An Empirical Analysis of Poverty Alleviation through Livestock Development in Pakistan

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Abstract

Most of the developing economies of the world are of agrarian in nature. Pakistan economy is one of these economies where majority of the population lives in rural areas. The agriculture sector is the basic source of livelihood for the people in Pakistan. Population growth in Pakistan has been very high amongst the developing world. Demand for dairy and livestock products has been increasing with the increase in the population. Recent study explored the impact of livestock output on poverty in Pakistan by using annual time series data for the period of 1972-2010. The time series econometric techniques of unit root test, Jahansen's cointegration method and vector error correction techniques were applied for the examination. Livestock output has been found to be negatively associated with the poverty levels in Pakistan in the long run. Causality test based on vector error correction block exogeniety test confirmed long run causality between livestock output, official development assistance, workers' remittances, credit to private sector, education and health expenditure. Causality test confirmed the bidirectional causality between livestock output and poverty. Moreover, other variables have also shown causal association with poverty levels in Pakistan. The present study concludes that development of the livestock sector, in Pakistan, would be helpful in promoting income sources and poverty alleviation.

Keywords: Livestock; Aid; Remittances; Bank Credit; Huma capital; Unit root; Error correction; Granger causality.

Introduction

There was time when higher levels of national and per capita GDP were considered to be objectives of development. Seers[1] argued that, in the process of economic development, poverty, income inequality and unemployment were supposed to decline from high levels. Industrialization of the economy was considered to be the

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key for the attainment of development. The developed economies of the modern times have gone through the process of industrialization. But in all process of economic growth the dream of poverty reduction may not come true. Economic growth may not be the necessary condition for poverty alleviation. The growth process would be of inclusive nature if the deprived and poor can participate in the economic activity. Poverty and inequality impede the strived to exploit the benefits of economic growth. Growth would be inclusive and pro-poor if low income households gain from the growth process of the economy. The adaptation of labor intensive production techniques can be a milestone on the way to poverty free economy.

Majority of the poor lives in rural areas. The developing countries like Pakistan are basically of agrarian in nature. The stimulation of economic activity in the rural areas may be helpful to lower the poverty levels in the economy. Agriculture sector has a fundamental role to play in growth and for the provision of livelihood for the masses. Agriculture is the way of life of about more than half of the population of the country. Growth of agriculture sector not only ignites the growth but it also has its poverty alleviating impact on the economy. A robust production and consumption linkage between agriculture and other sectors of the economy can be helpful in accelerating growth of the economy. Development of the agriculture sector stimulates national income; create employment through multiplier impacts from farm to non-farm activities in the economy.[2]

Agriculture sector has its very important sub-sectors such as minor crops, major crops, forestry and livestock. Livestock is predominantly essential subsector in an agrarian economy like Pakistan. Growth in the productivity and income in livestock sector has income multiplier and poverty reducing effects in the economy. Livestock has its direct and indirect contributions to food and nutrition of the household. Livestock has its role as a cushion against the fluctuations in the crop yield and it makes possible the availability of food stuffs by maintaining the food supply. The development of the livestock sector can be helpful in increasing the productivity of labor.

Pakistan economy is an agrarian economy. Agriculture sector is an important pillar of the economy. About 60 percent of the population of Pakistan earns their living from this sector. It adds more than 20 percent in the national GDP and generates more than 45 percent employment in the economy. Its major subsector is livestock sector. Livestock sector adds 11.6 percent to GDP, 8.5

percent to exports and 55.1 percent to agriculture valued of the Pakistan economy.[3] But despite its major contributions it is one of the neglected sectors of the economy. This sector is subsistent one. Landless low-income and small farmers belong to this sector. Livestock has great importance in remote and rural areas of Pakistan. Pakistan is a country in which about one third of the population is still living in severe and hard conditions of poverty. Poverty reigns supreme in rural areas of Pakistan. Improvement in the livestock sector may be helpful in alleviating poverty in the economy. The present study is focused on the examination of impact of livestock development on poverty in Pakistan. The study would provide profound insight into the efforts of livestock development and poverty alleviation in Pakistan.

