Pricing of Agricultural Capital Input in Pakistan: An Analysis of Bound Testing Approach

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ARTICLE DETAILS	ABSTRACT
History *Revised format: Nov 2017* *Available Online: Dec 2017* **Keywords** *Pakistan,* *Land,* *Price of Capital,* *Yield*	**Purpose:** This study aims to raise the trouble of adjustment the price of capital input in Pakistan. The data that is take to estimate the analysis is time series which span over from 1974 to 2014. Yield, gross domestic product, exchange rate, land, price of capital, agriculture employment, agriculture imports and exports are variables that use in this study. Econometric technique of auto-regressive distributed lag (ardl) to co-integration approach are applied apply to estimate the long run and short run relationship among variables. Conclusion of this study shows that yield and price of capital are negative and insignificant both in short and long run.
JEL Codes: *Q13, D24*	

1. Introduction

Pakistan is basically an agriculture country and agriculture have life-blood of Pakistan's economy. Agriculture sector have most important in both national and international level. Developed and under-developed countries have skipped the agriculture sector, before fifty years ago. In 1960's, economists have realized the important of agriculture sector and burden of industries. In 1970's to 1980s, the process of agriculture development increased day by day. 70% people of Pakistan's are engaged in village's areas and almost 50% people belong to agriculture farming. The main developments features are labor force, growth rate of gross domestic product (GDP), foreign exchange earrings and land areas etc. In 1994, 4.5 % would have increase GDP but in 1996, GDP reached in 5.2 %. Vegetables, fruits, wheat, cotton and rice are famous and important products of agriculture sector. According to north whitehead, **"**it requires a very unusual mind to undertake the analysis of the obvious**"**. 80 % nation's exports depend on agriculture sector. Agriculture sector gives the food and raw materials. The most important and essential crop is wheat and 14.4% contribute in agriculture fields. In 10 top countries of world, Pakistan has existed to produce wheat crop. Pakistan grows 8494 million hectors area with almost 2769 kg/ha yields. Rice and cotton are also very important crops.

In the developing countries of agriculture production, it is important to increase capital resources. Generally, economist have fixed or operating as a division of capital goods. In the production process, contribution of fixed capital have not used immediately. That's why; the term is commonly used for reference as tractors, trucks, pumps and hardware items for the collection. The work on capital is also involving the fertilizers that must be used in the process of production. The results widely known and

extensively studied the importance of capital goods, but they are generally less appreciate or recognized as a way of marketing is the process in a variety of price points.

Lower home price policy and interventionists that are follow by Pakistan. Government has a duty to maintain the balance of domestic price. Most policy makers who back establish of price policy are moved their income in manufacturing sector. Government controls the price policy through different mechanism such as fiscal and monetary situations, wage and interest rate, tax, subsidies, price stabilization and distribution of income etc. In 1960s, that's time government had decided the three

Price policies like as voluntary sale, liberal subsidies policy and relaxed considerably policy. In liberal subsidies policies, tube-well, tractors and improvable seeds were included. In 1970s, due to devaluation of local currency, agricultural exports and monopolies of government had faced the deficit. In the period of 1980 to 90s, government had introduced the new agriculture policy. In 1981, agriculture price policy had been completely shaped such as support policy. Due to this period, floating exchange rate policy had been applied. The devaluated of local currency, agriculture prices have different impact on exports, consumption, trade balance and foreign exchange rate on the product of agriculture sector. In the era of 2000s, due to bed governance and lack of funding, agriculture per year income increase by only 1 %. The higher prices of agriculture product are due to higher price of oil, whether situations and cost of energetic goods and have significant impact on prices of products especially in Pakistan because Pakistan is include in developing countries.

1.1 Research objectives of this study
The main objectives of this study are as follows:
1): to estimate the impact of prices on yield.
2): to analyze the effect of growth rate (GDP) on yield.
3): to measure the situations of imports and exports on yield.
4): to reveal the pricing of agriculture inputs in Pakistan.
Hypothesis:
H_0: prices of agriculture inputs do not have significant impact on Pakistan.
$H1$: prices of agriculture inputs have significant impact on Pakistan.

