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# Impact of Major Crops, Livestock and Labor Force Participation on Aggregate Productivity in Pakistan

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**Abstract**

Agriculture sector production plays an important role in promoting the economic situation of developing economies. This study investigates the relationship of major crops and livestock with gross domestic product (GDP) using time series data from 1993 to 2022. The study employed Auto-regressgive Distributed Lag (ARDL) model to find long run relationship between variables. The study found that wheat and cotton are found to have positive relation with the dependent variable. The output of sugarcane is found to have negative and insignificant impact on the dependent variable. Moreover, study finds that the output of livestock also has positive effect on aggregate productivity in Pakistan.

Key words: Major Crops, Livestock, Economic Growth, Wheat, Cotton, Pakistan

## 1. Introduction

Agriculture sector is considered as the backbone and the largest sector of Pakistan's economy. After the industrial revolution in 1970s, it has become the second largest sector for the economic

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growth in Pakistan. Majority of the population (both rural and urban) directly or indirectly depend on this sector. Workers depend on agriculture sector for livelihood, (Khan and Hafeez, 2017). It is the key sector to contribute in foreign exchange earnings. Agriculture sector productivity has been decreasing with the passage of time. The output of this sector is quite decreased due to unfavorable weather occurrences such as floods, droughts, high temperature, glacier melt as well as less attention of the government to the agricultural sector performance, (Rehman A et al., 2015).

Sustainable growth of agriculture sector is very important for rural development and food security in Pakistan. Growth in this sector is also important for the economic growth of the country, (Usman, 2016). The improvement in the agricultural production system enhances the food supplies, increases farm income and reduces consumer goods price. After COVID-19, there has been a rise in various commodities price that has further increased the significance of this sector.

Cotton is the one major crop of Pakistan. In 2011-2012, Pakistan's cotton production was being ranked as the 4$^{th}$ largest production with the 17% increase in production over the previous years. However, the area used to grow cotton has been declining over time. Major reason behind decline of cotton production is the genetic susceptibility of cotton germ plasm that is highly prone to disease and insect's attacks.

Similarly, sugarcane is the high-value cash crop of Pakistan used for the manufacturing of sugar related goods. It represents 0.7% of GDP and 3.4% increase in agricultural value. Sugarcane is the main source of biofuel (Robinson et al., 2011). Wheat is another major crop. Its output was affected by decline in cultivated area and yield in fiscal year (FY) 2022. Production of wheat crop observed a decline of 4.0% as compared to the last year.

Agriculture sector has a significant impact on the overall economic growth of our country. The study of impact of major crops and livestock on aggregate productivity holds a great importance for growing population and food security in Pakistan. Agriculture sector generates raw material that is being used in industrial sector. So, the industrial sector cannot grow without the growth of

agriculture sector. But, share of this sector is reducing with the passage of time. This is due to the reason that less attention is being paid to the sectoral performance over time. A sustainable development in agriculture sector requires high yielding varieties of common seeds, such as cotton, sugarcane, wheat as well as efficient use of modern physical and human capital. Therefore, it has become important to examine the contribution of agriculture sector and livestock in the overall productivity of Pakistan.

The objective of the study is to examine the impact of major crops on aggregate productivity of the country. Moreover, this study analysis the contribution of livestock production in the economy of Pakistan. Latest data set has been acquired to investigate the issue. The present study is different from previous studies that it examines the role of major crops and livestock together in the economy of the country. The study is based on time series data for the years 1993 to 2022. The study used ARDL and error correction estimation techniques to analyze the relationship between specified variables.

The study is organized as follows. In section 2, literature review is presented. Section 3 provides the data and methodology. The results and discussion are provided in section 4. Finally, conclusion and implication of the study are given in section 5.

## 2. Literature Review

This section corresponds to review of existing literature on the subject. A number of studies have been reviewed to shed light on the previous work done related to the issue.

