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IMPACT OF AGRICALUTURE ON ECONOMIC GROWTH OF PAKISTAN

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Abstract
This study investigates the dynamic relationship between agriculture and economic growth in Pakistan using annual time series data from 1976 to 2014. Employing advanced econometric techniques including the Augmented Dickey-Fuller (ADF) test, Johansen co-integration, and the Vector Error Correction Model (VECM), the research evaluates both the short-run and long-run associations among key macroeconomic variables: agricultural value added, GDP, foreign direct investment (FDI), trade openness, and energy use. The findings confirm that all variables are integrated of order one, and Johansen's co-integration test reveals a long-term equilibrium relationship among them. The VECM analysis further indicates a significant short-run adjustment mechanism with a speed of convergence of 73% toward long-run equilibrium. The overall model exhibits strong explanatory power with an adjusted R-squared of 68%, and diagnostic tests confirm the stability and reliability of the model. The results empirically validate the hypothesis that agriculture plays a statistically significant role in influencing economic growth in Pakistan. Based on these insights, the study recommends targeted policy interventions aimed at enhancing agricultural productivity, expanding public investment, and integrating agriculture more effectively with industrial and trade sectors to support sustainable economic growth

Keywords: Agriculture Sector, Economic Growth, Pakistan Economy, Vector Error Correction Model (VECM), Co-integration, Agricultural Productivity

Introduction

The agriculture sector has been uninterrupted engaged in the reconstruction of Pakistan's economy since independence. In the early time period, it was considered a dominant sector, but due to declining its performance due to the political, social, environmental and climate conditions its production yield has gone down gradually and now it is the second largest sector in Pakistan. It accounts for over 21 percent of GDP, and 45 percent of the total labor force is engaged in this sector. Around 63 percent of the country's population lives in rural areas is indirectly or directly linked to this sector for their livelihood. The agriculture sector has a strong linkage with the rest of the economy that is unnoticed in statistics. On the Other hand, it is the primary supplier of raw materials to downstream industry, which contributes significantly to Pakistan's export; it is the largest market for industrial manufactured goods such as pesticides, fertilizers, tractors, and agricultural equipment. The object of Agriculture has changed from "self-reliance" to "Commercialization," and this is called Economic operation in Agriculture. Farming supplies are now being changed instead to individual benefits, but as a commercial exchange business. Production aims to maximize the profitable level. Similarly, the concept of self-sufficiency has changed into profit maximization. This research comprises several variables having some predictors and is self-sufficient. Gross Domestic Product is one of the well-built indicators to measure the growth pattern of the economy. It notifies the Aggregate value of all final goods and services produced within a country over the specific period. According to the World Bank, the GDP of Pakistan was $161.99 billion or 5,475,716 million in PKR in the year 2009.

Significant of Agriculture

Agriculture can play imperative role in achieving the Millennium Development Goals that determine to half the share of people suffering from extreme poverty and hunger by 2015. Three out of every four poor people in developing countries live in rural areas, and most of them depend directly or indirectly on agriculture for their livelihoods. Agricultural productivity growth is vital for stimulating growth in other parts of the economy. In Asia, overcoming widespread poverty requires confronting widening rural-urban income disparities. Asia's fast-growing economies remain home to over 600 million rural people living in extreme poverty, and despite massive rural-urban migration, rural poverty will remain dominant for several more decades. For this reason, the'World Development Report' focuses on ways to generate rural jobs by diversifying into labor-intensive, high-value agriculture linked to a dynamic rural and nonfarm sector (World Bank, 2008). Agriculture is the prime sector of Pakistan's economy with respect to employment generation; Pakistan's twothird population depends directly or indirectly on this sector. Thus, for the overall economic development and poverty reduction in Pakistan, sustained and higher growth in agricultural production is necessary (Iqbal et al., 2003). A growth rate of more than five percent is necessary to attain a rapid growth of national income, provide employment to growing labor force, attaining macroeconomic stability, make available justice to the people and reducing poverty in Pakistan (Iqbal et al., 2003; Government of Pakistan, 2011a).

