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Determinants of Agricultural Share in GDP: Evidence from Pakistan

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Abstract

For the economic development of a country, agriculture development is considered a significant factor. The study's main purpose is to estimate the effects of different factors affecting the share of agriculture in Pakistan's GDP. For this purpose, secondary data for the period from 1990 to 2020 was taken from the World Bank and Economic Survey of Pakistan. The Ordinary Least Square (OLS) technique was used for the analysis. Study shows that different factors significantly impact the share of agriculture in GDP. Inflation has a negative relationship, and the exchange rate has a positive relationship with the share of agriculture in GDP. Imports of pesticides and agricultural raw materials have a direct relation, and agriculture credit has an inverse relation. The government should formulate policies to increase the share of agriculture in GDP. Agriculture can play a positive role in the national income, control inflation in the country, and make exports and imports beneficial for Pakistan's economy.

Keywords: Agriculture, Share, GDP, Determinants, Pakistan

Introduction

Agriculture is critical to the growth and development of every nation. There can be no economic progress or food security in the nation without a strong agricultural industry. This is especially true in rural areas. Reduced farmland, climate change, water scarcity, and high population and labor shifts from rural to urban regions have all slowed agricultural development. In order to increase agricultural production, new ways must be used. It may play a crucial role in promoting economic development if it has strong links to the secondary and tertiary industries. On the other hand, this industry has remained vulnerable to a variety of threats, including climate change, temperature fluctuations, water scarcity, shifts in precipitation patterns, and increases in input costs (GOP, 2021). Technology has a significant impact on a wide range of industries. It also has a major impact on the economy of any nation because of its function in agriculture, particularly in nations where agriculture accounts for a significant share of GDP. Changes in the agriculture sector might spark a shift from an agricultural-based to an industrial-based economy. A rise in agricultural production leads to a rise in the economy's industrialization, which permits more people to work in the economy. A country's long-term economic success is directly linked to its agricultural sector's ability to produce more food. Like that of the rest of the economy, Agriculture's growth engine is technical advancement, particularly in emerging nations. Progress in agricultural technology contributes significantly to farm income in both the direct and indirect sense. Exports of agricultural goods are also a major source of foreign income. Considering Pakistan is a labor-intensive nation, a rise in economic investment at home should increase job possibilities. To become self-reliant on crops, it can export and enhance its revenues by cultivating the land using contemporary ways, Pakistan has to keep up with technological advancements and adapt to new methods, according to the conclusions of the research (Hashmat & Ghousa, 2019).

The two harvest seasons in Pakistan are referred to as "Kharif" and "Rabi," respectively. Rice, sucrose, maize,

and jowar are some of the crops grown during the Kharif season. Wheat, tobacco, gram, and barley are among the crops harvested during the Rabi season. Farming relies heavily on both the summer and winter seasons. Pakistan's economy relies heavily on agriculture. Growth of 2.77 percent above the aim of 2.8 percent in the agricultural sector in 2020-21 is generally promising. 4.65 percent of the year's most significant crops (wheat, rice, sugarcane, maize, and cotton) have grown this year. Improvements were seen in the production of main Kharif crops such as sugarcane, maize, and rice in 2020, which exceeded output objectives. In comparison to the previous year, "Rabi's" most significant crop, wheat, grew by 8.1 percent and achieved a record-high output level of 27.293 million tonnes (GOP, 2021). A majority of the population relies on agriculture for their livelihoods, both directly and indirectly, which means not just reducing poverty but also creating an elevation in the economic model of the people via agriculture (Aldosari et al., 2017).

For many nations, technological advancements have significantly impacted their growth during the last several decades. Technology has an important role in advancing social and economic progress among the educated and well-educated populace. Because of the complicated relationship between economy, society, environment, and technical information, dealing with technological innovation necessitates a multidisciplinary approach and skillful communication. Developing nations' inability to fully integrate technology into their everyday lives has been the primary cause of their persistent underdevelopment up to this point. A variety of factors are leading emerging nations to demonstrate their progress in science and technology (Hashmat & Ghousa, 2019). Sustainable development relies heavily on agriculture. As a result, it aids in the alleviation of hunger and poverty in underdeveloped countries. Food security and economic prosperity are intertwined in Pakistan's agriculture industry. However, as compared to other parts of the globe, this industry has underperformed in recent years, resulting in rising levels of poverty and unemployment. There is a growing tendency in the national population and Punjab in particular. As the population grows, so does the need for food (Ali et al., 2021).