Kurosaki (1999) provided a historical and comparative analysis of agriculture in India and Pakistan, focusing on productivity, crop mix, and impact of institutional changes. The research analyzed the growth performance of major crops in both countries and examined the crops composites. It highlighted the distinct turn around in agriculture shortly after partition in 1947, with both countries shifting towards more lucrative crops. The study also mentioned that the absolute level of achievement in term of per acre productivity and per capita production is not high as compared to the international standards.

Using a dual economy model, Dawson (2004) investigated the role of agricultural exports to economic growth in less developed countries (LDCs). The study examined data from the years

1974 to 1995 and developed a growth -source model using a panel data for 62 LDCs. The finding showed that lower-middle, and upper-income LDCs experienced significantly different structural patterns of economic growth. The study found that over 30% less marginal productivity exists in non-export sub-sectors than in corresponding export sub-sectors.

Similarly, Hye (2009) examined the dynamic relationship between Pakistan's industrial and agricultural output. The unrestricted error correction model (UECM) was used in the study to estimate the output relationship between agriculture and industrial sectors. The results suggested that agriculture output has a long-term significant impact on industrial output, while industrial output has both short-term and long-term impact on agriculture output.

Lopez and Dawson (2010) highlighted the importance of improving export promoting policies for both agriculture and non-agriculture sectors in underdeveloped countries for their economic progress. These studies collectively suggest that agricultural exports have a beneficial significance in the economic development of under-developed countries. The policies that aim to promote agricultural exports can contribute to higher economic growth rates.

Jatuporn et al. (2011) investigated the relationship between agriculture sector and economic growth in terms of trade (exports and imports) in developing economies. The study highlighted that the advancements in agriculture sector have helped developing nations to increase GDP. Likewise, Raza et al. (2012) examined the agriculture sector's contribution to economic growth of Pakistan. Findings show that crops and livestock contribute 91% in aggregate production while the contribution of fisheries and forestry are minimum because of low investment intensity and facilities. The paper applied simple regression model to identify the significant relationship of agriculture sub-sector with GDP. The finding indicates that sub-sector except forestry play a significant role in economic growth of the country.

Chandio et al. (2016) analyzed the impact of agriculture sub-sectors in the agriculture GDP of Pakistan using secondary data from 1998 to 2015. The relationship is estimated using Ordinary least square (OLS) showing the positive and significant contribution of agricultural sub-sectors to the agriculture GDP, except for the forestry sub-sector which had a poor share in overall production. The study suggested that government should intervene and introduce innovative agriculture technologies to improve the share of sub-sectors in the overall agriculture GDP.

Shafique (2017) compared the traditional farming methods used by illiterate farmers with the increasing automation in some areas and the impact on production and competition in the international market. The study analyzed the impact of agriculture sector on Pakistan's economy and highlighted the challenges faced by the agricultural sector and proposed possible solutions. The finding reveals that agriculture problems, such as limited water, poor management, and natural calamities, negatively affect Pakistan's economic growth and the total factor production. This leads to fluctuations in the country's GDP and a slowdown in economic growth. It also highlights the low yield per hectare in Pakistan due to use of old machines and techniques in farming.

A study by Khan (2020) examined the composition and efficiency of Pakistan's agricultural sector, attributing the sector's perilous situation to the state's policies and agents. The study demonstrated that the production and distribution of crop seeds and livestock breeds, legalization of private ownership of agricultural land, the transfer and adaptation of productivity enhancing technology, market structure and government regulations for agricultural products all are significant issues for public policy to improve the agriculture sector of Pakistan.

Khurshid et al. (2021) examined the relationship between agricultural exports and economic growth in under-developed countries. The finding indicates a positive relationship between agricultural exports and economic growth rate of under-developed economies.

Similarly, Abro (2022) conducted an empirical analysis of total factor productivity (TFP) of the agriculture sector and economic growth of Pakistan. The study highlighted key factors that affect agricultural TFP and economic growth in Pakistan from 1980-2018. The study found that increasing capital stock, skilled labor force and increase in cultivated land play an important role in agriculture sector of the country.