Research objectives

The study generally seeks to achieve the following objectives:

i. To investigate the effect of agriculture on economic growth of Pakistan.
ii. To give some positive suggestion on the basis of the present study results

Research Questions

The study seeks to answer the following research questions:

i. What is the role of agriculture in growth of Pakistan?
ii. How agriculture effect the economic growth of Pakistan.

Research Hypothesis

The following are the hypotheses of the study:

i. H0: There is no relationship of agriculture and economic growth of Pakistan.
   H1: There is a long-run and short-run relationship of agriculture and economic growth of Pakistan.

Organization of the Study

The rest of the study is organized as follows: Chapter Two reviews the relevant literature both theoretically and empirically on the relationship between agriculture and economic growth. Chapter three presents the econometric method, while Chapter four represents empirical results and analysis. Chapter five summarizes key findings and conclusions.

Literature Review

This chapter includes the research work which have been done by different researchers at different times. Jamboo (2017) examined the impact of agriculture on the economic growth of Pakistan by using the time series secondary data from the years 2000 to 2014. The econometric technique for this study is the vector correction model (VECM), The empirical analysis indicated that spending on agriculture research has high impact on growth.

Umar and Zainab (2015) investigated the relationship between agriculture and economic growth of Pakistan for the time period 1980 to 2014. By using the secondary data and Auto Aggressive distributed lag (ARDL)

approach for the empirical analysis and findings. The result showed significant impact of agricultural productivity in the long run while the other variables don't have a significant impact on agricultural productivity in the long run. In the addition net export, government expenditure, and inflation rate, seems to influence agriculture productivity in short run.

Raza et al,. (2012) examined the effect of agriculture on economic growth for the period of time (1980-2010). Using econometric technique, the ordinary least square (OLS) method. They found that crop and livestock total contributed 91% combined in the aggregate agriculture sector. That it represents significance contribution for the performance in this sector.

Awan and Mustafa (2011) investigate the effect of agriculture on economic growth for the periods of time 1970-2009. In this study used econometric technique. Johansen test found that the long run relationship between the agriculture GDP and total cropped area was positive for the Pakistan economy.

Raza et al,. (2013) studied the impact of agriculture on the economic growth for the period of time (1972-2011) using econometric technique. Vector Error Correction model found that the empirical evidence demonstrates that there exist a statistically significant long run positive relationship between inflation and economic growth.

Ali (2016) investigated the impact of agriculture on the economic growth from 1990 to 2014. Econometric technique of ordinary least square (OLS) was used by him in this study. In the result they found out that there is a strong relationship in our variable agriculture sector and GDP growth rate.

Rehman et al. (2019) conducted a study on the impact of agriculture on the economic growth from the time 1970 to 2015. Applying the ordinary least square method and Augmented Dickey-Fuller test. In the conclusion it proved that the regression indicated that rice output and cultivated area have a significant and positive relationship with agriculture GDP.

Ali and Saif (2017) examined the impact of agriculture on the economic growth from the time period (1978-2015).Econometric technique ADF unit root test was applied to determine the order of integration of variable while Johansen and Juselius is used to check the co integration. Finally VECM is used to check the short run co relation found that there is short run and long run relationship in variables.