Literature Review
There is large number of theoretical and empirical studies that discussed the growth and poverty link. Economic growth has been considered to be helpful in poverty alleviation. The average income of lowest income quintile decreases or increases with the same rate as there is decrease or increase in the average national income.[4] There is an inverse association between poverty and economic growth but the Kuznets hypothesis is not confirmed.[5] Though majority of the poor pursue its livelihood from the agriculture sector yet extent of dependence on agriculture sector differs from one developing economy to another.[6] Livestock sector has fundamental importance for the poor in low income economies.[7] This sector is one of the major sources of income for the poor household in rural areas. Livestock sector guarantees the food security of the household as they can exchange their livestock and/or livestock products for grain.[8]

Kristjanson *et al.*[9] examined the importance of livestock sector by analyzing the movements into and out of poverty in the western districts of Kenya. The researchers found diversification in livestock to be helpful in poverty alleviation as 24 percent of total families moved out of situation of poverty during two decades or so. The development of the livestock sector was found to be an alley to alleviate poverty. Moreover, it was also observed that losses in the livestock sector were secondary cause to move household into the cruel hell of poverty. The study suggested livestock sector development as fundamental policy recommendation for the alleviation of poverty in the western districts of Kenya. In another study, Hefferman[10] was also of the opinion that development of diversity in livestock sector at local,

national and world level. The introduction of new and modern approaches for the development of the livestock would be fruitful in the betterment of livelihood of the low income households in the economy.

Machethe[11] concluded that agricultural research, investment in non-physical capital, biophysical capital formation and establishment of rural institutions would intensify growth of the agriculture sector. Moreover, progress in small-holder agriculture might be the fruitful arrangement to alleviate poverty and reduce income inequality. Hollmann *et al.*[12] attempted to understand the importance of livestock in the combat against poverty by conducting interviews of 143 farmers owning no cattle in five different chosen regions in Colombia. The livestock was found to have fundamental importance in the lives of those households. The poor are more vulnerable in drought or no rain situation and frost damages that result in crop failure. The small-holder farmers have to sale out their cattle to pay off their debts, making payments for their own healthcare and hold cash balances to stay alive. One of the raison d'être to own cattle, for a household, is to build up their savings and increase their capital. Livestock is their capital. Rearing cattle is very much useful for the livestock-holder. Livestock make available the milk, butter and beef for the cattle-holder household. Small-holders believe livestock to a contributor in their quality of life.

Ali[13] found livestock to play basic role in employment generation, poverty alleviation and lowering income inequality in rural areas of India. The author found livestock distribution more egalitarian than the land ownership in the country. In India, more than seventy percent of small and landless rural households owned livestock. These households own animals like poultry, sheep, goat and pigs because of lower initial investments and operational expenditure for small animals. Development of livestock sector can be engine of growth and it could be a potential sector in increasing the growth earnings, generating employment and income, and thereby reducing poverty in the economy. Livestock sector development not only helps in reducing the poverty levels but it can also satisfy the domestic needs. [14] Pica *et al.* [15], using panel data of 66 countries for 1961-2003, found a positive correlation between livestock development and growth. Livestock was found to be basic source of per capita GDP growth in 33 economies of 66 economies in the panel. Moreover, bidirectional causality was observed between livestock and economic growth in 9 countries. Otte *et al.*[16] pointed out agriculture sector to be

fundamental source of livelihood for the poor. Majority of the poor families own cattle in their portfolio. The demand for the food source is growing rapidly with the growing population of the world.

