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Agriculture and Industrial Sector Growth in Pakistan: The Role of Human and Physical Capital

[1]*Tahmina Abid,* [1]*Khalil Mudassar and* [2]*Rana Ejaz Ali Khan*

[1]Department of Economics, Government Sadiq Egerton College, Bahawalpur, Pakistan
[2]Department of Economics, The Islamia University of Bahawalpur, Bahawalpur, Pakistan

Abstract: This study is an attempt to capture the impact of human capital and physical capital on agricultural and industrial growth in Pakistan. On annual time series data for the years 1970-2012, ARDL bound testing approach has been employed. The sensitivity analysis and CUSUM test is used for the robustness of the estimated coefficients.The results have shown that human and physical capital haspositive impact on agricultural growth. The role of human capital is stronger than physical capital. Similarly the agricultural price policies and land utilization for agriculture increases the agricultural growth. However, general inflation decreases the agricultural growth. For the industrial sector the human capital and physical capital both positively contribute in growth. However, the contribution of physical capital is almost two times than human capital. The urbanization also increases the industrial growth but exchange rate has negative impact on industrial growth.

JEL Classification: J24, O16, O47, D24
Key words: Human capital · Physical capital · Agriculture sector · Industrial sector · Agricultural price policies · Urbanization, Exchange rate

INTRODUCTION

The concept of human capital was firstly presented by the Schultz [1] and Becker [2] and three proxies are generally used to measure the human capital, i.e. average years of schooling of workers, literacy rate and the enrollment rate at primary, secondary and higher education. Romer [3], Barro [4] and Mankiw [5] expressed the positive relationship between human capital and economic growth. They argued that increase in the education level of the labor escorts to increase its productivity, efficiency and cognitive skills. So the inventors of human capital theory established the notation that investment in education enhances the stock of human capital and its capabilities [2]. Human capital theorists launched that provision of literacy improved the efficiency of workers and professional aptitude.

According to the World Development Report 1998 the role of physical capital is also substantial and cannot be ignored. In the assessment of 192 countries the report indicated that average accounting share of human capital and physical capital is 64 and 16 percent respectively and 29 percent is the share of social capital. No country has the ability to achieve the sustainable growth without investment in physical capital. The physical capital is generally measured by the gross fixed capital formation of public and private sector.

The literature investigated that how much physical and human capital converges the economies on path of growth. Some of the studies have also estimated the effect of human and physical capital on specific sectors of the economy. Herr explained the role of capital formation in Australian agriculture sector. The study explained that capital formation results into considerable growth in the form of agriculture productivity. It is also evidenced that capital formation works as a principal vehicle for introducing technical change [6]. Solowargued that at the industry level, only stock of capital positively affects the output growth [7]. Xu [8], Hwang [9], Leamer [10] and Edwards [11] recommended growth of the agriculture sector depends on the number of natural and physical resources of the economy. Murphy *et al.* [12] concluded that human capital is required to electrify growth of ICT industries in OECD countries. The study argued that the

Corresponding Author: Tahmina Abid, Department of Economics, Government Sadiq Egerton College, Bahawalpur, Pakistan.

economies that have high stock of human capital enjoy the high output growth rate. The higher stock of human capital also increases physical capital stock that enhances the growth of ICT industries. Arora and Bagde [13] analyzed the role of human capital in exports of software in India. The study concluded that country can boost up the exports by producing more human capital. Hye and Jafri [14] attempted to see the impact of human capital on agricultural growth in Pakistan. The study concluded that physical capital and human capital positively impact the agricultural value added. However the human capital cause the agriculture value added only for the short period. Hamid and Ahmed [15] also used the same variables for Pakistan and concluded that human capital has insignificant impact on value added of agriculture. The study explained that labor productivity and land labor ratio is low in Pakistan.

The role of human capital and physical capital in productivity and growth of agricultural and industrial sector may vary for economies. It may be due to the composition of economies, i.e. the share of the different sectors of the economy in GDP, the development stage of the economy, the stock of resources, the availability of natural resources as well as the availability of physical and human capital.

For the developing countries, there is variation in the composition of human and physical capital. From here the question arises that in Pakistan for agricultural and industrial sector whether human capital or the physical capital is contributing more in their growth. Based on this research question, the objective of current study is to investigate that either the human capitalor physical capital contributes more in agricultural and industrial growth in Pakistan. The novelty of the study is that it focuses on simultaneous role of human capital and physical capital on agriculture and industrial sector in Pakistan.