The detailed review of literature shows that previous research, for example a study by Kurosaki (1999) focused on major crop production in Pakistan and India. Likewise Rehman et al. (2017) explored the contribution of livestock production and population to agricultural GDP in Pakistan. The review indicates that previous research has mainly examined specific components of agricultural sector. However, these studies have not addressed the combined influence of major crops, livestock production, and labor force participation on economic growth in Pakistan. This

highlights a research gap in the existing literature. Therefore this study analyzed the combined impact of major crops, livestock production, and labor force participation on economic growth of Pakistan.

## 3. Data and Methodology

Data model and methodology are presented in this section.

### Description of Variables

#### Gross Domestic Product (GDP)

The GDP is calculated by adding the total value of all products and services produced inside boundaries over the course of a given year. Gross domestic product reveals the economic health of the economy. Higher productivity indicates higher resources available to the residents of the country. This also indicates that production is being done at larger scale in the country.

#### Wheat and Productivity

Wheat is important cereal product for many countries. This is an important food crop which also helps in the agriculture sustainability. It has significance in the aggregate agricultural production as well as overall production of the country. It plays a vital role in food security of the country. For example, in 2023, wheat contributed about 2% to GDP and 8.2% value added in agriculture.

#### Sugarcane and Productivity

Sugarcane is another important cash crop which plays a vital role in agricultural productivity of the country. In Pakistan, sugarcane is cultivated mainly in Punjab, Sindh and KPK. Sugar industries get raw material from the production of this crop. They provide employment to the millions of people in the country. In 2023, sugarcane contributed 0.9% to GDP and 3.7% to the value added in agriculture.

#### Cotton and Productivity

Cotton is another major crop of Pakistan. In 2011-2012, Pakistan considered the $4^{th}$ largest cotton production. With the passage of time, production of this crop has been declining. This may be due to less attention being paid to the yield of this crop. In 2023, cotton contributed 0.3% to GDP

and 1.4% value added in agriculture. Increased focus on the production of cotton may lead to higher yield and therefore higher contribution in overall performance of the sector.

**Volume of Export and Productivity**

It refers to the total quantity of goods being produced in one country and sold in another country. They are the services provided to the people of other countries by the people of domestic country. Such sellers of goods and services are called exporters. Those who buy these goods and services are called importers. Higher production of goods and services would result in higher magnitude of exports in a country. This would further lead to higher production level in the country.

**Gross Capital Formation and Productivity**

According to the World Bank, gross fixed capital formation includes total expenditures on adding fixed assets of the economy and net changes in the level of inventories. Fixed assets include land improvements, plants, machineries, equipment and construction of roads and buildings. Higher level of such assets indicate higher capital stock of the country.

**Labor Force Participation (LFP) and Productivity**

LFP is the proportion of working age population which is engaged in an economic activity in a country. This is an estimate of active work force of the economy. The total number of employed and unemployed individuals makes up the labor force. Labor force participation has an important contribution in the productivity of the country. That is, higher labor force participation leads to higher production level and therefore higher standards of living. According to Ahmad and Hafeez (2007) labor force participation through investment in human capital can lead to higher productivity and earnings. Similarly, women make vital contribution to agriculture and other rural activities. They also take part in livestock operations, Gondal (2003).

We develop following economic models to examine the impact of production of major crops and livestock on the aggregate productivity. Study is based on Usman (2016). Our models are specified as follow.