It was concluded in SA PPLPP[17] that majority of the rural households, in Bangladesh, Bhutan ad India, acquire their livelihood from small-scale poultry farming. Households generate food and cash by keeping small flocks. The study suggested improvement and support of small scale poultry in rural areas to increase its contribution in the livelihood of the people. Control over animal diseases, adaptation of favorable husbandry practices, implementation of suitable policies and encouragement of the institutions would be supportive in the exploiting the small scale poultry. Livestock sector is a source of social and economic security for the household. It is a source of revenue and security. It provides financial and social capital to the households. This sector makes available the high quality nutrition to the poor women to develop mental and physical growth of their children and enhance the cognitive skills in them. Livestock provides the basic social, economic and cultural system in rural areas. It is argued that poverty could not be combated against until the issues of lack of social security, education, and improved healthcare and lack of food shortage are addressed.[18]

In the recent study, Ali *et al.*[19], impact of agriculture value added on income inequality, in Pakistan, has been analyzed. Time series data has been used for the analysis. Johansen cointegration test results confirmed long run equilibrium association among income inequality measured be Gini coefficient, agriculture value added, service sector value added , exports earnings, and foreign direct investment. Agriculture value added, exports earnings, foreign direct investment showed negative impact on income inequality in Pakistan economy. The development of agriculture sector would be helpful in achieving the objective of alleviated poverty and just distribution of income. Agriculture sector is one of the major sectors in the Pakistan economy. It has its subsectors among which livestock is the important sector. Development of the livestock sector would help in increasing the output and productivity of the agriculture sector.

The review of some theoretical and empirical studies there seems an agreement of conventional wisdom about the importance and role of agriculture sector in general and of livestock sector in particular in employment creation, income generation, making possible the sustainability in the food supply, overall economic

growth and alleviation of poverty as well. Aspired from recognized importance of livestock in the lives of the poor and deprived, this study is an attempt to explore the impact of livestock on poverty in Pakistan by using cointegration and vector error correction techniques.

Model, Data and Methodology

The Model and Data Sources
The study is an endeavor to examine the impact of livestock development on poverty levels in Pakistan economy. This is a time series analysis of sampled period of 1972-2010. In this analysis, annual poverty head count ratio (P) is regressor. Livestock output as percentage of total agriculture output is taken as livestock development (L) Variable. Moreover, the impacts of other important variables such as official development assistance (O), worker's remittances (W), and credit of the banking sector to private sector (C), education (E), and health (H) expenditure have also been controlled in the model. All of these variables have been taken as percentage of GDP. Here is the regression to be estimated:

$$lnP_t = \alpha + \beta_1 lnL_t + \beta_2 lnO_t + \beta_3 lnW_t + \beta_4 lnC_t + \beta_5 lnE_t + \beta_6 lnH_t + e_t$$
(1)

Where,

lnP_t = Natural log of poverty head count ratio

lnL_t = Natural log of Livestock sector output as percentage of total agriculture output

lnO_t = Natural log of official development assistance as percentage of GDP

lnW_t = Natural log of worker's remittances as percentage of GDP

lnC_t = Natural log of bank credit to private Sector as percentage of GDP

lnE_t = Natural log of education expenditure as percentage of GDP

lnH_t = Natural log of health expenditure as percentage of GDP

e_t = white noise error term.

The data of poverty headcount ratio has been taken from various issues of Pakistan Economic Survey. The data for the rest of the variables has been taken from Pakistan Economic Survey,[20] State Bank of Pakistan Statistical Book,[21] World Development

Indicators of the World Bank,[22] and Annual reports of State Bank of Pakistan.[23]

Methodological Specifications
It is a prerequisite, before the application of cointegration test, to pretest the order of integration of time series variables. Augmented Dickey-Fuller (ADF) test is the most commonly used unit root test to check the stationarity of the time series. ADF test is used when the errors terms are serially correlated.[24] In the present study, we have applied ADF test. The regression estimated for the ADF test is:

$$\Delta y_t = \theta_0 + \theta_1 t + \theta_2 y_{t-1} + \sum_{j=1}^{m} \theta_j \Delta y_{t-1} + \epsilon_t$$

(2)

Here, null hypothesis: $H_0 : \theta_2 = 0$. If the time series are integrated of the same order then they are cointegrated. If cointegrated variables are considered to have long run equilibrium association between them.[25] If the time series are I(0) at their first difference then the method of cointegration development in Johansen[26] and Johansen & Juselius[27] is applied. Johansen cointegration method may be expressed as:

$$\Delta x_t = \alpha + \sum_{i=1}^{p} T_k \Delta x_{t-k} + \pi x_{t-1} + \varepsilon_t$$