2. Review of Literature

Ahmad et al. (2008) examined the total productivity factor in the field of agricultural sector. In 2008, total factor productivity (TFP) had raised at the yearly average rate of 0.28 percent. Time series data was used from 1965 to 2005. This study used the growth accounting method. The result of this study proposed that total factor productivity and value added had a vital role in agriculture sector.

Ahmad et al. (1999) pointed out the size of farm and land productivity. Data was time series and applied the cob-douglas production function. Land, output, fertilizer and tenants' farm were variables that used in this study. The epitome of this paper proposed that land productivity and farm size had negative relation so that agricultural production was become very low. Technical efficiency had positive relation with farm size.

Hsu et al. (2003) identified the china's agriculture of total factor of productivity (TFP). This study consists of 27 provinces which covered the time period from 1984 to 1999. They used the econometric technique of ordinary least square (OLS). Total factor productivity (TFP) was calculated by malmo- quist index. The result of this paper was that latest technology had given the higher productivity but the method of traditional was gave the less production.

Hassan et al. (2005) presented the mixed farming region of wheat farming especially in Punjab province.

They used the wheat seeds, ploughing, irrigation and water charges were taken as variables. Cob-douglas production function was used to estimate the analysis. The final suggestion of this paper explained that wheat crop had increased by increasing level of irrigation, fertilizer and ploughing.

Kiani (2008) analyzed the relationship between farm size and productivity especially in Pakistan. Annual time series data was used in this study. This paper applied the cob-douglas function of production. He took the variables of labor, farm size, cropping intensity, output land, tractor and fertilizers. Productivity per acre and firm dimension had negative related with each other. He also discussed the place of rural labor market which had two determinants. Hired labor and family labor were these two determinants. He also suggested that government should be removed or banned the higher price which had given on harvesting capital.

Olajide et al. (2012) revealed the relationship between economic growth and agriculture resources in Nigeria They used the ordinary least square (OLS) to estimate the data. They spanned over from the phase of 1970 to 2010. They took only two variables such as gross domestic product and agriculture output. International monetary fund's (IMF) and central bank of Nigeria (CBN) were the sources of gathering data. The conclusion of this study proved that gross domestic product had positive related with agriculture sector. 34.4 percent agricultural sector had involved the economy development.

Ilyas et al. (2011) estimated the components of manufacturing of value added. This study was existed in Pakistan. They had used yearly time period from 1965 to 2007. They determined the three components such like trade openness, total factor productivity and investment of price level. They had applied the bound testing approach to integration. World Bank and federal bureau of statistics were means of collected data. The result of this study showed that both in short and long run, total factor productivity (TFP) had the most important and significant determinant in value added of manufacturing. Trade openness and investment of price level had insignificant and negative impact on manufacture of value added.

Chaudhry et al. (2009) found the factors of yams productivity in Punjab province of Pakistan. They had taken the variables of plant protection, seed and sowing, yield per acre, cost of cultivation, irrigation and labor cost. They used the secondary time series data. Ordinary least square (OLS) and cob- douglas production function were both econometric technique that were used in this study. This study showed that worth of production would rise due to better seeds and water irrigation.

Ghafoor et al. (2010) worked at the factors impact on saving and investment on the small stage. Primary data was used in this study. They had existed in Sargodha district. Saving of farmers, food consumption expenditure, age, health expenditure, family and agriculture expenditure, credit instalments, income of farmers, non-food expenditure, land holding were those variables that used in this paper. Conclusion of this study proposed that small household earnings had negative impact on agriculture products so that farming households want to provide the credit at small interest then it can become to develop the agriculture sector. Second important thing was that latest technology should be introduced for the small households at the lower prices. They bought the new technology to enhance the agricultural-sector.

Raza and Siddiqui (2014) supported the outputs of agricultural determinants. Annually time series data was used which coated data from 1972 to 2012. They applied the Johannsen co-integration technique to estimate the empirical analysis. In this study, they had taken the variables of water availability, agricultural outputs, numbers of tube well, fertilizer consumption, numbers of tractors and labor in agriculture sector. They finally found that a large numbers of tractors had played a vital role in agriculture output. They also concluded that many labors, better seeds, many tube wells and availability of water had positive relationship with agriculture output.