MATERIALS AND METHODS

To see the impact of human capital and physical capital in agricultural and industrial sector growth the traditional form of Cobb Douglas production function in agricultural and industrial growth models can be expressed in equation No. 1 and 2, respectively.

$$AGRI = \beta_0\, HCAP^{\beta1}\, PCAP^{\beta2}\, URBN^{\beta3}\, PRICE^{\beta4} LAND^{\beta5}\, INF^{6\beta}\, e \quad (1)$$

$$INDUS = \delta_0\, HCAP^{\delta1}\, PCAP^{\delta2}\, URBN^{\delta3}\, INF^{\delta4}\, EXR^{\delta5} e \quad (2)$$

where,

AGRI = Agricultural growth (Annual growth rate of agricultural value added)
INDUS = Industrial growth (Annual growth rate of industrial value added)
HCAP = Human capital (Human capital index)
PCAP = Physical capital (Gross fixed capital formation in million rupees)
URBN = Urbanization (Urban population as percentage of total population)
PRICE = Agricultural price policy (Index of agricultural procurement price in major crops)
LAND = Land used for agriculture
INF = Inflation (Consumer price index)
EXR = Exchange rate (Nominal exchange rate)
e = error term

All the variables are self-explanatory however, human capital index has been constructed by adjusting health and education indices;

Human capital index = ½ (education index) + ½ (Health index))

Education index = ½ (Gross enrollment index) + ½ (Education expenditures index)

Gross enrollment index = 100*[gross enrollment - minimum) / maximum - minimum)]

Education expenditure index = 100*[(education expenditure - minimum) / (maximum - minimum)]

Health index = 1/3 (life expectancy index) + 1/3 [100 - (mortality rate index)] + 1/3 (health expenditure index)

Life expectancy index = 100*[(life expectancy - minimum) / maximum - minimum)]

Mortality rate index = 100*[(mortality rate - minimum) / (minimum-maximum)]

Health expenditure index = 100*[(health expenditure - minimum) / maximum-minimum)]

The human capital index is constructed following the methodology of UNDP (United Nations Development Program) for construction of human development index[1] in 1999-2000. The education and health status indices have half weightage. In education index gross enrollment and education expenditures have one half weightage. In health index each indicator, life expectancy, mortality rate and health expenditure have one third weightage.

[1]See Ibrahim Index of African governance [16]. They explained that for the index of specific category we identify the indicators and normalize the raw data of indicators then we give the weights to these indicators. They suggested equal weights for all the pillars of the index. Finally, if the lower value of indicator represents the best performance then we subtract it form 100. In the health index of current study the low value of mortality rate is required so we subtracted it form 100 (see also governance index [17] for Pakistan).

Source of Data: The annual time series data for the period 1970-2012 has been used. It has been collected from Pakistan Economic Survey (GOP various issues), Annual Report (SBP various issues) and World Development Indicator.

Unit Root Test: To check the stationary properties of the data ADF unit root test is applied. The basic property for the stationarity is that the series oscillate over the constant mean and variance. It does not depend on the time variations, on the other hand non stationary series influence the random shocks and the series keep on the random walk.

The following regression equation is estimated for the ADF test;

$$\Delta Y_i = \beta_1 + \gamma t + \delta Y_{i-1} + \Sigma\, a_{j\Delta} Y_{j-i} + U_i$$

where $u_i$is a pure white noise error term

The ADF test follows the amended *t* statistic. It includes the lagged values of the dependent variables for managing the problem of serial correlation that occurs in time series data.

Auto Regressive Distributive Lag (ARDL) Model with Bound Testing Approach: A number of tests and approaches like Engle-Granger [18] residual based test, Maximum Likelihood based test, Johansen [19] test and Gregory and Hansen [20] tests have been used in literature for co-integration. These techniques showsome complications like low power and stationarity problems. They do not have good outcome of small data set. To overcome these difficulties this study follows the Auto-Regressive Distributed Lag (ARDL) Approach to co-integration proposed by Pesaran [21] and Pesaran and Shin [22].

The equation No.1 and 2 can be treated under ARDL approach as:

$$\begin{aligned}\Delta \text{ Ln AGRIt} = a &+ \sum_{k=1}^{n} b_k \Delta \text{ Ln HCAP}_{t-k} + \sum_{k=0}^{n} c_k \Delta\text{Ln PCAP}_{\,t-k} + \sum_{k=0}^{n} d_k \Delta\text{Ln URBN}_{t-k} \\ &+ \sum_{k=0}^{n} e_k \Delta\text{Ln PRICE}_{\,t-k} + \sum_{k=0}^{n} f_k \Delta\text{Ln LAND}_{\,t-k} \sum_{k=0}^{n} g_k \Delta\text{Ln INF}_{t-k} + \beta_1 \text{ AGRI}_{t-1} \\ &+ \beta_2 \text{ HCAP}_{t-1} + \beta_3 \text{ PCAP}_{t-1} + \beta_4 \text{ URBN}_{t-1} + \beta_5 \text{ PRICE}_{t-1} + \beta_6 \text{ LAND}_{t-1} + \beta_7 \text{ INF}_{t-1} \\ &+ \mu t \ldots\ldots\ldots\ldots (3)\end{aligned}$$

$$\begin{aligned}\Delta\text{INDUS}_t = a &+ \sum_{k=1}^{n} b_k \Delta \text{ Ln HCAP}_{t-k} + \sum_{k=0}^{n} c_k \Delta\text{Ln PCAP}_{\,t-k} + \sum_{k=0}^{n} d_k \Delta\text{Ln URBN}_{t-k} \\ &+ \sum_{k=0}^{n} e_k \Delta\text{Ln INF}_{\,t-k} \sum_{k=0}^{n} f_k \Delta\text{Ln EXR}_{t-k} + \beta_1\text{INDUS}_{t-1} + \beta_2\text{HCAP}_{t-1} \\ &+ \beta_3\text{PCAP}_{t-1} + \beta_4\text{URBN}_{t-1} + \beta_5\text{INF}_{t-1} + \beta_6\text{EXR}_{t-1} + \mu t \ \ldots\ldots\ldots \quad (4)\end{aligned}$$

The model is tested through ARDL testing technique that depends on F-statistics and the bound test will show either the variables are cointegrated or not.