(3)

Where x_t a vector of variables is included in the model and ε_t is the error term. k is lag length and π is nth order impact matrix. Where n is the number of variables included in the model. This nth order matrix provides the information about the long run association between these variables. The rank of this nth order matrix is the number of cointegrating equations. Johansen cointegration method estimates two statistics; the trace and Max-eigen statistics. The trace statistics is estimated as:

$$\lambda_{Trace}(r) = -A \sum_{k-1}^{m-1} ln(1 - \Omega_n)$$

(4)

Where A denotes the number of observations, *r* and *n* indicate the number of cointegrating vectors and the number of variables, respectively. Eigen-values are denoted by Ω's. the trace test

statistic tests the null hypothesis $r \leq q_0$ (where $q_0 = 0, 1, 2, 3,…$) against the alternative hypothesis that $r > q_1$ (Where $q_1 = 1, 2, 3,…$). The max-eigen statistic is expressed as:

$$\lambda_{Max}(r, r+1) = -A \log(1 - \Omega_{r+1}) \qquad (5)$$

Max-eigen statistic tests the null hypothesis $r = z$ (where $z = 0, 1, 2, 3,…$) against the alternative that $r > z + 1$. Selection of optimum lag length before the cointegration analysis is another prerequisite. SIC criterion is most commonly used for the selection of optimum lag length. If the cointegration test confirms the existence of any cointegrating vector it implies that time series are cointegrated and they have long run equilibrium association. The long run equilibrium association between the I(1) variables can be expressed as error correction mechanism.[28] The time series variables integrated of order one may be cointegrated and there may be this equilibrium in the short run. There may be an error term that ties the short run behavior of the dependant variable to its long run path. This error term is known as error correction error term. The concept of error term was presented by Sargan[29], later on, it was popularized by "Granger representation theorem".[30] If the time series are cointegrated their relationship can be expressed as Error Correction Model. The error correction model takes into account the short run dynamics of the variables. After finding out the long run equilibrium relationship between the variables by Johansen cointegration method, the error correction equation for each of the time series variable is estimated. The error term equations estimated are as follows:

$$\Delta lnP_{1t} = \gamma_{01} + \sum_{i=1}^{n} \gamma_{11,i} \Delta lnL_{t-1} + \sum_{i=1}^{n} \gamma_{21,i} \Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{31,i} \Delta lnW_{t-1} + \sum_{i=1}^{n} \gamma_{41,i} \Delta lnC_{t-1} + \sum_{i=1}^{n} \gamma_{51,i} \Delta lnE_{t-1} + \sum_{i=1}^{n} \gamma_{61,i} \Delta lnH_{t-1} + \delta_1 ECM_{1,t-1} + v_1$$
$$(6)$$

$$\Delta lnL_{2t} = \gamma_{02} + \sum_{i=1}^{n} \gamma_{12,i} \Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{22,i} \Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{32,i} \Delta lnW_{t-1} + \sum_{i=1}^{n} \gamma_{42,i} \Delta lnC_{t-1} + \sum_{i=1}^{n} \gamma_{52,i} \Delta lnE_{t-1} + \sum_{i=1}^{n} \gamma_{62,i} \Delta lnH_{t-1} + \delta_2 ECM_{2,t-1} + v_2$$
$$(7)$$

$$\Delta lnO_{3t} = \gamma_{03} + \sum_{i=1}^{n} \gamma_{13,i} \Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{23,i} \Delta lnL_{t-1} + \sum_{i=1}^{n} \gamma_{33,i} \Delta lnW_{t-1} + \sum_{i=1}^{n} \gamma_{43,i} \Delta lnC_{t-1} + \sum_{i=1}^{n} \gamma_{53,i} \Delta lnE_{t-1} + \sum_{i=1}^{n} \gamma_{63,i} \Delta lnH_{t-1} + \delta_3 ECM_{3,t-1} + v_3$$
$$(8)$$