**Model 1: Major Crops and Aggregate Productivity**

$$GDP = \alpha 0 + \alpha 1 Cotton + \alpha 2 Sugarcane + \alpha 3 Wheat + \alpha 4 LFPR + \alpha 5 GCF + \alpha 6 VX + \varepsilon$$

E = error term

$\alpha 0$ is intercept term and $\alpha 1\ to\ \alpha 6$ are slope coefficients

**Model 2: Major Crops and Labor Force Participation**

$$LFPR = \alpha 0 + \alpha 1 Cotton + \alpha 2 Sugarcane + \alpha 3 Wheat + \alpha 4 GDP + \alpha 5 VX + \alpha 6 GCF + \varepsilon$$

Where; E = error term

$\alpha 0$ is intercept term and $\alpha 1\ to\ \alpha 6$ are slope coefficients

**Model 3: Livestock Production and Aggregate Productivity**

$$GDP = \alpha 0 + \alpha 1 Milk + \alpha 2 Beef + \alpha 3 Mutton + \alpha 4 LFPR + \alpha 5 VX + \alpha 6 GCF + \varepsilon$$

Where;

E = error term

$\alpha 0$ is intercept term and $\alpha 1\ to\ \alpha 6$ are slope coefficients

Table 1 indicates the description of variables.

**Table 1: Description of Variables**

| Variable Name | Data Source | Description |
|---|---|---|
| GDP | World development indicator (WDI) | Gross domestic product (current US$) |
| Cotton | Economic Survey of Pakistan | Production of Cotton (000 tons) |
| Wheat | Economic Survey of Pakistan | Production of Wheat (000 tons) |
| Sugarcane | Economic Survey of Pakistan | Production of Sugarcane |
| VX | World development indicator (WDI) | Export Volume index (2015=100) |
| GCF | WDI | Gross capital formation (current US $) |
| Beef | Economic Survey of Pakistan | Production of Beef (000 tons) |
| Mutton | Economic Survey of Pakistan | Production of Mutton (000 tons) |
| Milk | Economic Survey of Pakistan | Production of Milk (000 tons) |
| LFPR | WDI | Labor force participation in agriculture sector |

## 4. Results and Discussion

This section presents the empirical results and discussion.

**Model 1: Production of Major Crops and Aggregate Productivity**

Estimation results and discussion are given in this section. Unit root is an econometric technique that is used to examine the stationary of the variables. It is necessary to make the variables stationary for the estimation of the data. We have checked the unit root with Augmented Dickey-Fuller test. The results of unit root test are given in Table 2.

**Table 2: Result of Unit Root Test**

| Variable | Test statistics | Probability | Order of integration |
|---|---|---|---|
| GDP | -5.094788 | 0.0018 | I(1) |
| Wheat | -4.964676 | 0.0006 | I(0) |
| Sugarcane | -7.907621 | 0.0000 | I(1) |
| Cotton | -7.048680 | 0.0000 | I(1) |
| LFPR | -6.522892 | 0.0000 | I(0) |
| VX | -4.293314 | 0.0024 | I(1) |
| GCF | -4.435637 | 0.0017 | I(1) |

The findings demonstrate that variables including gross domestic product, sugarcane production, cotton production, volume of exports, gross capital formation are stationary at first difference. They are integrated of order 1. However, wheat production and labor force participation are integrated of order 0.

**Result of Autoregressive Distributed Lag (ARDL) Model**

Autoregressive distributed lag was presented by Pesaran and Shin (1999). ARDL is applied to the data which is integrated of both orders; order of I(0) and I(1). The variables included in this model are incorporated of different lag lengths.

**BOUND TEST:**

Bound test is employed to estimate the long-term relationship between variables. Table 3 shows the results of bound test.

**Table 3: Result of Bound Test**

| F-statistic | | 9.238048 |
|---|---|---|
| **Significance** | **Lower bound** | **Upper bound** |
| 5 percent | 2.27 | 3.28 |
| 1 percent | 2.88 | 3.99 |

According to the results, value of F-statistic is 9.238048 which is higher than upper bound and lower bound. Therefore, it can be concluded that there exists long run relationship between the variables in the model. Based on the bound test results, null hypothesis is rejected and demonstrate that there exists long-term relationship between major crops (wheat, sugarcane, cotton) and aggregate productivity. The results of the model in long run are given in Table 4.