H_0: There is no cointegration among the variables.

That is $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$

H_1: There is cointegration among the variables.

That is $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$

Error Correction Model (ECM): The ECM in the ARDL bound testing methodology can be formulated by using the simple linear transformation of the variables. The ECM of ARDL bound testing approach analysis evades the fake and spurious results of the ARDL cointegration. It also focuses on the aspect of the speed of the adjustment of the equilibrium of long run estimates. The ECM shows that how much disequilibrium of past can be adjusted in the next period.

$$\Delta \text{AGRIt} = \text{a} + \sum_{k=1}^{n} b_k \,\Delta\text{HCAP}_{t-k} + \sum_{k=0}^{n} c_k \,\Delta\,\text{PCAP}_{\,t-k} + \sum_{k=0}^{n} d_k \,\Delta\,\text{URBN}_{t-k} + \sum_{k=0}^{n} e_k \,\Delta\,\text{PRICE}_{\,t-k} + \sum_{k=0}^{n} f_k \,\Delta\,\text{LAND}_{\,t-k} \sum_{k=0}^{n} g_k \,\Delta\,\text{INF}_{t-k} + \lambda\text{ECM}_{t-1} + \mu t \;\ldots\ldots\ldots\ldots \quad (5)$$

$$\Delta \text{INDUS}_t = \text{a} + \sum_{k=1}^{n} b_k \,\Delta\text{HCAP}_{t-k} + \sum_{k=0}^{n} c_k \,\Delta\,\text{PCAP}_{\,t-k} + \sum_{k=0}^{n} d_k \,\Delta\,\text{URBN}_{t-k} + \sum_{k=0}^{n} e_k \,\Delta\,\text{EXR}_{\,t-k} \sum_{k=0}^{n} f_k \,\Delta\,\text{INFL}_{t-k} + \lambda\text{ECM}_{t-1} + \mu t \;\ldots\ldots \quad (6)$$

Sensitivity Analysis: The sensitivity analysis for the selected ARDL model of bound testing approach pursues two tests of robustness of estimates and the stability of the model. For the robustness of the estimates we adopted the diagnostic tests of the ARDL model. They are serial correlation, normality, functional form and heteroscedasticity tests.

Stability Tests of Estimated Parameters: To check the stability of the parameters, Pesaran [21] used the CUSUM (cumulative sum of recursive residuals) and CUSUMSQ (cumulative sum of squares of recursive residuals). These tests are applied in the form of graphs that plot the test statistic which depends on the time intervals and the suitable confidence interval. If the test statistic lies outside the critical bounds of the confidence interval the null hypothesis, i.e. there exists the structural breaks and the non-constancy of the coefficients, is not rejected.

Impulse Response Function: In the simple functional form of impulse response function, let Yt be a k-dimensional series that can be written as:

$$Y_t = A_1 Y_{t-1} + \bullet \bullet \bullet + A_p Y_{t-p} + U_t = \theta(B) U_t = \Sigma \theta_i U_t$$

where cov(Ut) = $\Sigma\theta$i is the coefficient that measures the impulse responses. In impulse response function the individual coefficient is often arduous to interpret. For the purpose experts follows the special technique that is called Impulse Response Function. This function traces out the dependent variable responses in the autoregressive system due to the shocks of the error terms of the equations. More precisely, the impulse response function indicates the response of any dynamic structure due to the effect of any external fluctuation.

Econometric Estimates: The results of unit root testfor agricultural growth model are shown in Table 2.

The results of the Table 1 express that HCAP, LAND and INF are stationary at level while the other variables are stationary at first difference and integrated on zero and one order.

The results of Unit Root Test for industrial growth model are shown in Table 2.

Table 2 shows that HCAP and INF are stationary at level while the other variables are stationary at first difference and integrated at order zero and one. ARDL follows the order of integration 1(1), 1(0) or both but 1(2) order of integration is not feasible in ARDL approach for bound testing approach. It controls the problem of endogeneity also.

The results of ARDL in the short-run for agricultural growth are shown in Table 3.