$$\Delta lnW_{4t} = \gamma_{04} + \sum_{i=1}^{n} \gamma_{14,i}\Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{24,i}\Delta lnL_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{34,i}\Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{44,i}\Delta lnC_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{54,i}\Delta lnE_{t-1} + \sum_{i=1}^{n} \gamma_{64,i}\Delta lnH_{t-1} + \delta_4 ECM_{4,t-1} + v_4$$
$$(9)$$
$$\Delta lnC_{5t} = \gamma_{05} + \sum_{i=1}^{n} \gamma_{15,i}\Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{24,i}\Delta lnL_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{35,i}\Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{45,i}\Delta lnW_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{55,i}\Delta lnE_{t-1} + \sum_{i=1}^{n} \gamma_{65,i}\Delta lnH_{t-1} + \delta_5 ECM_{5,t-1} + v_5$$
$$(10)$$
$$\Delta lnE_{6t} = \gamma_{06} + \sum_{i=1}^{n} \gamma_{16,i}\Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{26,i}\Delta lnL_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{36,i}\Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{46,i}\Delta lnW_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{56,i}\Delta lnC_{t-1} + \sum_{i=1}^{n} \gamma_{66,i}\Delta lnH_{t-1} + \delta_6 ECM_{6,t-1} + v_6$$
$$(11)$$
$$\Delta lnH_{7t} = \gamma_{07} + \sum_{i=1}^{n} \gamma_{17,i}\Delta lnP_{t-1} + \sum_{i=1}^{n} \gamma_{27,i}\Delta lnL_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{37,i}\Delta lnO_{t-1} + \sum_{i=1}^{n} \gamma_{47,i}\Delta lnW_{t-1} +$$
$$\sum_{i=1}^{n} \gamma_{57,i}\Delta lnC_{t-1} + \sum_{i=1}^{n} \gamma_{67,i}\Delta lnE_{t-1} + \delta_7 ECM_{7,t-1} + v_7$$
$$(12)$$

The vector error correction mechanism is very useful technique of econometric analysis since it not only provides information about the short run causality between the variables but also provides a profound insight about the long run causality between the variables. Granger causality test based on vector error correction block exogeniety test is applied in this present study. This multivariate test based on vector error correction offers additional information and channel for long run causality.[31] This information is ignored by Sims and Granger causality methods. In this method, joint significance of the coefficients of the lagged time series confirms long run causality. The χ^2test is at service to test the joint significance of these coefficients. Significance of the error term is checked by *t*-statistic. There are some diagnostic test to test the validity of the estimated models. Serial correlation LM test analyses the possible autocorrelation in the residuals. Jarque-Bera normality test is applied to check the normality of the error terms. The vector error correction residual heteroscedasticity test is also applied. After testing the validity of the model, vector error correction causality test is applied.

Results and Discussion
The ADF unit root test results are presented in Table 1. The all of the time series variables were found non-stationary at their level except bank credit to private sector but with constant and trend.

However, all of the variables were concluded to be stationary at their first difference. So the variables were I(1). The I(1) variables triggered our search for long run association among the time series variables. Johansen cointegration technique was applied to test the presence of long run relationship amongst the variables.

Table 1: Unit Root Test Results

Variable	ADF-Statistic					
	Level			1st Difference		
	None	c	ct	None	c	ct
lnP_t	-0.95	-2.32	-2.67	-2.80**	-2.90	-2.91
lnL_t	1.63	-0.14	-2.18	-0.53	-3.38**	-3.34
lnO_t	-1.54	-2.37	-4.73	-6.85**	-6.92**	-6.80**
lnW_t	-0.15	-1.55	-1.64	-5.23**	-5.17**	-5.10**
lnC_t	-0.63	-3.75	-3.99**	-4.83**	-4.78**	-4.70**
lnE_t	0.11	-2.83	-2.54	-6.40**	-6.39**	-6.43**
lnH_t	-1.60	-2.26	-2.57	-5.07**	-5.00**	-5.37**
Critical Value (5%)	-1.95	-2.94	-3.53	-1.95	-2.94	-3.54

Source: Authors' estimations.
Note: c stands for constant but no trend. ct stands for with constant and trend.
***denotes significance at 0.05 level.*

The VAR test was applied, before the identification of the cointegrating vectors, to select the optimum lag length. The SIC criterion was used to for the selection of optimum lag length of 2 for the cointegration test. The cointegration test results are reported in the Table 2. The null hypotheses of 'none', 'at most one', 'at most two', 'at most three' and 'at most four' cointegrating vectors in the favor of 'at least 5' were strongly rejected by the Trace test statistics at 0.05 level of significance.