3. Data and Methodology

For assembling the model, I used the time series data of 41 years. This study covered the time phase from 1974 to 2014. In this paper, the econometric technique of auto regressive distributed lag (ARDL) is applied. Unit root of augmented dickey- fuller (ADF) test also used to estimate the stationary of variables. All variables data are secondary that are taken from various sites. Agricultural statistics of Pakistan, state bank of Pakistan (SBP) and World Bank are sources to collect data.

Table 1: List is outcome and covariates variables.

Variables	Description of variables	Unit of measurement
Yield	Yield	Million (rs)
Gdp	Gross domestic product	Million (rs)
Price	Prices of product	Billion (rs)
Exr	Exchange rate	2010=100
Agri_ emp	Agriculture employment	Million (rs)
Agri_ imp	Agriculture import	Billion (rs)
Agri _exp	Agriculture export	Billion (rs)
Ld	Land	Million (hectares)

Source: SBP and Pakistan's agricultural.

3.1 Description of variables
The descriptions of variables are as follows:

3.1.1   Yield
Quantities of crops have measured of a harvest that is cultivated on per unit of land portion. The measurements of crops are mostly coated for grain and cereal which are generally measured in kilograms per hectare. It is also known as "agriculture output".

3.1.2   Gross Domestic Product
The average value of goods and services are produced by domestic level within one year is called gross domestic product. It is very important indicator that is used to calculate the production and output of economy. GDP also included the total consumption, investment and government expenditure.

3.1.3   Exchange Rate
The conversion of one nation currency into other nation currency. There are two components of exchange rate. One of the domestic currency and other is foreign currency. It can be estimated both indirectly and directly. The direct method is price of one unit of foreign currency into change in domestic currency and second method is the price of one unit of domestic currency into change in foreign currency.

3.1.4   Price
 In commonly, price is those amount or payments that are given by one group to another in get back for produced things. Most economists say that free market price system is determined by the intersection of demand and supply.

3.1.5   Land
Agricultural land is known as crop land. Agricultural ground has normally converted into agricultural side. For human being, cattle and production of yield food is the systematic and control usage. Farming ground are being included land under forever harvest, arable land and permanents meadows.

3.1.6   Agricultural Employment
Agricultural labors are almost 1.3 billion in all over the world and 40 % of the world workforce.

Employers are those people who work at public and private level and get remuneration in the form of salary, tips, wages and commission etc.

3.1.7 Agricultural Imports
Agricultural imports are those which bought from the other countries. In Pakistan, the value of agriculture raw material imports were 4.29 in 2011 but it would increase in 6.17. In Pakistan's budget, imports has greater than exports that's why economy has destroyed day by day.

3.1.8 Agricultural Exports
Goods and services produced in own country in which send to other countries for sell. Usually, Pakistan's do lower exports and higher imports. According to food and farming ministry, Pakistan have exported for fruits by 120 billion and 19 billion of fishes exported during 2009- 2010.

4. Econometric Issues
This portion consists of the important of econometric issues such like order of integration, bound test approach, and error correction model (ECM) and long run approach. Augmented dicker fuller (ADF) test is applied to estimate the unit root. When augmented dicker fuller (ADF) result's shows that some variables exist at level and some are exist at 1st difference, it means that auto regressive distributed lag (ARDL) must be used. Ardl is used to examine the short run and long run relationship between variables.

Table 2. Unit root of ADF

Variables	Level	1st difference	Conclusion
Yield	-----------	-10.87*	I(1)
Gdp	-5.99*	------	I(0)
Land	-----------	-7.77**	I(1)
Price	-4.65***	-----	I(0)
Ex	------	-4.36**	I(1)
Agri- emp	------	-9.73**	I(1)
Agri – imp	-5.99***	---------	I(0)
Agri- exp	--------	-6.96***	I(1)

Source: (*, **, ***) shows that variables at significance at 1%, 5% and 10%.
The above table shows that the result of augmented dicker fuller test of gross domestic product, price and agriculture imports are stationary at level and other variables are stationary at first difference.