Research Method

Introduction

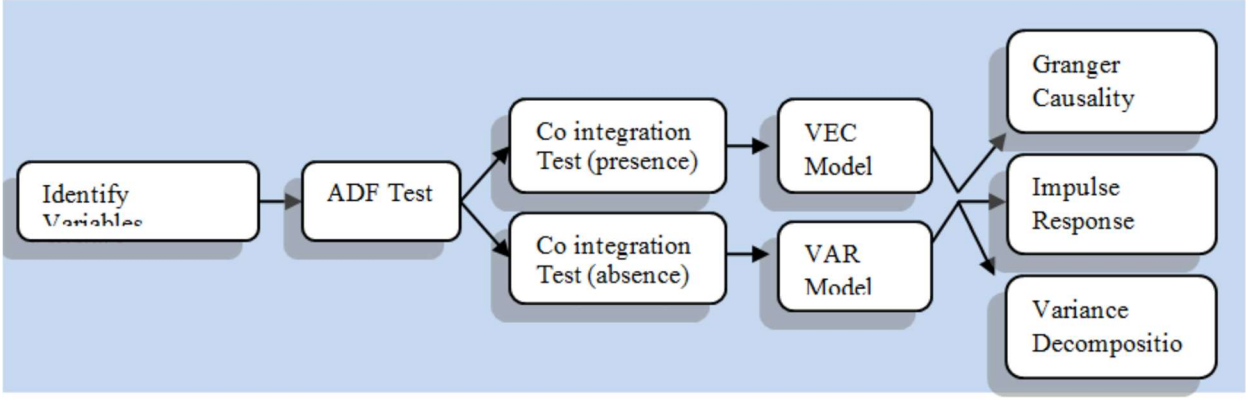
In this chapter we explained three parts. Firstly, we will talk about the data source and secondly description of the variables and last the empirical model for the study.

Data and its Sources

Time series annual data for the present study is used from the year 1976 to 2014. Depended variable gross domestic production (GDP) has been used for economic growth with independent variables foreign direct investment (FDI) Trade openness (TO) and agriculture (Agri).
All the data on four variables taken from world development indicator (WDI)

Empirical Model

For empirical analysis we get help from the following flow chart which is already used in the research paper of (Aimer 2016).



On the basis of this flow chart the following steps will be used.

Step (i):
Unit root test is important for co integration analysis. To check the order of integration for variables whether they are stationary I(0) or non-stationary I(1) for analysis of Johansen co integration as all variables should be non-stationary at same order for example integrated of order one I(1). Dickey and Fuller (1979, 1981) gives one of the generally used methods known as Augmented Dickey Fuller (ADF) test of identifying the order of integration I(d) of variables whether the time series data are stationary or not.

Step (ii):
If combination of two non-stationary variables generates linear combination, so they called co integrated. So Johansen (1988) presented the Maximum Likelihood Method for estimating the more than one co integration vector. But for this test all variables should have same order of integration I (d) i.e. I (1). The method of Maximum Likelihood estimation will be used to estimate our long run coefficients and find the order of co integration using two test statistics Maximum Eigen value test and Trace test.

Step (iii)
In step three we will used the error correction model for short run relationship among variables and select it as a good model and reliable results if it fulfill the assumption of OLS (Ordinary Least Square). For detecting the hetroskedasticity will be used the Bruesh-Pegon LM test while for serial correlation the Q test. The overall goodness of fit of the model will be checked by R^2 and adjusted R^2 that how much independed variables showed the variation in depended variable.

Result and Discussion
Introduction
In this chapter, we included the different analyses which have done for the study. The first section of the chapter is about analysis, which we need before the model estimation in the second section. There is an estimate of our proper model in the last section; the post estimation for the model is given.

First Section
In this first section the empirical analyses were conducted before the selected model using proper econometric techniques. These analyses is given below:

Unit Root Test

Dealing with time series data, there is always a need for stationarity because if the data is not stationary, the results of analysis give the wrong direction, which is called spurious regression. For detecting this problem, we need to check the unit roots in our data. The Augmented Dickey-Fuller test has been used for this purpose. Results are in the following table

Table 1: Result of Augmented Dickey-Fuller Test

	Level		1st diff		
Variables	T.Stat.	Prob	t.Stat.	Prob	outcome
Gdp	3.8288	1.0000	-3.9292	0.0045	I(1)
Fdi	3.4827	1.0000	-3.9585	0.0041	I(1)
To	-0.4876	0.4979	-8.9515	0.0000	I(1)
Eu	-1.9302	0.3154	-4.7972	0.0004	I(1)
Agri	2.739	1.0000	-5.0728	0.0002	I(1)

Source: *Author calculation*

We find out the results for unit root, including intercept. In Table 2, the last column shows the outcomes and indicates that Gdp, Fdi, To Eu, and Agri are not stationary at the level. The table showed that they are all integrated at order one I(1). The rejection of the null hypothesis is based on non-stationarity at the significance level 0.05.