Table 1: Results of Unit Root Test for Agricultural Growth Model

Variables		ADF Statistics Level	First Difference	Decision	Order of Integration
AGRI		-1.322	-5.892*	Stationary at 1st difference	I(1)
HCAP		- 4.439*	- 5.176*	Stationary at level and 1st difference	I(0), I(1)
PCAP		-1.569	-5.662*	Stationary at 1st difference	I(1)
URBN		1.521	-5.562*	Stationary at 1st difference	I(1)
PRICE		-1.583	- 4.403*	Stationary at 1st difference	I(1)
LAND		-2.687***	-10.369*	Stationary at level and 1st difference	I(0), I(1)
INF		-2.817***	-6.295*	Stationary at level and1st difference	I(0), I(1)
Critical Values	1%	-3.600	-3.606	-	-
	5%	-2.935	-2.937		
	10%	-2.606	-2.607		

* and **represent 1 and 5 percent level of significance respectively

Table 2: Results of Unit Root Test for Industrial Growth Model

Variables		ADF Statistics Level	First Difference	Decision	Order of Integration
INDUS		-2.287	-7.115*	Stationary at 1st difference	I(1)
HCAP		- 4.439*	- 5.176*	Stationary at level and 1st difference	I(0), I(1)
PCAP		-1.741	-4.470*	Stationary at 1st difference	I(1)
URBN		1.521	-5.562*	Stationary at 1st difference	I(1)
INF		-2.817***	-6.295*	Stationary at level and1st difference	I(0), I(1)
EXR		-1.242	-5.575*	Stationary at 1st difference	I(1)
Critical Values	1%	-3.600	-3.606	-	-
	5%	-2.935	-2.937		
	10%	-2.606	-2.607		

* and ** represent 1 and 5 percent level of significance respectively

Table 3: Results of Dynamic ARDL (Short run) for Agricultural Growth Model

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 1, 1, 0, 0, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable = AGRI

Regressors	Coefficients	t-Values	P. Values
AGRI(-1)	0.35272	3.213	0.003*
C	0.8373	0.3825	0.704
HCAP	0.06090	2.6761	0.012**
PCAP	–0.03779	–1.3992	0.171
PCAP(-1)	0.05752	2.0581	0.048**
URBN	–18.4471	–3.2834	0.002*
URBN(-1)	17.8018	3.1928	0.003*
PRICE	0.07842	2.7133	0.011**
LAND	1.2312	2.8360	0.008*
INF	–0.6013	–2.5593	0.015**
R^2= 97%	DW-value= 2.0964	F-statistic = 193.6363 (0.0000)*	
Test for existence of level of relationship among the variables			
F-statistic = 3.3838	90% lower bound = 1.9118	90% upper bound = 3.1392	

* and ** represent 1 and 5 percent level of significance respectively

The results of short-run estimates in ARDL bound testing approach for agricultural growth model shows that lag value of agricultural growth is positive and highly significant. It explains that the previous period growth is an important source to stimulate the short-run agricultural growth. The human capital positively influences the agricultural growth which explains that it increases the total factor productivity. The school enrolment, public sector education and health expenditures and health-care improve the quality of human capital which ultimately enhances the labor productivity in agriculturesector. The contribution of human capital in this model is 6 percent, i.e. one percent increase in human capital increases the agricultural growth by 6 percent in the short-run. The lagged value of physical capital and urbanization increases the agricultural growth rate in the short-run. The agricultural price policy and land utilization for agriculture increases the agricultural growth rate. However the general price level decreases the agricultural growth.

The results of ARDL in the long-run for agricultural growth are shown in Table 4.

The estimated coefficients of human capital and physical capital are positive which explain that increase in human and physical capital leads to increase in agricultural growth. The comparison of long-run and short-run estimates concludes that in the short-run human capital and physical capital are equally contributing in agricultural growth but in the long-run the human capital is more productive than physical capital. The urbanization has no significant effect on growth rate of agriculture sector. The agricultural price policy and land utilization for agriculture sector has positive impact while inflation has the negative impact on agricultural growth.

The results of ECM for agricultural growth model are shown in Table 5.

The coefficient of error correction is 0.44 with required negative sign which indicates 44 percent disequilibrium adjusted toward long-run equilibrium in a year after short-term shocks. Human capital, agriculture price policy and land utilization have positive role for the correction of disequilibrium. The inflation and urbanization have negative role in the process of adjustment.

The results of short-run dynamics of industrial growth are shown in Table 6.

The results in Table 6 reveal that the lagged value of industrial growth is positive. The coefficient of human capital positively affects the industrial growth that is one percent increase in human capital accelerates the industrial growth by almost 4 percent. The more educated and healthy labor force acceleratesthe process of industrialization.

The physical capital increases the industrial growth rate in the short-run. The lag value of urbanization and general price level decreases the industrial growth rate. The exchange rate also negatively affects the industrial growth rate.

The results of ARDL in the long-run for industrial growth model are shown in Table 7.

The estimated coefficient of physical capital explains that one percent increase in physical capital or gross fixed capital formation increases the industrial growth by 14 percent. The coefficient of human capital shows that one percent increase in human capital results into 6 percent increase in industrial growth. The results of human and physical capital reveal that both humanand physical capitals are important for industrial growth. The evidences proved that physical capital is more than two times more productive as compared to human capital.