**Table 4: Long Run Results of the Model for Major Crops and Aggregate Productivity**

| Variables | Coefficient | t-Statistic | Prob |
|---|---|---|---|
| Wheat | 3.085 | 4.110* | 0.015 |
| Sugarcane | -9.724 | -0.567 | 0.600 |
| Cotton | 1.850 | 4.488* | 0.011 |
| LFPR | 9.941 | 4.027* | 0.016 |
| VX | 4.200 | 1.494 | 0.209 |
| GCP | 12.526 | 5.536* | 0.005 |
| C | -3.3911 | -8.106 | 0.001 |
| R-square | 0.908 | | |
| Adjusted R-square | 0.804 | | |
| Durbin Watson | 2.0391 | | |

**Note**: *, **, *** show the level of significance at 1%, 5% and 10% level respectively.

Results of ARDL model presents that the probability value of the independent variables less than 0.05 indicate that there prevails significant impact of independent variables on the dependent variable. The results show that production of wheat places a significant impact on aggregate productivity in the long run, Wheat production as a main crop in Pakistan, contributes significantly to gross domestic product. This explains that increase in the productivity of wheat is likely to exert positive impact on the dependent variable. However, fluctuations in production due to factors like climate change vulnerability can negatively impact economic growth (World Bank, 2019).

Similarly, production of cotton also exerts significant and positive impact on gross domestic product in the long run. This result is supported by the findings of Rehman et al. (2019).

However, the relationship between sugarcane and the dependent variable is found negative and insignificant. Early sugarcane's modest development rate provides resources and space for inter-cropping in the field. Multiple studies have demonstrated that inter-cropping sugarcane with other crops, like peas, watermelon, and onions, can both greatly enhance economic income and lower sugarcane output. (Al-Azad and Alam, 2004; Nazir et al., 2002).

Labor force participation is likely to place higher impact on the productivity of the country. This shows that taking higher part in economic activity results in higher production level. LFP in agriculture has a significant impact on gross domestic product in the long run. That is, one percent increase in LFP leads to about 10 percent increase in the aggregate domestic productivity keeping other variables constant.

Similarly gross fixed capital formation has positive and significant contribution in the aggregate domestic product of the country. However, the volume of exports is found to have positive but weak impact on the dependent variable.

**Results of Error Correction Model**

This study also analysis the impact of major crops on the gross domestic product in the short run. The study employs error correction model to find the estimates in the short run. The assumption behind this is that if there exists co-integration among the variables, error correction in the short run will also occur. In the error correction model, the value of error correction term must lie between 0 and -1. The results of error correction model are given in Table 5.

The results of short run model indicate that wheat and cotton are likely to exert strong positive impact on the dependent variable. In the short run, a negative impression of sugarcane on GDP is found as in long run. Multiple studies have demonstrated that inter-cropping sugarcane with other crops, likes peas, watermelon, and onions can both greatly enhance economic income and lower sugarcane output. (Al-Azad and Alam, 2004; Nazir et al., 2002).

**Table 5: Result of Error Correction Model for Major Crops and Aggregate Productivity**

| Variable | Coefficient | t-Statistic | Prob. |
|---|---|---|---|
| Wheat | 2.962 | 10.192* | 0.001 |
| Cotton | 4.903 | 3.336* | 0.000 |

| | | | |
|---|---|---|---|
| Sugarcane | -3.008 | -5.262* | 0.006 |
| LFPR | -2.651 | -6.193* | 0.002 |
| VX | -1.441 | -5.363* | 0.003 |
| GCF | 5.621 | 1.190 | 0.000 |
| Cointeq(-1) | -0.437 | -14.256* | 0.000 |
| Adjusted R-square | 0.844 | | |
| Durbin Watson | 2.039 | | |

**Note:** *, **, *** show the level of significance at1%, 5% and 10% levels respectively.

**Model 2: Production of Major Crops and LFP**

ARDL bound test is used to determine the existence of long run relationship between variables. Results if bound test are given in Table 6.