Lag Selection

The next analysis before estimating the model is taking the optimal lags for VAR and vector error correction model (VECM). The following table shows the different criteria for lag selection.

Table 2: Lag Selection Criterion

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2684.481	NA	5.35e+58	149.4156	149.6355	149.4924
1	-2501.801	304.4670	8.52e+54	140.6556	141.9752	141.1162
2	-2472.461	40.74925	7.29e+54	140.4145	142.8338	141.2589
3	-2411.763	67.44320*	1.27e+54*	138.4313*	141.9502*	139.6595*

Source: *Author's calculation*

Lag length selection criteria such as Log Likelihood (LogL), Likelihood Ratio test statistic (LR), Final Prediction Error (FEP), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan Quinnin information criterion (HQ) have been used to identify the optimal lag. As can be seen in Table 2 that LR, FPE, and SC criteria indicate the three lags for estimating the Johenson co-integration test, VAR, and VECM at 5%. So Johansen's co-integration test, VAR, and VECM model can be estimated by using three lags.

Johenson Co-integration Test

After the selection of optimal lags we know to run the Johenson co-integration test for checking the long run relationship among variables. When we have more than two variables, then the integration vector also

increases; therefore, we need to run the Johenson co-integration test instead of the Engle-Granger test. The following is the result of the Johenson co-integration test.

Table 3: Result of Johenson Co-integration Test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.607017	88.35036	69.81889	0.0008
At most 1 *	0.549036	53.79277	47.85613	0.0125
At most 2	0.309388	24.32716	29.79707	0.1870
At most 3	0.234701	10.63062	15.49471	0.2353
At most 4	0.019630	0.733524	3.841466	0.3917

Trace indicates 2 co integration equations at 0.05 level

Table 3 showed the results of Johenson co integration test which indicate that there is two vector of co integration among the concern variables. From this indication we conclude that GDP of Pakistan, foreign direct investment, trade openness, energy consumption and agriculture have a linear and long run relationship.

Second Section

After the first section we move to second section in which we estimate the proper model of VECM. Because our preliminarily analysis guided when there is long run relationship in the variables we can estimate the short run and long run relationship among variables. And these relationships is estimated by using the VECM approach.

Table.4: Vector Error Correction Model

	Coefficient	Std. Error	t-Statistic	Prob.
C(14)	-7.337325	1.930559	-3.800622	0.0009
C(15)	1.930442	0.503308	3.835509	0.0008
C(16)	5.738704	2.194083	2.615537	0.0155
C(17)	3.695538	1.823313	2.026826	0.0544
C(18)	-1.707635	0.701213	-2.435259	0.0230
C(19)	-1.225318	0.576607	-2.125047	0.0445
C(20)	-5.128675	2.060234	-2.489366	0.0205
C(21)	3.551071	1.865723	1.903322	0.0696
C(22)	2.54E+08	1.20E+08	2.107462	0.0462
C(23)	-27743222	1.35E+08	-0.206210	0.8384
C(24)	1.80E+10	9.00E+09	2.005069	0.0569
C(25)	9.55E+09	8.49E+09	1.125323	0.2721
C(26)	9.30E+09	2.22E+09	4.196238	0.0003
R-squared	0.790661	Mean dependent var		6.29E+09
Adjusted R-squared	0.681441	S.D. dependent var		8.34E+09
S.E. of regression	4.71E+09	Akaike info criterion		47.65692
Sum squared resid	5.10E+20	Schwarz criterion		48.22874
Log likelihood	-844.8245	Hannan-Quinn criterion.		47.85650
F-statistic	7.239157	Durbin-Watson stat		2.081048
Prob(F-statistic)	0.000028			

Source: Author

Table 4 represents the vector error correction model in which C(14) is the error correction term. Error correction term measures the rate of convergence to the long run equilibrium, which is negative and significant in this model. When the error correction term is negative and significant, it shows a long-run relationship between dependent variables and independent variables. So this model explains that the speed of convergence towards long-run equilibrium is 73%.