Model specification**:**
Equation 1:
Y = f (yd)........ (1)
Where equation 1 present:
Y= output
Yd= yield
Equation 2:
yield=α+a₁(pri)+a₂(gdp)+a₃(exr)+a₄(land)+a₅(agri_exp)+a₆(agri_imp)+a₇(agri_emp)+ε

$yield=\alpha+a_1(pri)+a_2(gdp)+a_3(exr)+a_4(land)+a_5(agri\_exp)+a_6(agri\_imp)+a_7(agri\_emp)+\varepsilon$

There are some particular variables that effect on yield such as price, gross domestic product, land, agriculture employment, agriculture imports and agriculture exports. Now equation 2 is converted into ardl equation.
ARDL Equation:

$$\Delta YIELD_t = a_0 + \sum_{i=1}^{k1}\alpha_{1t}\Delta(YIELD)_{t-i} + \sum_{i=0}^{k2}\alpha_{2t}\Delta(PRI)_{t-i} + \sum_{i=o}^{k3}\alpha_{3t}\Delta(GDP)_{t-i}$$
$$+ \sum_{i=0}^{k4}\alpha_{4t}\Delta(EXR)_{t-i} + \sum_{i=0}^{k5}\alpha_{5t}\Delta(Land)_{t-i} + \sum_{i=0}^{k6}\alpha_{6t}\Delta(Agri\_exp)_{t-i}$$
$$+ \sum_{i=0}^{k7}\alpha_{7t}\Delta(Agri\_imp)_{t-i} + \sum_{i=0}^{k8}\alpha_{8t}\Delta(Agri\_emp)_{t-i}$$
$$+ \emptyset_1(yield)_{t-1} + \emptyset_2(pri)_{t-1} + \emptyset_3(GDP)_{t-1} + \emptyset_4(exr)_{t-1}$$
$$+ \emptyset_5(land)_{t-1} + \emptyset_6(agri\_exp)_{t-1} + \emptyset_7(agri\_imp)_{t-1} +$$
$$\emptyset_8(agri\_emp)_{t-1} + \varepsilon_t$$

This equation shows the short run and long run equation between dependent and independent variables.

Table 3. Bound test.

F – value	3.46	
Critical bound values	Lcb	Ucb
10%	1.92	2.89
5%	2.17	3.21

Source: computation based on software Review 9.5

The above table shows the bound testing result. If f value is greater than upper bound value then long run will be exist while if f-value is less than upper bound value it means that long run does not exist. This study shows that the long run relationship does exist.

Table 4: Bound test.

R^2	Adj- r^2	Akaike	Schwarz	Darbin-watson
0.98	0.97	11.54	12.14	2.01

Source: author's estimation.

98 percent variation in yield variable is due to independent variables of price, land, gross domestic product, agricultural employments, agricultural imports and agricultural exports. The value of Durbin Watson shows that auto correlation does not exist.

Estimation of long run analysis:

The long run equation and table are as follows:

$$\textbf{Yield}_t = \eta_0 + \sum_{i=1}^{k1}\eta_{1i}(\textbf{YIELD})_{t\text{-}i} + \sum_{i=0}^{k2}\eta_{2i}(\textbf{PRI})_{t\text{-}i} + \sum_{i=0}^{k3}\eta_{3i}(\textbf{GDP})_{t\text{-}i}$$
$$+ \sum_{i=0}^{k4}\eta_{4i}(\textbf{EXP})_{t\text{-}i} + \sum_{i=0}^{k5}\eta_{5i}(\textbf{IMP})_{t\text{-}i} + \sum_{i=0}^{k6}\eta_{6i}(\textbf{EMP})_{t\text{-}i}$$
$$+ \sum_{i=0}^{k7}\eta_{7i}(\textbf{LAND})_{t\text{-}i} + \sum_{i=0}^{k8}\eta_{8i}(\textbf{EXR})_{t\text{-}i} + \varepsilon_t$$

In the long run, the analysis shows the relationship between yield and prices has negative and insignificance (Matthias Kalkuhe and Joachim Von Braun (2014)). The positive and significant relation established between land and yield. The relationship between gross domestic product and yield is significance and positive and this study confirm the result that is written in brackets "(Olajide, o.t., Akinlabi, b. H. And Tijani, a.a. (2011)". Exchange rate and yield have a positive and significant relation (Riaz Hussain (2015)).yield with import; export and employment have insignificant but positive relation among (David Boansi1, Boris Odilon Kounagbé Lokonon2 and John Appah (2014)).