**Table 6: Result of Bound Test**

| **F-statistic** | **3.692497** | |
|---|---|---|
| **Significance** | **Lower bound** | **Upper bound** |
| 5 percent | 2.37 | 3.38 |
| 1 percent | 2.98 | 3.89 |

The results of bound test show that there exists long run relationship between the variables. Therefore long run results are estimated and given in Table 7.

The estimated results indicate that production of cotton has a negative and statistically significant impact on LFP in the long run. The negative and significant relationship between cotton production and labor force participation occur due to increased mechanization in the cotton industry leading to reduce the demand for manual labor which can contribute to unemployment and underemployment among agricultural workers (Dorosh & Rashid, 2013; Khan & Rafiq, 2020). However, wheat production has a significant and positive impact on LFP in agriculture sector in the long run. That is, 1 unit increase in production of wheat leads to about 0.3 unit increase in LFP in agriculture sector keeping other variables constant. Moreover, production of sugarcane exerts a significant impact on LFP in agriculture in the long run.

**Table 7: Long Run Results of the Model for Major Crops and Labor Force Participation**

| Variable | Coefficient | t-Statistic | Prob. |
|---|---|---|---|
| Cotton | -0.0001 | -2.664* | 0.0373 |
| Wheat | 0.0028 | 4.155* | 0.006 |
| Sugarcane | 0.0027 | 0.099 | 0.925 |
| GDP | 0.0090 | 2.566* | 0.042 |
| VX | -0.0009 | -4.226* | 0.006 |
| GCF | -0.0009 | -4.553* | 0.004 |
| Constant | 0.3491 | 3.969 | 0.007 |
| R-square | 0.90887 | | |
| Adjusted R-square | 0.6046 | | |
| Durbin Watson | 2.3619 | | |

**Note:** *, **, *** show the level of significance at1%, 5% and 10% levels respectively.

Similarly, the result of variable for gross domestic product exerts a significant and positive impact on LFP in the long run. It has been found that 1 unit increase in the aggregate domestic product is likely to increase LFP in agriculture sector by 0.009 units keeping other variables constant.

Export is found to have a significant impact on LFP in the long run. However, the trend is found negative. This may be due to adaptation of labor-saving technologies and shifts towards export-oriented agricultural production which often requires less labor-intensive practices. Thus reducing the demand for agricultural labor (Dorosh & Rashid, 2013; Diao et al., 2018). Likewise, capital formation has a negative and statistically significant impact on LFP in the long run. The results of major crops and labor force participation in short run are given in Table 8.

**Table 8: Results of Model for Major Crops and Labor Force Participation in Short Run**

| Variable | Coefficient | t-statistic | Prob. |
|---|---|---|---|
| Cotton | 0.0002 | 6.919* | 0.001 |
| Wheat | 0.0035 | 6.563* | 0.001 |
| Sugarcane | 0.0003 | 4.409* | 0.001 |
| GDP | 0.0003 | 6.594* | 0.001 |
| VX | 0.0070 | 0.920 | 0.001 |
| GCF | 0.00002 | 5.750* | 0.001 |
| CointEq (-1) | 0.2054 | -6.832* | 0.000 |
| R-square | 0.895 | | |
| Adjusted R-square | 0.7904 | | |
| Durbin-Watson stat | 2.3619 | | |

**Note:** *, **, *** show the level of significance at1%, 5% and 10% levels respectively.

**Model 3: Impact of Livestock Production on Aggregate Productivity**

The results of unit root test are given in Table 9. Unit root is an econometric technique that is used to examine the stationarity of data. It is necessary to make the variables stationary for the estimation of the data. The study has tested the presence of unit root with the help of Augmented Dickey-Fuller (ADF) test.

The finding shows that variable including GDP, production of mutton, production of milk, volume of exports and gross capital formation are stationary at first difference. That is they all are integrated of order 1. However, beef production and labor force participation are integration of order 0.

The results of bound test indicate that there exists long run relationship between the specified variables. Therefore, autoregressive distributed lag model is applied to find the results of the model for livestock and productivity in the long run.