Goodness of Fit

The overall goodness of fit is measured by the R-squared and adjusted R-squared. Table 4 showed R-squared 79% and adjusted R-squared 68%. It means that 68% variation in the dependent variable is explained by independent variables in the model.

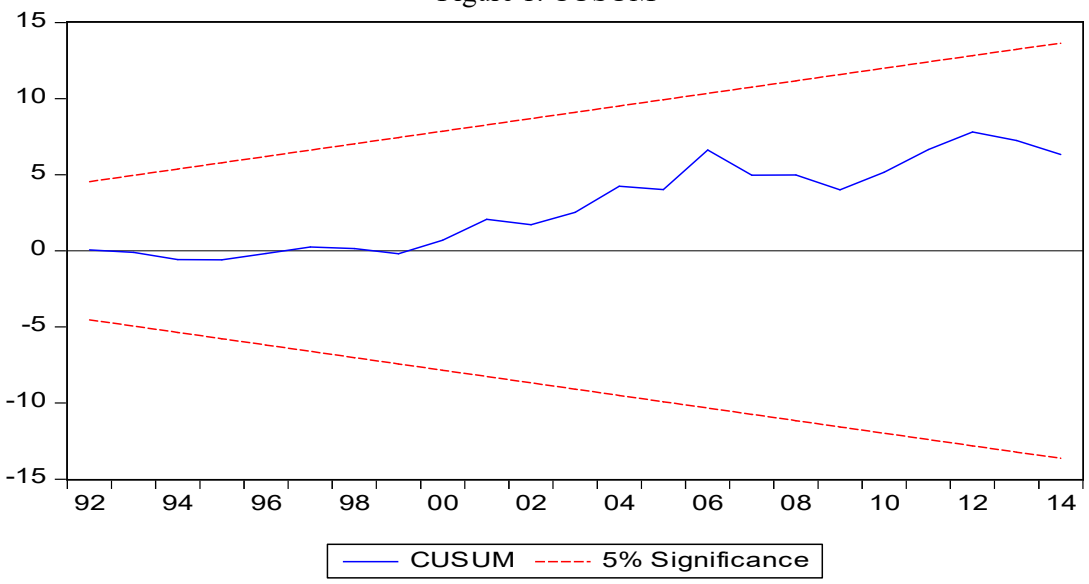
Serial Correlation

For reliable results, the estimated model must fulfill the assumption of no serial correlation. For detecting serial correlation, we looked at the Durbin-Watson value in the model. If the value of the Durbin-Watson statistic is 2 or close to 2, the model does not have the problem of serial correlation. So our results are reliable because the value of the Durbin-Watson statistic is 2.08.

Stability of Parameters

Figure 1 showed result of CUSUM test. Through this figure it can be noted that calculated lines are within the significant bounds of 5%. So, model indicates parameters or mean stability by CUSUM.

Figure 1: CUSUM



Conclusion and Policy Recommendation

Chapter five explains the conclusion of result of this study and policy recommendation for policy makers.

Conclusion

A time series of annual data from 1976 to 2014 has been used for the present study of the impact of agricultural growth on the economy of Pakistan. The time series techniques showed the long-run and short-run relationship of variables. The study refutes the null hypothesis of no relationship between economic growth and agriculture by supporting the alternative hypothesis of an existing relationship between the two variables, as Ali and Saif (2017).

Policy Recommendation

On the basis of the result, this research gives suggestions to policymakers and the government to take some positive steps for the betterment of the agricultural sector. And also encourages the public towards agriculture.

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