Usman (2016) analyzed agriculture's contribution to Pakistan's GDP growth rate. Major crops, livestock, and other crops that contribute to the agricultural sector are among the study's key factors. The findings also show how much the agriculture sector contributes to Pakistan's GDP growth rate. The vast majority of this research relies on secondary sources, and the time period covered by the study is 25 years ago (1990-2014). The researcher used a regression model to support their findings. Our findings demonstrate a substantial connection between the agricultural sector and economic growth in our variables. There is also evidence that important crops and many other crops have a considerable influence on the agricultural industry and on the country's gross domestic product (GDP). In addition to being a key component of agriculture, livestock also plays a vital role in the industry. Ajmair (2018) studied the importance of the agriculture sector in Pakistan's economic growth and found determinants of the output of agriculture in Pakistan based on empirical literature on relevant determinants of the agriculture sector. In this study, data was used from 1976 to 2014. For estimation of results, regression is used in a methodology that justifies the use of the Kalman filtering approach. This study shows that agriculture growth positively affects permanent cropland and gross fixed capital formation and negatively affects remittances. The policy recommendation of this research motivates investors to invest in agriculture and enlarges gross national expenditure on the agriculture sector. Government must give incentives to farmers to cultivate cash crops for better profits.

Ahmed et al. (2017) studied food security dependence upon agriculture total factors of productivity and identified factors and determinants of agriculture growth in Pakistan. Describe the role of agriculture, such as the agriculture sector providing food, providing raw material to the industrial sector, and industry providing machinery, fertilizer, and pesticides to the agriculture sector. The agriculture sector is a source of foreign exchange earnings and raises incomes of the villagers and farmers, and helps to induce poverty in the country. The authors used an autoregressive lag model to estimate the result using time series data from 1965 to 2009. According to the results, fertilizer is the most important determinant of growth and secondly, human capital is the next important factor in agriculture growth. Simply four factors: human capital, fertilizer, agriculture credit, and area under cultivation, are important factors for agriculture growth. Policy implementation is that the government should provide fertilizer timely and cheap and educate farmers on efficient cultivation techniques and easy supply of credit. Shahbaz et al. (2016) analyzed the relationship between financial

development and energy consumption in the agriculture sector and economic growth over the time period of 1972 to 2011. Autoregressive distribution lag (ARDL), a bound testing approach to cointegration, assuming structural break, confirms cointegration techniques are used for estimation. Results show that energy resources are a very important factor in economic growth and in agriculture productivity. And there is a positive and significant impact of financial development on economic development and energy consumption. When agriculture growth increases, it also increases energy demand for production purposes. Policy implementation of this study is that the government should formulate appropriate policy for energy provide and develop a system that attracts investors in the economic and agriculture sectors.

Sattar (2012) analyzed a variety of constricting variables that have a negative influence on Pakistan's agricultural production. Farmers must deal with long-term issues that have a detrimental influence on their farms' per-acre yields. High input costs, a disproportionate load on farmers from loans, soil degradation, a shortage of irrigated water, a lack of suitable infrastructure, and low-quality raw materials are some of the contributing reasons. Interviews were conducted with a total of N=365 farmers using a multistage sampling method. To assess the validity of the empirical findings, a semi test (Chi-square) was run on the data. Therefore, the researcher instigated this study to show that low agricultural productivity in Pakistan is primarily caused by an inadequate supply of credit facilities, the use of outdated agricultural methods on farms, and diverse natural constraints (such as biodiversity, land degradation, and climate fluctuations). The researcher concludes that Pakistan's farmers face major challenges related to agricultural output due to soil salinity, water logged soil, pesticide attacks on crops and soil erosion. Pakistan's agriculture industry is composed of challenges, including improving farm management methods, changing agricultural reforms, and providing farmers with enough financial and water resources.

Rehman et al. (2016) analyzed the link between gross domestic products (AGDP) and factors such as the area under cultivation, fertilizer use, credit distribution, and freshwater in Pakistan. They have used time-series data from secondary sources such as the National Statistics Office, Statistical Year Books, and the Pakistan Economic Survey. The author examined data spanning the years 1978 to 2015. Data were analyzed by using the Phillips-Perron (P-P) and Augmented Dickey Fuller (ADF) test, and results were interpreted by using the Johansen cointegration test. The Cobb-Douglas Production Function was used to examine the impact of these major factors on agricultural productivity in Pakistan. Results show that fertilizer consumption, improved seed distribution, and credit distribution had a positive and significant influence on AGDP, whereas water availability had a negative but insignificant influence on AGDP. Based on the results, the suggestion is that the Government of Pakistan should formulate policies and funding schemes to develop and improve water availability, including irrigation systems.