Urbanization also positively influenced the industrial growth however the exchange rate has negative effect on industrial growth.

The results of ECM for industrial growth model are shown in Table 8.

The results in Table 8 show that the correction term is highly significant with expected negative sign. The coefficient of error correction indicates that 35 percent past disequilibrium isadjusted toward long-run equilibrium in a year after shot-run shocks. Human capital, physical capital, urbanization and inflation have positive role for correction of disequilibrium but exchange rate is insignificant to remove the disequilibrium in the current year.

Diagnostic tests are conducted for goodness of model. Serial correlation, functional form, heterosacdasticity and normality of data istested by these tests. The results of diagnostic tests for agricultural and industrial growth models are shown in Table 9.

The results of robustness of agricultural and industrial growth models cleared all the tests of robustness. The LM statistic of the model is less than the critical value and cannot reject the null hypothesis that there is no serial correlation. There is no other correct functional form of the model and there is no heteroscedasticity. Hence the models verify all the test of robustness. The graphs of CUSUM and CUSUMSQ for agricultural and industrial growth models shown in Annexure A reveal that both lines lie within the critical bounds of the models.

The impulse response of growth of value added by agricultural sector (shown in Fig.1 Annexure B) is one standard deviation to human capital, physical capital, urbanization, agricultural price policy, land use by agriculture sector and inflation. The Impulse Response Function suggests that this influence of the explanatory variables is not temporary and growth rate of agricultural sector does not steadily restore to the converging point.

The impulse response of growth rate of industrial sector is one standard deviation to human capital, physical capital, urbanization, exchange rate and inflation.It suggests that the influence of growth rate of industry is temporary and it restores to the converging point.

Table 4: Results of Dynamic ARDL (Long run) for Agricultural Growth Model

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 1, 1, 0, 0, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable is AGRI

Regressors	Coefficients	t-Values	P. Values
HCAP	0.9409	2.9649	0.006*
PCAP	0.1473	3.9735	0.000*
URBN	–0.9969	–1.1647	0.253
PRICE	0.1212	2.5880	0.014**
LAND	1.9021	3.0918	0.004*
INF	–0.0929	–2.9738	0.006*

* and ** represent 1 and 5 percent level of significance respectively

Table 5: Results of Error Correction Model for ARDL (Agricultural Growth Model)

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 1, 1, 0, 0, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable = AGRI

Regressors	Coefficients	t-Values	P. Values
dHCAP	0.0609	2.6761	0.011**
dPCAP	0.0378	1.3992	0.171
dURBN	–18.4471	–3.2834	0.002*
dPRICE	0.0784	2.7133	0.010*
dLAND	1.2312	2.8360	0.008*
dINF	–0.0601	–2.5593	0.015**
ECM(-1)	–0.4473	–5.8974	0.000*
R^2 = 0.5797	DW-Statistic = 2.0964	F-statistic = 7.3571 (0.000)*	

* and ** represent 1 and 5 percent level of significance respectively

Table 6: Results of Dynamic ARDL (Short run) for Industrial Growth

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 0, 1, 1, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable is INDUSTRY

Regressors	Coefficients	t-Values	P. Values
INDUS(-1)	0.29684	2.1711	0.037**
C	7.5680	4.3173	0.000*
HCAP	0.04253	2.1164	0.042**
PCAP	0.10539	2.8646	0.007*
URBN	24.2759	3.9143	0.000*
URBN(-1)	–23.7893	–3.8370	0.001*
INF	0.08037	2.7426	0.010*
INF(-1)	–0.05016	–1.8203	0.078***
EXR	–0.09500	–3.0498	0.004*
R^2= 79%	DW-value= 1.7928	F-statistic = 18.2515 (0.0000)*	
Test for existence of level of relationship among the variables			
F-statistic = 3.2548	90% lower bound = 1.9780	90% upper bound = 3.1452	

*, ** and *** represent 1, 5 and 10 percent level of significance respectively

Table 7: Results of Dynamic ARDL (Long run) for Industrial Growth

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 0, 1, 1, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable = INDUS

Regressors	Coefficients	t-Values	P. Values
HCAP	0.06048	2.0329	0.050**
PCAP	0.14988	2.8478	0.008*
URBN	0.69197	9.1336	0.000*
INF	0.42957	1.2736	0.212
EXR	–0.13512	–3.3330	0.002*

* and ** represent 1 and 5 percent level of significance respectively

Table 8: Results of Error Correction Model ARDL (Industrial Growth Model)

Autoregressive Distributed Lag Estimates ARDL bound testing (1, 0, 0, 1, 1, 0) selected based on Schwarz Bayesian Criterion (SBC)
Dependent variable = INDUS

Regressors	Coefficients	t-Values	P. Values
dHCAP	0.04253	2.1164	0.041**
dPHY	0.10539	2.8646	0.007*
dURBN	24.2759	3.9143	0.000*
dINF	0.08037	2.7426	0.010*
dEXR	–0.70316	–3.0498	0.004*
ECM(-1)	–0.35029	–5.1429	0.000*
R^2 = 0.5249	DW-Statistic = 1.7928	F-statistic = 7.2922 (0.000)*	