The confirmation of cointegrating relationship implies that poverty, livestock output, official development assistance, workers' remittances, bank credit to private sector, education expenditure and health expenditure move together in the long run. The cointegrating vectors were normalized by the independent variable (given in Table 3).Poverty with respect to livestock output changes is highly elastic with one percent change in livestock

output leading to more than proportionate increase in poverty head count ratio in Pakistan. The results show poverty alleviating impact of livestock output. This result is supported by the economic theory. Majority of the population lives in rural areas in developing economies. Moreover, larger proportion of the rural and deprived masses also lives in these areas. Agriculture is the way of living for these landless and small rural people. Livestock is the major source of living and non-crop income for the rural people. Livestock sector provides about 55.1 percent of the agriculture value added in Pakistan economy.[32]

Table 2: Unrestricted Cointegration Rank Test (Trace Test)

Hypothesized No. of CE(s).	Eigen value	Trace Statistic	0.05 Critical Value	p-value**
None *	0.88	268.61	125.62	0.00
At most 1 *	0.85	191.98	95.75	0.00
At most 2 *	0.82	124.63	69.82	0.00
At most 3 *	0.60	62.86	47.86	0.00
At most 4 *	0.40	30.06	29.80	0.05
At most 5	0.27	11.42	15.49	0.19
At most 6	0.00	0.00	3.84	0.97

Source: Author
*denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon-Haug-Michelis (1999) p-values.
Note: Trace test indicates 5 cointegrating equations at the 0.05 level.

The official development assistance also helps to reduce poverty levels in Pakistan. Pakistan economy, like other developing economies of the world, is also a capital deficient economy characterized with low levels of per capita income and savings. The desired levels of investment cannot be fulfilled with the available meager domestic financial resources. Inflows of foreign aid can fulfill the saving-investment gap. Better and productive utilization of foreign aid can help to stimulate economic growth, generate employment opportunities and alleviate poverty in Pakistan economy. Ali and Ahmad[33] argue that aid may be beneficial for the growth in recipient economy but reliance on external aid may open the doors for higher levels of corruption and bad economic administration. As a result, the aid flows may become less productive in the recipient economy. The increased inflows of foreign capital in terms of aid and debt increase the

future liability of the recipient economy. The outflows of capital in terms of debt servicing have crowding out impact on domestic investment in Pakistan [38] [42].[34]

Table 3: Normalized Cointegrating Vector

Dependant Variable: lnP_t

Variables	Coefficients	Standard Error	t-value
lnL_t	-2.42*	0.71	-3.42
lnO_t	-8.55*	0.80	-10.73
lnW_t	-1.61*	0.42	-3.84
lnC_t	-19.71*	2.86	-6.90
lnE_t	-5.77*	1.56	-3.70
lnH_t	5.79*	1.12	5.16

Source: Authors' estimations.
significant at 5% level.

Inflows of workers' remittance help to reduce poverty in Pakistan. The household receiving the remittances spend this money to provide education and technical training, improved health services and improved nutrition to their family individuals. This works as investment in non-physical capital. Improvement in human capital increases the capability, ability, productive efficiency of the family members. The income of these individuals increase and the families can get rid of vicious cycle of poverty. Ali[35] concluded that workers' remittances reduce income inequality in Pakistan both in short run and long run. Financial development also provides opportunities for the low income families by opening the corridors of access to microcredit facilities for them. Bank credit to private sector may help the small investors and business to have more financial resources for their investment projects. This helps in generating the business and economic activities for the masses.