Table 5. Long run analysis.

—	Long Run Coefficients			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LAND	0.000277	0.000116	2.392984	0.0249
PRI	-6.715641	8.869644	-0.757149	0.4563
GDP	16.516976	5.188907	3.183132	0.0040
EXR	783.294961	390.077687	2.008049	0.0560
AGRI_EMP	14.213289	15.737069	0.903173	0.3754
AGRI_EXP	3.491208	7.886175	0.442700	0.6619
AGRI_IMP	44.525846	58.866156	0.756391	0.4568
C	-3306.80...	1155.893409	-2.860825	0.0086

Calculation finds out the review 9.5

Explain the short run analysis

The short run analysis shows that the variables relationship in short period. In the short run, co integration equation value must be negative and have a significant. In short run, exchange rate has negative relation with yield but have a positive relationship between yield and exchange rate.

Table 6. Short run analysis.

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(YIELD(-1))	-0.329603	0.107146	-3.076193	0.0052
D(LAND)	0.000244	0.000038	6.494314	0.0000
D(PRI)	-4.543272	2.771078	-1.639532	0.1141
D(GDP)	1.992348	1.077315	1.849365	0.0768
D(EXR)	-955.222313	377.228920	-2.532209	0.0183
D(AGRI_EMP)	4.474471	4.444873	1.006659	0.3241
D(AGRI_EXP)	1.159381	3.722650	0.311440	0.7582
D(AGRI_IMP)	1.978771	11.426298	0.173177	0.8640
CointEq(-1)	-0.490440	0.078124	-6.277746	0.0000

Cointeq = YIELD - (0.0003*LAND -6.7156*PRI + 16.5170*GDP + 783.2950
*EXR + 14.2133*AGRI_EMP + 3.4912*AGRI_EXP + 44.5258*AGRI_IMP
-3306.8091)

Source: calculation based on reviews 9.5

Test for stability

The test for variables stability for short run and long run also rise through the "cusum" and "cusum square" diagram.   Cusum and cusum square are significant at 5 % level.
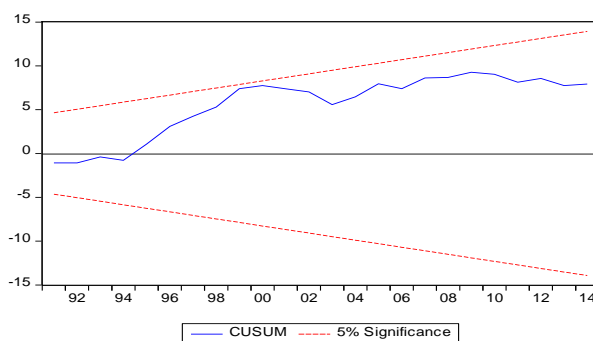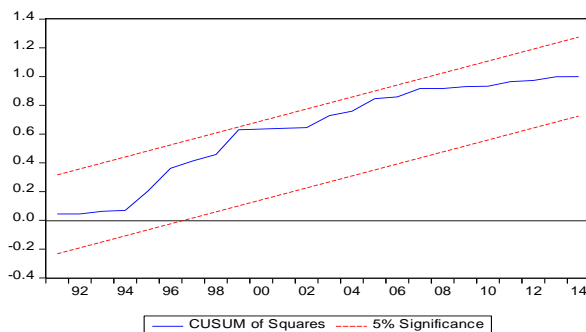
Figure 1. Cusum

Figure 2. Cusum square

5. Conclusion
In this study an attempt is to get the price of capital inputs in Pakistan. This study attempts the time period from 1974 to 2014. Furthermore, auto regressive distributed lag (ARDL) is use to check the long and short run variables relationship. Similarly, augmented dicker fuller test (ADF) apply to examine the order of integration. The result of this study shows that price of capital and yield has negative and insignificant relation both short and long run and exchange rate are negative in short run and have positive in long run. So, prices of input capital are very high and farmers does not reach the purchased it and in this result production are very litter. Government should make the price policy on the capital inputs. That, way the production will increase to use these inputs capital.

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