* and ** represent 1 and 5 percent level of significance respectively

Table 9: Results of Sensitivity Analysis of Agricultural and Industrial Growth Models

	Agricultural Growth Model		Industrial Growth Model	
Test	Value	P-value	Value	P-value
Serial Correlation test	0.7353	0.391	0.2240	0.636
Ramsey Reset test	0.4933	0.824	0.8356	0.366
Normality (J.B test)	2.0857	0.352	0.02127	0.989
Heteroscedasticity test	2.2605	0.133	0.1264	0.722

Discussion and Policy Recommendations: The human and physical capital both positively contribute in agricultural growth, however the role of human capital is stronger than the physical capital. The establishment of agriculture research and development by stressing on vocational, professional and technical education for agriculturists should be focused in policy formation. The government should expand public investment in health and education and focus on policies to increase the quality and quantity.

Agricultural price policies have shown positive impact on agricultural growth. Higher procurement prices of agricultural products like wheat, cotton and sugarcane increase production of these crops. The implementation of agriculture price policy and inclusion of more crops in agriculture price policy may result into enhanced agricultural growth.

Land utilization for agriculture sector has shown positive impact on growth rate of agriculture. Agriculture land is an important input for agricultural production through intensive or extensive land utilization. In Pakistan, still 35 percent of land is under cultivation. It may be increased for enhanced agriculture sector growth.

The coefficient of inflation has indicatednegative effect on the process of agricultural growth. The higher inflation represents the higher prices of inputs and the economic uncertainties which may result into decreased agricultural production.

For the industrial sector, both the human and physical capitalpositively contribute in industrial growth rate. However, the contribution of physical capital is almost two times greater than that of human capital. It represents the poor industrial infrastructure in the form of information technology, energy and power plants, transportation, communication and steel mills. The measures to increase the efficiency of physical capital may enhance the industrial growth.

Urbanization has shown positive impact on industrial sector growth in Pakistan. It explains the existence of human capital and infrastructure for industrialization in urban areas. The energy, gas, transportation and communication facilities along with skilled labor and consumer market are available in urban areas which enhance the industrial growth rate.

The exchange rate has negative impact on industrial growth. Increase in exchange rate depreciates the domestic currency. The raw material and machinery are imported for industrial sector. The high prices of these factors reduce the industrial growth in the country.

Annexure A:

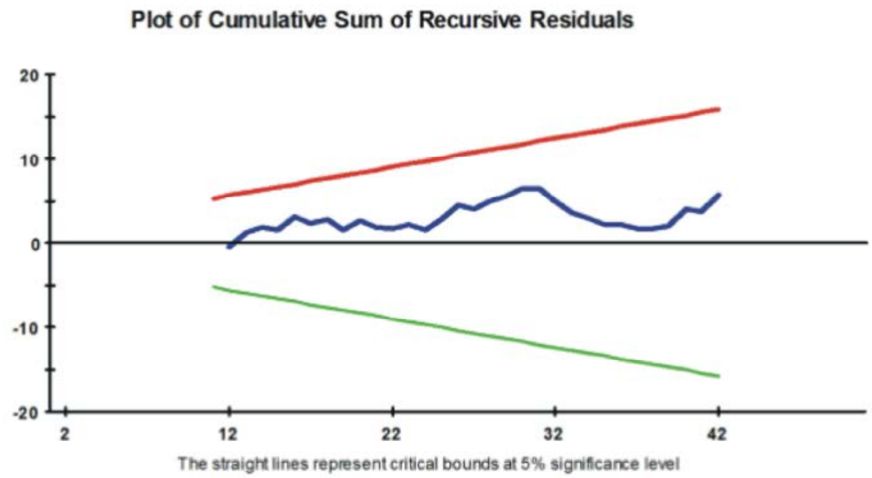

Fig. 1: CUSUM graphs of Agricultural growth model

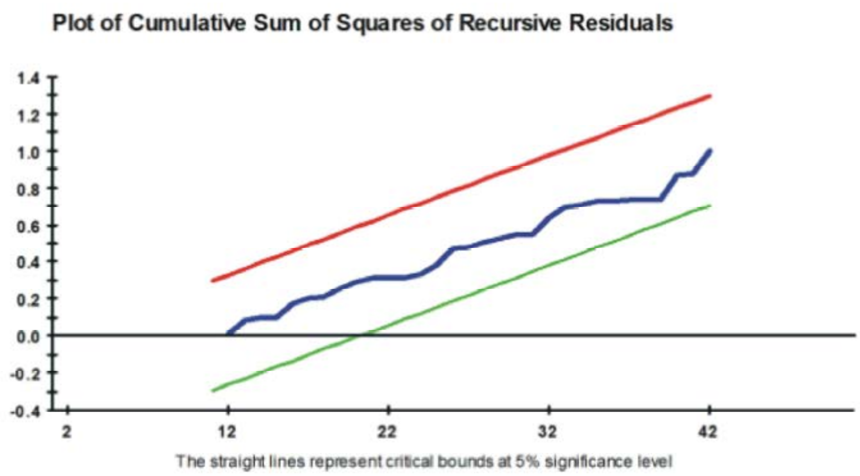

Fig. 2: CUSUMSQ graphs of Agricultural growth model

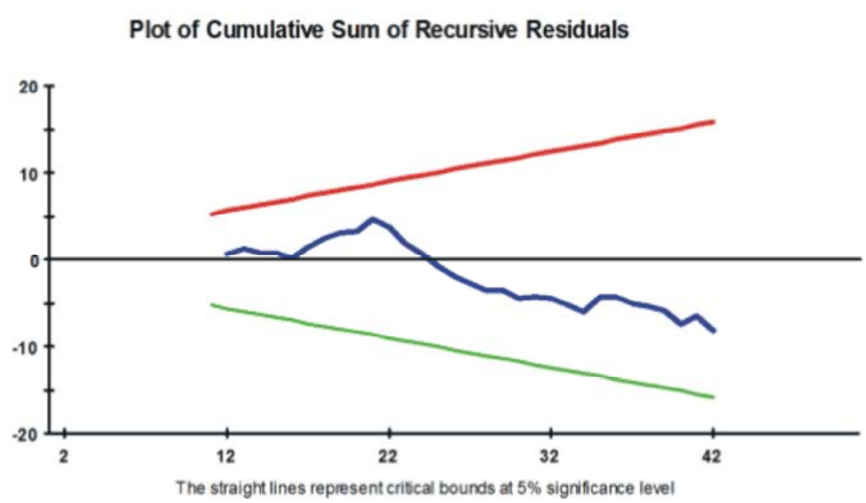

Fig. 3: CUSUM graphs of Industrial growth model

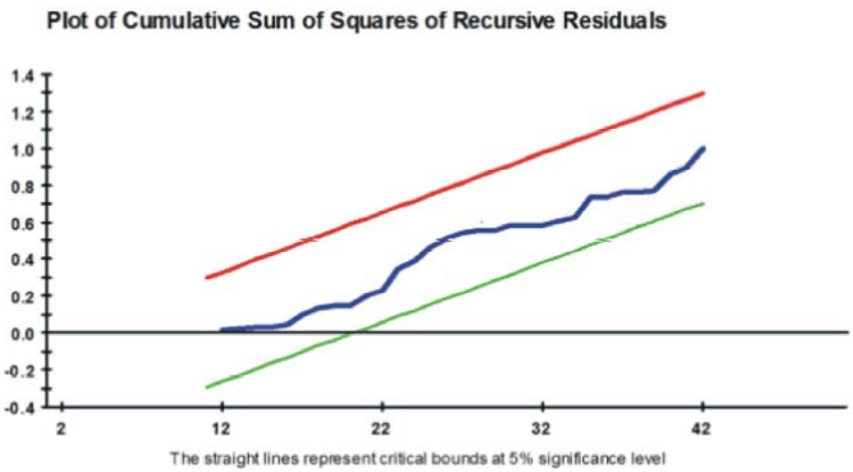

Fig. 4: CUSUMSQ graphs of Industrial growth model

Annexure B:

