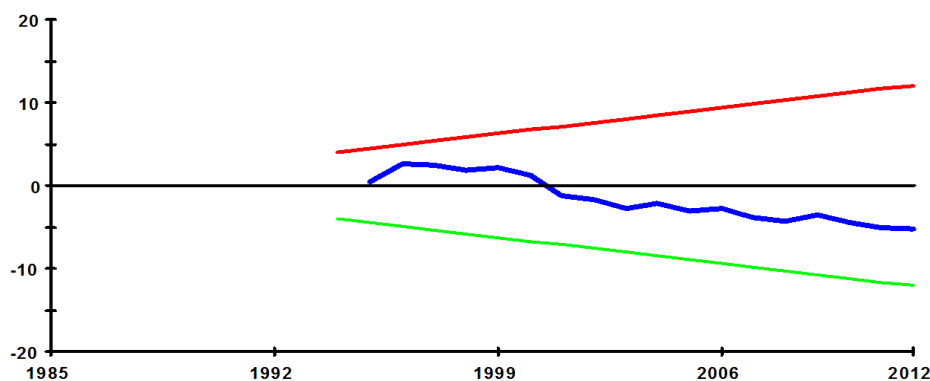


Figure 2: Cumulative sum of recursive residuals.

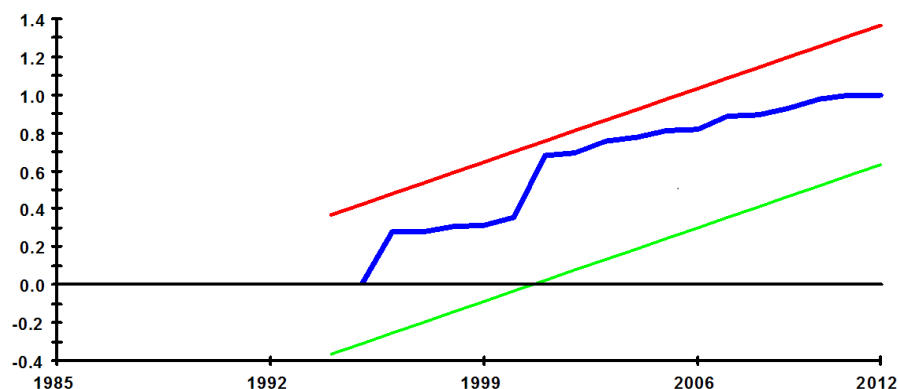


Figure 3: Cumulative sum of squares of recursive residuals.

The error version model explained the short period results as one unit rises in livestock production index increases productivity of labour by and HDI brought about rise in productivity by 3.12 units and the 1 unit changes in GDP Growth Rate brings expansion in productivity of labor by 7.14 units. one point increases in GINI coefficient, encourages the productivity of labor by 5.488 units as one unit enhances in poverty declines the productivity of labor by 1.414 units. While the FDI impact on labor productivity is positive but statistically insignificant. The livestock production index effect on labor productivity is positive with statistical significant at 1 % while the other control variables GDPGR is also significant with positive impact on productivity of labor. While the unequal distribution of income GINI, Poverty HCR and FDI does not affect the productivity of labour.

The value of ECM (-1) with negative sign showed the model highly significant in the short run and long run. The value of adjustment co efficient was 0.29 reflects that 29 % disequilibrium in the current period would move towards equilibrium in the future year.

## Conclusions and Recommendations

The results of short run and long run derived from empirical research were most important. In the long run LSI, GDPGR, GINI and FDI were found statistically significant at 1%. As 1 unit increases in livestock index, the labour Productivity of rural area would rise by 10.694 units and livestock production index has positive effect on Productivity of labour. Further the other variable GDPGR, GINI and FDI affect labour productivity positively is also statistical significant at 1% while HCR impact on labour productivity is insignificant and reduces the labor productivity in case of Pakistan. The study highlights ambiguous aspect of production of livestock production which raises the agriculture inputs and supportive hand in case of crops failure. In absence of livestock production the peasants cannot think and purchase agric inputs as result of that their productivity work will fall. As whole the agriculture production of the country will reduce in the absence of livestock sector. The Error correction model depicted the features of short run results. The negative sign was attached with ECM (-1) represented the model highly significant at 1% as shown by P-Value (.000). In the short run LSI and GDPGR are statistical significant at 1%

and raises the productivity of labor in rural as well as urban areas. While in short run GINI, HCR and FDI are insignificant. Further to check the stability of the model CUSUM and CUSUM sum of square test was applied to check the stability of the model that CUSUM and CUSUM sum of the square laid inside the 5% critical bound values. The adjustment coefficient is 29 % showed disequilibrium in previous time period would push to equilibrium in the current period.