Ahmad and Heng (2012) identified determinants of agriculture productivity growth in Pakistan by employing an autoregressive distributed lag model for the time series data from 1965 to 2009. Results show that fertilizer is the most important determinant, with long-run and short-run elasticity of 0.16 and 0.20, respectively. Human capital is the next important determinant with 0.14 and 0.09 long-run and short-run elasticity. Agriculture credit has relatively lower short-run and long-run elasticity of 0.06 and 0.1, respectively. The area under crops is insignificant in both the short-run and long-run. Ghafoor and Aslam (2015) investigated the impact of agriculture productivity on economic growth. A secondary data source covers the time span from 1972 to 2012. Estimating economic growth was done via the use of the auto-regressive distributed lags approach (ARDL). Some of the variables considered in this study are net national product per individual gross capital creation, hired labor force, inflation, trade, openness, and agricultural value-added. While all other factors positively impact economic growth, inflation has a negative one. Because of this, it's been concluded that the government should focus on expanding employment opportunities for those with higher education, both in agriculture and the industrial sector.

Akmal et al. (2012) studied that agriculture was practiced on land when crops were grown, animals were reared, and food was produced for humans and industry. Nonetheless, credit serves as the primary source of funding for all operations. Most emerging nations relied heavily on borrowing to expand their economies. This research aims to examine the effect of agricultural lending on economic development. Secondary data from 1970 to 2010

was used to examine the impact of water availability, labour availability, and crop intensity on agricultural GDP. Agricultural credit must be distributed to encompass all elements of agricultural activity, such as main and minor crops, horticulture, and animal production. More research is needed on the influence of credit on food grain products, exportable primary goods like cotton, and so on and so forth.

Rani and Kumar (2021) examined the structure of agriculture productivity and crop diversification across different zones in Punjab, India, during 1966–1967 to 2017–2018. The composition entropy index demonstrates that practically all zones are concentrated in a few crops, while some are less or more. As a result, crop specialization occurs lateral to agricultural diversification in discovered zones. Crop diversity is positively impacted by market and transportation accessibility, as well. As a result of increased usage of fertilizer, irrigation intensity, and rainfall, crop variety has decreased. The study also looked at the elements that contribute to regional productivity variations, such as improved roads, fertilizer use and urbanization, and a higher level of literacy and crop yield. Analysis shows that agro-climatic regional preparedness is needed by clearly recognizing the current resource endowments and restrictions in agro-climatically homogenous areas.

Methodology

In this research, secondary data will be used for analysis results. Secondary data is obtained from the economic survey of Pakistan and World Bank indicators. The ordinary least square technique is selected for the estimation of results and estimations of an unknown parameter. Linear regression analysis is used in the methodology.

This model is belonging to secondary data. Secondary data is obtained from economic survey of Pakistan and World Bank Indicator. The model estimated the effects of different factors affecting the share of agriculture in GDP of Pakistan. Regression equation of this model is following:

$$LnGDP= \alpha + \ln(\beta_1 I) + \ln(\beta_2 ER) + \ln(\beta_3 AC) + \ln(\beta_4 P) + \ln(\beta_5 E) + \ln(\beta_6 AREA) + \ln(\beta_7 OPW) + \ln(\beta_8 OPR) + \ln(\beta_9 ARMI) + \epsilon \quad (1)$$

Variables used in the model are given below.

GDP= GDP as share of agriculture (% of GDP)

I= Inflation (consumer prices (annual %)

ER= Exchange rate (Pakistan Rupees in Terms of dollar)

AC= Agriculture credit (Rs billion)

P= imports of pesticides (oooN/Tonnes)

E= agriculture employment (%)

AREA= Irrigated area (Million Hectares)

OPW= Output price of wheat (% share)

OPR= Output price of rice (% share)

ARMI= Agricultural raw materials imports

Explanation of Variables

GDP (share of agriculture): The total agriculture production in any country is called share of agriculture. Share of agriculture plays an important role in economic development in the form of crops yields, productivity of animals and provide employment. As increase in food production, real prices of food has fallen, so it is also control inflation of an economy (Blandford, 2011). Data of this variable obtained from World Bank indicator.

Inflation: Inflation is an increase in the general price level of goods and services in an economy of a country. With inflation, the ability to buy currency decreases over time. Inflation is the most important factor. Data of inflation is obtained from World Bank Indicator.