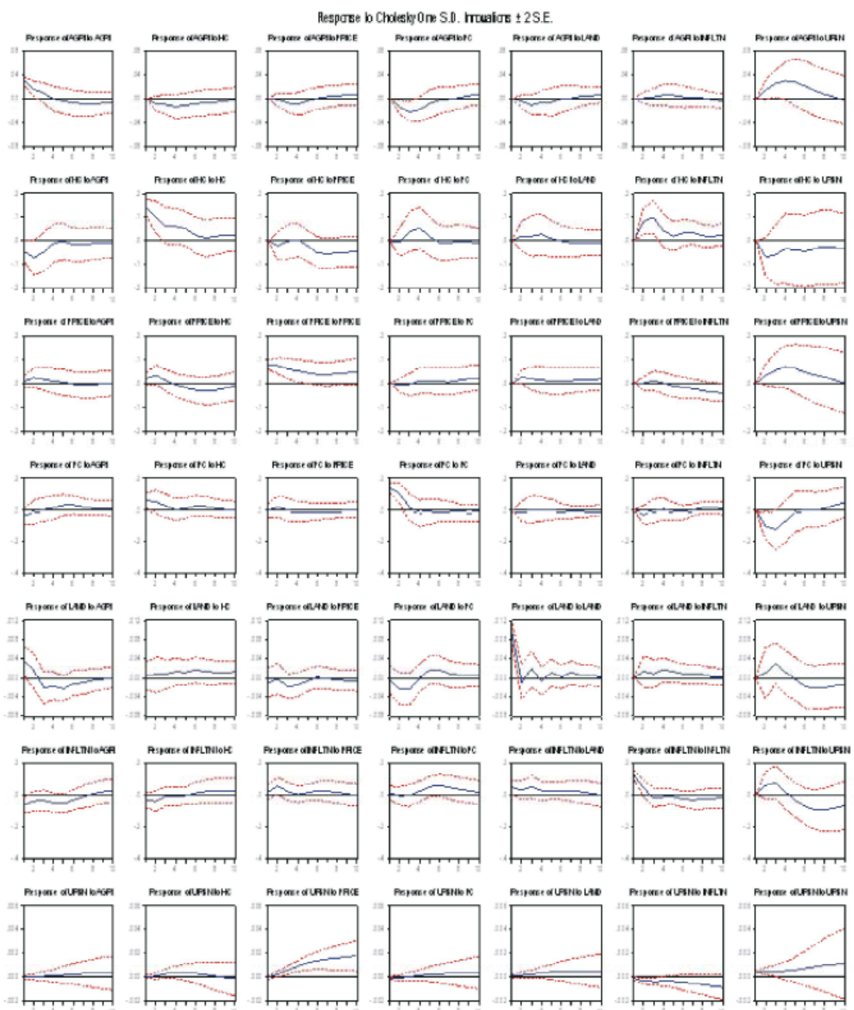

Fig. 1: Impulse Response of Agriculture Growth Model

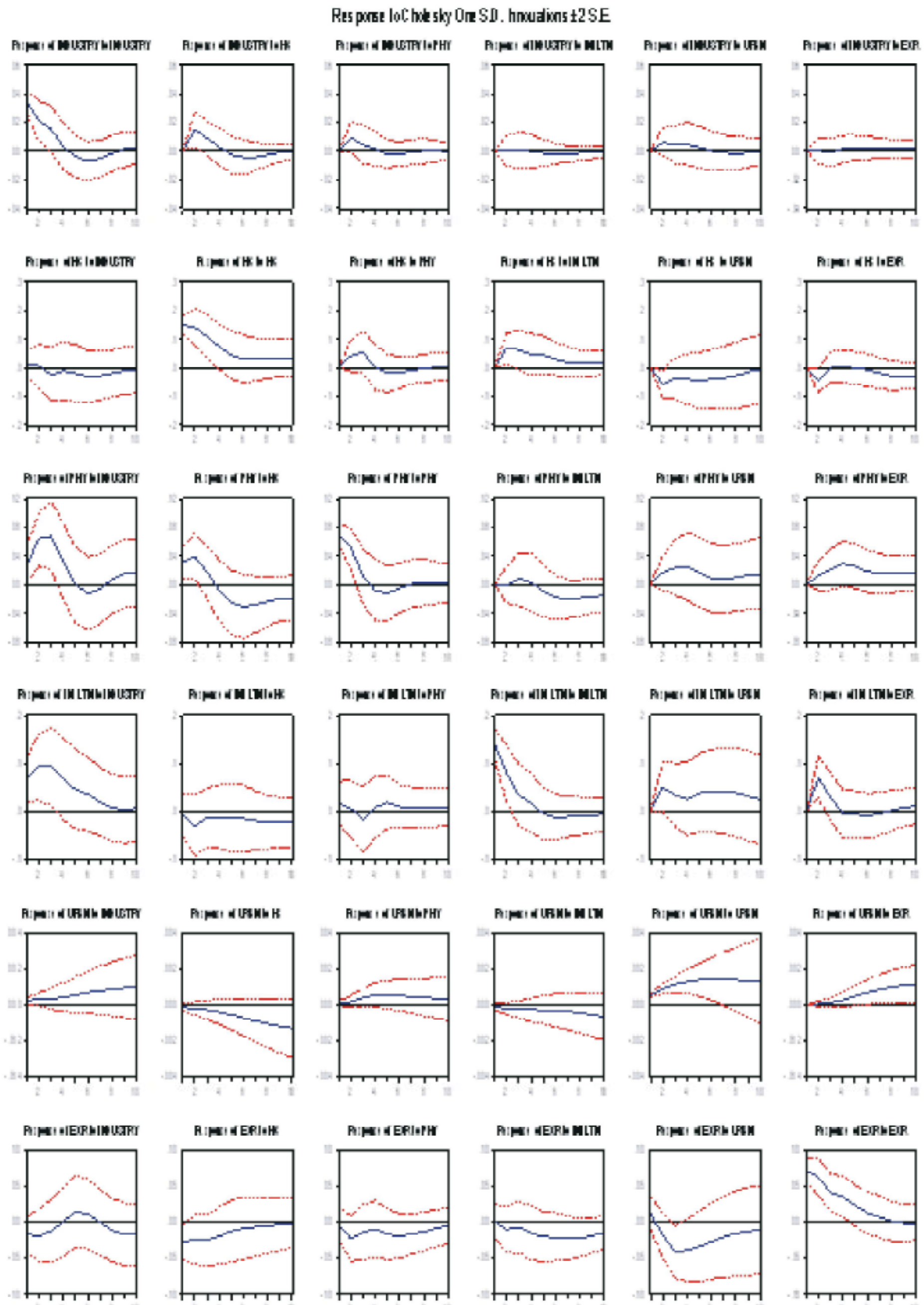

Fig. 2: Impulse Response of Industrial Growth Model

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