Education expenditure elasticity of poverty has the negative sign showing that increase in education facilities help alleviating poverty in Pakistan but the health expenditure elasticity has the positive sign. Poverty alleviating impact of education conforms to economic theory. The positive sign of the health expenditure draws attention to fact that the health services in Pakistan are poor biased. The lack of better health facilities in remote and rural areas is not fulfilling the requirements of the masses. It is the human capital that has been considered, in

economic theory, 'the active agent'. Health is the prerequisite for the increase in productivity. Education makes possible the people to absorb new and modern technology and improves the capacity of the people. Moreover, better and improved human capital provides a base for the sustained growth of the economy. Growth of the economy can make possible the attainment of goal of poverty free economy. Human capital is an important and core factor to stimulate economic growth of an economy. Education and health are considered to be the fundamental objectives of development.[36] Access to education facilities and improved health services important milestones on the way to development. The results of the study are in strong agreement with Ali[37] and Ali & Ahmad[38] that human capital (education and better health) helps in reducing poverty.

The relationship of I(1) cointegrated variables can be expressed as error correction mechanism. If the I(1) variables are cointegrated then there must exist at least unidirectional causality between the variables.[39] The error correction models (6) – (12) were estimated. After finding the error term of each model to be normally distributed, serially uncorrelated and homoscedastic, we have applied Granger Causality test based on the block exogeniety Wald test. The results of the test are given in the Table 4. The coefficient of error correction term in the poverty equation has the correct sign and it is statistically significant at 0.01level. The speed of adjustment is higher. About 44 percent of disturbances occurred in last time period are corrected in current time period. The system is stable. The significance of the error correction term implies that the independent variables Granger cause poverty in long run.

There is bidirectional causality between the poverty levels and livestock output in Pakistan. Bidirectional causality is also concluded between poverty and official development assistance. The poor economies are characterized with the lack of financial resources. These financial resources cannot fulfill the requirement of the economy of desired levels of investment in the economy. Low investment levels result in low growth and unemployment. The inflows of financial assistance make available the financial resources for investment. There is a unidirectional causality between poverty and workers' remittances and direction of causality is from remittances to poverty. This confirms the argument that an inflow of remittances not only provides the finance to households or families for the education, health and consumption but, at macro level, these inflows of foreign

exchange, through proper channels, have positive impact on the macroeconomic condition of the economy.

Unidirectional causality running from poverty to bank credit to private sector is concluded. Financial sector, in Pakistan, is not so developed in remote and rural areas of Pakistan. Poverty levels in remote rural areas are very high. People in remote areas are excluded from the economic activity as they have meager resources or no resources. The provision of microcredit facilities would help to fulfill the financial requirements of these people. This would be helpfulto stimulate economic activity and generate employment and source of income in these areas.The causality running from poverty to education expenditure is pointing out that the poor have limited access to the education facilities. Poor families have little money to send their children to school. The poor children are more likely to drop out from the school. Poor children remain absent from school due to bad health due to malnutrition and bad environment in which they live. Opportunity cost of these children to get enrolled in school is high.

Table 4: Granger Causality Based on Block Exogeniety Wald Test Results

Variable	Independent Variables						
	$D(lnP_t)$	$D(lnL_t)$	$D(lnO_t)$	$D(lnW_t)$	$D(lnC_t)$	$D(lnE_t)$	$D(lnH_t)$
$D(lnP_t)$	-	14.23* [0.00]	8.35** [0.02]	0.04 [0.98]	5.98** [0.05]	21.53* [0.00]	0.07 [0.97]
$D(lnL_t)$	6.32** [0.04]	-	2.99 [0.22]	0.34 [0.84]	7.88** [0.02]	35.06* [0.00]	8.97** [0.01]
$D(lnO_t)$	13.84* [0.00]	5.01*** [0.08]	-	3.83 [0.15]	4.05 [0.13]	0.09 [0.96]	0.06 [0.97]
$D(lnW_t)$	20.66* [0.00]	1.36 [0.51]	1.82 [0.40]	-	1.68 [0.43]	14.82* [0.00]	0.13 [0.94]
$D(lnC_t)$	0.06 [0.97]	4.03 [0.13]	8.03** [0.02]	1.86 [0.39]	-	14.15* [0.00]	1.11 [0.57]
$D(lnE_t)$	0.10 [0.95]	5.94*** [0.05]	0.38 [0.83]	0.89 [0.64]	1.22 [0.54]	-	0.25 [0.88]
$D(lnH_t)$	7.78** [0.02]	7.45** [0.02]	0.51 [0.78]	0.10 [0.95]	0.64 [0.73]	6.73** [0.03]	-
$\sum \chi^2$	42.32* [0.00]	17.89 [0.12]	29.17* [0.00]	7.70 [0.81]	24.22** [0.02]	87.25* [0.00]	14.64 [0.26]
[df = 12)							
ECT (-1)	-0.44* (-4.82)	0.02 (0.47)	0.63 (0.67)	0.54 (0.51)	0.21 (0.94)	0.69 (3.86)	-0.03 (-0.09)