**Table 9: Result of Unit Root Test**

| Variable | Test statistics | Probability | Order of integration |
|---|---|---|---|
| GDP | -5.095 | 0.002 | I(1) |
| Beef | -8.414 | 0.000 | I(0) |
| Mutton | -4.7945 | 0.009 | I(1) |
| Milk | -17.183 | 0.000 | I(1) |
| LFPR | -6.523 | 0.000 | I(0) |
| VX | -4.293 | 0.002 | I(1) |
| GCF | -4.436 | 0.002 | I (1) |

The results of the model for livestock and productivity are given in Table 11. Results of the ARDL model indicate that the production of beef places a positive and significant impact on GDP in the long run. Similarly, production of mutton also exerts a significant and positive impact on GDP in the long run. That is 1 unit increase in the production of mutton leads to about 4 unit increases in GDP in Pakistan.

Bound test is applied to the data in order to examine whether or not long run relationship prevails between the variables. The results of bound test are given in Table 10.

**Table 10: Result of Bound Test**

| F-Statistic | 26.55537 | |
|---|---|---|
| **Significance** | **Lower Bound** | **Upper Bound** |
| 5 percent | 2.47 | 3.38 |
| 1 percent | 2.87 | 3.85 |

It has been found that production of Milk has a significant impact on GDP in the long run. However, the trend is negative. This may be due to various factors such as inefficient supply chain management, lack of infrastructure, and limited market access, leading to under-utilization of the sector's economic potential (Memon et al., 2014; Nazli & Haque, 2015). Additionally, reliance on traditional and small-scale dairy farming methods may limit productivity gains and overall contribution to GDP growth.

Gross capital formation has a significant effect on GDP in the long run. However, exports have a negative and statistically significant impact on GDP. That is, 1 unit increase in volume of exports leads to about 2 units decrease in GDP. This may be due to limited infrastructure, lower productivity, and domestic demand prioritization. Challenges in meeting international quality standards and trade restrictions can further impede the competitiveness of livestock products of Pakistan in the global market.

**Table 11: Long Run Result of Model for Livestock and Aggregate Productivity**

| Variable | Coefficient | t-Statistic |
|---|---|---|
| Beef | 3.421 | 1.833** |
| Mutton | 4.431 | 2.033* |
| Milk | -2.071 | -2.085* |
| LFPR | 1.911 | 1.848** |
| VX | -2.210 | -1.858** |
| GCF | 3.707 | 1.489 |
| Constant | -8.291 | -1.858** |
| R-square | 0.9957 | |
| Adjusted R-square | 0.8928 | |
| Durbin Watson | 2.6141 | |

**Note:** *, **, *** show the level of significance at1%, 5% and 10% levels respectively.

## 5. Conclusion and Policy Recommendation

This study was conducted to examine the impact of major crops and livestock production on economic growth in Pakistan based on the time series data over the time period of 1993 to 2022. The data were collected from Economic Survey of Pakistan and WDI. The ADF unit root test, ARDL method and error correction techniques were applied to analyze the data.

Major crops include cotton, wheat and sugarcane. The output of livestock includes productivity of beef, mutton and milk. The volume of exports, gross capital formation and labor force

participation are used as controlling variables for the specified models. The results illustrate that there prevails significant relationship of major crops and livestock with the aggregate productivity. The results show that output of cotton, and wheat have a positive and significant relationship with GDP in long run. While the output of sugarcane has a negative and insignificant relationship with GDP in long run. Similarly, output of beef and mutton explains positive and significant association with the dependent variables. However output of milk exhibit a significant but inverse relationship with GDP.

**Recommendations**

On the basis of empirical finding some policy implementation in Pakistan.

- For sustainable agricultural sector development, there is a need of paying more attention to improve the yield of major crops and livestock productivity.

By implementing these policies, Pakistan can harness the potential of its agriculture sector, including major crops and livestock to drive aggregate domestic product, and enhance food security for its population.

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