## Author's Contribution

**Muhammad Shahid:** Contributed the central theme, modeling, analysis and interpreting the paper.

**Mahmood Shah:** Guided me throughout the paper.

**Adiqa Kiani:** Helped in formatting of the manuscript, the whole manuscript, interpreting results and correcting the mistakes.

**Farhat Parveen:** Contributed mathematical equations and interpreting paper.

## References

- Aghwan, Z.A., A.U. Bello, A.A. Abubakar, J.C. Imlan, A.Q. Sazili. 2016. Efficient halal bleeding, animal handling and welfare: A holistic approach for meat quality. *Meat Sci.*, 121:420–428.
- Annual Statistical Report, 2012-13. Poult. Sect. Punjab, Pak.
- Bruinsma, J. 2003. World agriculture towards 2015 / 2030, and FAO perspective, London: Earth scan.
- Birthal, P.S. and J. Ali. 2005. Potential of livestock sector in rural transformation: In rural transformation in India: the role of non-farm sector. *Inst. Hum. Dev. Manohar Publ. Distrib.* New Delhi.
- Brown, R.L. , J. Durbin and J.M. Evans. 1975. Techniques for testing the constancy of regression relationships over time. *J. R. Stat. Soc Ser. B.* 37: 149-192.
- Christin, C., V. Alary and G. Denis. 2011. Livestock's contribution to poverty alleviation: How to measure it? *World Dev.* Volume 39, Issue 9, September 2011, Pages1638-164.
- Dixon, J.A., Gulliver and D. Gibbon. 2001. Farming system and poverty: Improving farmer's livelihood in a changing world Rome and Washington DC, FAO and World Bank.
- FAO. 2003. FAO world livestock production system: Current status, issue and trend. FAO Anim. Prod. Health Paper no.127 Rome, FAO
- Fasina, F.O., M.D. Wai, S.N. Mohammed and O.N. Onyekonwu. 2007. Contribution of poultry production to household income: a case of Jos South local Government in Nigeria. *Nat. Vet. Res. Inst. Res. Rep. No. 3. Family Poult.* 17 (1and2), 30–34.
- Government of Pakistan. 2013. Economic Survey of Pakistan, 2012-13. Federal Bureau of Statistics, Ministry of Economic Affairs. Stat. Islamabad, Pakistan.
- Government of Pakistan. 2014. Economic survey of Pakistan, 2013-14. Federal Bureau of Statistics, Ministry of Economic Affairs. Stat. Islamabad, Pakistan.
- Mathijs, E. 2015. Exploring future patterns of meat consumption. *Meat Sci.* 109: 112–116. .
- Pandit, R., M.K., Schilizzi and S. Bashir. 2012. Livestock and rural household food security: The case of small farmers of the Punjab, Pakistan. working paper 1207. Sch. Agric. Res. Econ. Univ. West. Aust. Crawley, Australia.
- PES, 2014-15. Pakistan Economic Survey, Finance Division, , Govt of Pakistan.
- Pesaran, M.H. and B. Pesaran. 1997. Working with Microfit 4.0: Interact. Econ. Anal. Oxf., Oxford Univ. Press.
- Pesaran, M.H. and Y. Shin. 1999. An autoregressive distributed lag modeling approach to co integration analysis. In: S. Strom (ed.) *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.* Cambridge: Cambridge University Press.
- Pica Ciamarra, U., L. Tasciotti, J. Otte and A. Zezza. 2011. Livestock assets, livestock income and rural households: cross-country evidence from household surveys. FAO working paper no. 11-17. Food Agric. Organ. U.N. (FAO), Rome.
- Randolph, T.F., E. Grace, D. Nicholson, C.F. Leroy, J.L. Cole, D.C. Demment, M.W. Omere, A. Zinsstag and M. Ruel. 2007. Role Livestock Human Nutr. Health Poverty Reduction in Dev. Countries.
- Rehman, A., L. Jingdong, A. Chandio and I. Hussain. 2017. Livestock production and population census in Pakistan: Determining their relationship with agricultural GDP using econometric analysis. *Inf. Process. Agric.* 4(2): 101-178.

- Richard, H. and Adams Jr. 1996. Livestock income, Male/female animals and inequalities in rural Pakistan discussion paper no. 21. Sansoucy R. livestock, a driving force for food security and sustainable development.
- Smil, V. 2014. Eating meat: Constants and changes. Global Food Sec. 3: 67–71.
- Sprague, P. 2014. Bureau of labor statistics united states department of labor, May 2014 | Vol. 3 / No. 12.
- Thorton, P.K., R.L Kruska and N. Henninger. 2002. Mapping poverty and livestock in Nairobi. Int. Livestock Res. Inst.