Exchange rate: The value of one country's currency in terms of another country's currency is called the exchange rate. The exchange rate is a very important factor in determining agriculture products, and a country trades able agriculture products linked with an exchange rate of that country with trading partner's countries. Data of exchange rate is obtained from World Bank Indicator.

Agriculture credit: Agriculture credit is a strategy to get resources for crop production. Which increases the standard of living of pure rural farmers and agriculture credit plays an important role in economic

development in the form of investment for farmers. Data of agriculture credit is obtained from economic survey of Pakistan.

Imports of pesticides: Pesticides are used to kill different types of pests that harm crops and plants life. Imports of pesticides are very important for agriculture productivity. Data of pesticides is obtained from economic survey of Pakistan.

Agriculture employment: Agriculture employment is persons who engaged in any farming activity to produce goods for pay or any type of profit. Employment is a very important factor for agriculture productivity because more people working in the field results from more production and efficiency also increase in the agriculture sector in the economy. Data of agriculture employment is obtained from World Bank Indicator.

Irrigated area: Irrigated area means the area of a country that is used for the production of the agriculture sector or area which is cultivated through the different types of sources for agriculture crops. More area cultivation results from more increase in production of crops, so irrigated area also an important factor for economy of any country. Data of irrigated area is obtained from economic survey of Pakistan.

Output price of wheat: Prices of wheat that can be sold in the market for household consumption purposes. Date of prices of wheat is obtained from economic survey of Pakistan.

Output price of rice: Price of rice that can be sold in the market for household consumption purposes. Date of prices of rice is obtained from economic survey of Pakistan.

Agricultural raw materials imports: Agriculture raw material that can be imported from other countries for farming. Date of raw material imports is obtained from economic survey of Pakistan.

Results and Discussion

In this section estimate the effects of important determinants of economic growth as share of agriculture. The importance of agriculture for a country's economy can be viewed in three ways: First, it provides food to consumers, second it is a source of foreign exchange and third, it provides a market for industrial goods. Over the time, structure change of an economy of a country due to technology transfer in agriculture sector. Inflation, exchange rate, agriculture credit, imports of pesticides, agriculture employment, irrigated area, output price of wheat and rice and agriculture raw materials are independent variables and GDP growth as share of agriculture income is dependent variable. For analysis time series data is used from 1999 to 2020 taken from economic survey of Pakistan and World Bank indicators.

Pakistan

Table 1. Descriptive statistics.

Variables	Mean	Median	Maximum	Minimum	Std.Dev.	Skewness	Probability
GDP	1.367641	1.363291	1.408533	1.334614	0.018357	0.573782	0.425454
Inf	0.873191	0.956751	1.307199	0.403005	0.231045	0.491242	0.377984
ER	1.800933	1.782718	2.209434	1.377381	0.234092	0.175961	0.593938
AC	5.076734	5.138221	6.084463	4.160739	0.640064	0.028205	0.317097
PES	4.393321	4.444263	4.618686	4.082785	0.152366	0.568601	0.314555
EMP	4.393321	4.444263	4.618686	4.082785	0.152366	0.568601	0.878094
AREA	1.26564	1.273233	1.302331	1.224015	0.022528	0.453944	0.303306
OPW	1.561542	1.590842	1.62634	1.432167	0.060299	0.885757	0.084232
OPR	1.158178	1.162564	1.251395	1.020775	0.060016	-0.360057	0.485557
ARMI	0.637446	0.628453	0.775738	0.509585	0.069525	0.410063	0.497446

Table 1 revealed descriptive statistics of the model. Mean is average of a data set and medium is middle of the set of the number. Maximum is the maximum value of a variable and minimum is the minimum value of all variables. All values of standard deviation are small which show that data is clustered around the mean of all variables.

Table 2. Unit Root Test (ADF) test.

Variables	level		1st Difference	
	C	C and Intercept	C	C and Intercept
GDP	0.6352	0.2130	0.0000	0,0001
Inf	0.4948	0.2243	0.0000	0,0001
ER	1.0000	0.8736	0.0121	0.0043
AC	0.9884	0.9145	0.0061	0.0032
Pes	0.8245	0.0994	0.0000	0.0000
Emp	0.2585	0.2010	0.0000	0.0000
Area	0.9590	0.4220	0.0000	0.0000
OPW	0.8505	0.2663	0.0000	0.0000
OPR	0.7180	0.1745	0.0000	0.0000
ARMI	0.7868	0.0006	0.0000	0.0000

Table 2 shows probabilities value of all variables, which revealed that the probabilities value are less than 0.05 at the 1st different. The unit roots results of the Augmented Dickey-Fuller test are presented in Table. The table shows the results of all variables in level form and, at first, the difference between trends and without trends. To determine the order of integration, we also applied ADF unit root test to examine the variables in their first differences. The null of stationary is accepted for all the variables for their first differences. The ordinary least squares (OLS) technique is used in estimation.