Source: Authors' estimations.
 (**) denote significance at 0.01(0.05) level.
 ***shows significance at 0.10 level.*

Bidirectional causality between livestock output and education, and livestock output and health is also confirmed. Development in the livestock sector increases the income of the people and increases the income of the household. This increased income enables the household to get better education and better health services. On the other hand education enables the people to acquire and adopt new and modern knowledge about the animal husbandry. This in turn helps the poor people to increase and improve their livestock and dairy product output and earn higher incomes. Moreover, unidirectional causality is running from health to education. More education provides the additional knowledge about healthcare and nutrition of the household. More educated and learned people take care of the environment in which they live in. on the other hand, better health facilities improves the health of the individuals and make them more healthy and productive. More healthy children are less likely to absent or drop out from the schools. Better health care resulted in an increase in the productivity and efficiency is fruitful for the people to work, generate their income and get rid of poverty.

Conclusion

Agriculture sector being an important and major sector of the Pakistan economy provides foundations for the economic growth. Its contribution in the national GDP of the economy is more than twenty percent. About half of the labor force generates employment opportunities from this sector. Livestock sector is the fundamental subsector of agriculture sector. The contribution of livestock in the agriculture value added more than fifty percent. This sector contributes more than ten percent in national GDP and about nine percent exports earnings of the economy. Keeping in view the contribution of the livestock in the economy, this study is an attempt to assess the role of livestock sector in poverty alleviation in Pakistan for the period of 1972-2010. Official development assistance, workers' remittances, bank credit to private sector, education and health expenditure are also controlled in the model to assess the impact of these variables on poverty in Pakistan. Annual time series data has been used for the analysis. The time series econometric techniques of unit root test, Johansen cointegration and Granger causality test based on vector error correction have been used for the analysis.

Cointegration test confirmed the presence of long run relationship between poverty and livestock variable. All of the variables except health expenditure are found to have poverty

alleviating impact in the economy. All of the estimated poverty elasticities are statistically significant. Causality test results confirmed bidirectional causality between poverty and livestock, and poverty and official development assistance. Unidirectional causality from workers' remittance to poverty, poverty to bank credit to private sector, poverty to education expenditure, and health expenditure to poverty has been found. Moreover, there is bidirectional causality between livestock output and education and health expenditure and livestock. The estimated vector error correction models are statistically valid and stable. The results are evident that the betterment and management of livestock sector can be fruitful in generating growth, increasing the income levels, creating employment opportunities and alleviating poverty from the Pakistan economy.

Since more than half of the population, in Pakistan, lives in rural and backward areas. A larger proportion of masses directly or indirectly related to livestock sector. It is the need of time to develop livestock sector in Pakistan. Development in livestock sector would be beneficial in exploiting and managing the domestic and local resources. Increase in the education and training facilities would help to adopt modern genetic technology, new and better cattle healthcare techniques, use of high yield varieties of seeds and multicut varieties of green fodder and use of nourished feed for livestock. The extension of veterinary services in remote rural areas is desirable. Lack of financial resources is an impediment in the improvement of the livestock sector. The development of financial infrastructure in rural areas would help to extend the microcredit facilities in these areas. The availability of financial resources would enable the smallholders and livestock-owners to attain better healthcare facilities, veterinary services, and nourished fodder for their livestock.

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