Table 3. Ordinary Least Square results.

Variable		Coefficient	Std. Error	t-Statistic	Prob.
Constant		0.600075	0.450973	1.330621	0.1976
Inflation	LN(I)	-0.034720	0.013918	-2.494576	0.0210
Exchange rate	LN(ER)	0.152725	0.054461	2.804327	0.0106
Agriculture credit	LN(AC)	-0.062505	0.025335	-2.467179	0.0223
Imports of pesticides	LN(P)	0.036161	0.030097	1.201464	0.2429
Agriculture employment	LN(E)	0.304316	0.142898	2.129609	0.0452
Irrigated area	LN(AREA)	0.413723	0.458790	0.901770	0.3774
Output price of wheat	LN(OPW)	-0.107221	0.094227	-1.137896	0.2680
Output price of rice	LN(OPR)	-0.164379	0.054523	-3.014854	0.0066
Agricultural raw materials imports	LN(ARMI)	0.020479	0.040126	0.510369	0.6151
R-squared	0.617258	Durbin-Watson stat		1.9575	
Adjusted R-squared	0.453226	Prob (F statistic)		0.0058	

Dependent variable: GDP (share of agriculture).

Table 3 shows that from the nine basic independent variables four variables are not significant. Imposts of pesticides, irrigated area, agriculture raw material imports and output price wheat are not significant impact on the economic growth. Value of R2 show that 0.61% variation in economic growth due to independent variables, as show in table. The adjusted R2 value is measurement adjusted for degree of freedom and 45% show that dependent variables is influenced 55% through the independent variables, keeping remaining factors constant for time. The value of Durbin-Watson statistics 1.95 shows that there is no autocorrelation in the data. The F-statistics explore that overall model is significant.

Results revealed that inflation has significant impact on economic growth but negative relation. Table show that if one % increases in inflation there will be 0.03 % decrease economic growth. Reverse relation between inflation and economic growth. Exchange rate has significant impact on economic growth and positive relation. Table show that if one % increases in exchange rate there will be 0.15 % increase in economic growth. Significant impact of agriculture credit on economic growth but results shows that reverse relation. Results

show that if one % increases in agriculture credit there will be 0.06 % decrease in economic growth. Agriculture employment has significant impact and positive relation with economic growth. Results show that if one % increases in agriculture employment there will be 0.30 % increases in economic growth. Output price of rice has also significant impact but reverse relation with economic growth. Results show that if one % increases in output price of rice there will be 0.16 decreases in economic growth.

Conclusions and Recommendations

In the fourth part of the results, estimate the influence of different economic factors on the GDP as a share of agricultural income. Inflation has an inverse relation with DGP, inputs that are used in farming is very important for farmers, but when input price inflation creates flow problems for farmers, they cannot use such inputs in farming, because this inflation decreases the productivity of land and has negative impact on GDP agriculture share. Changes in the exchange rate affect the competitiveness of our agricultural trade because they indicate a relative change in the prices of goods traded in other countries. About half of the real value of US agricultural exports can be attributed to changes in the exchange rate. So, the exchange rate and GDP have a positive relation. Agriculture credit has inverse relation with GDP because farmers in Pakistan take loans from bank for agricultural propose but do not use them for farming and use this agriculture loan for other purposes. Imports of pesticides have a positive relation with GDP; through used of different types of pesticides, agriculture productivity increases the participation of agriculture factors is positive in GDP. Agriculture employment has direct relation with GDP, more population of the country becomes involved in agriculture, agriculture share increase in GDP. Irrigated land also a very important factor with direct relation with GDP, more cultivable land of the country is used, the income will increase in the development of the country. Outputs prices of wheat and rice have inverse relation with GDP, because when prices of wheat and rice go up, people will buy it less. Agriculture raw material imports has a positive relation with GDP; when good agricultural raw material imports in the country, farmers will have more opportunity to benefits from it and national income also increase.

Government should control inflation through economic policies and subsidize important agricultural inputs such as fertilizers, seeds and pesticides so that poor farmers can easily access inputs. Farmers should be encouraged to grow permanent crops for better profit. Through print and electronic media, the government should sensitize rural farmers on the proper use of fertilizers, pesticides and other products.

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