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An Estimation of the Long Run Relationship between Agriculture Output, Export and Investment in Sindh-Pakistan (Some Evidences From Johnson Model 1988-95)

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Abstract:
Primary goals of any agricultural investment policy must be increasing productivity to protect food security and promote economic development of the region by export. The main goal of this study is to evaluate total investment and its co integration with agriculture output and agriculture export in Sindh-Pakistan. This study concludes that investment is helpful in the short run and long run. More investment of public and private sector will boost export of agric commodities in era of free trade will also do more to raise productivity and thereby promote agricultural and economic development in emerging economies like Sindh – Pakistan in the long-run.
The close inspection of graphs shows the existence of strong time trend in the data and coefficients of the sample autocorrelation die down at high lags and indicate that these series are not stationary in levels and confirms the presence of time trend in the series. The ADF test (1979) is also concluded that all variables are I (1) in their levels and I (0) in the first difference at 5 percent level of significance. The result of granger causality test (1969) revealed that none of the above combinations has bivariate causality. The result shows the cointegration relation exists in lagout, lagexp, linv, lpinv for Pakistan though it is unidirectional causality not bivariate. However for Sindh the cointegration relation exists in lsagout, lsinv and lspinv. The multivariate cointegration test of Johansen's (1988) concludes that both trace and eigen vale test indicates one cointegration relationship between lagout, lagexp, lginv and lpinv. However for Sindh only trace test indicates one cointegration relationship between lsagout, lsagexp, lsginv and lpinv.

Keywords: *Agriculture output, agriculture export, agriculture investment, government investment, private investment*

1. Introduction

The topic of Agricultural Sector Development has been studied worldwide by individuals, research organizations, public sector agencies and international donors. All of them have used similar variables with different methods for analysis. They have used five main variables i.e., land labour, water, capital, and modern purchase variables in their studies for measurement of growth and change in the sector. Mellor (1966) , Khan M.H (1980) Syed Shjaat Ali (2004), World Bank (,2007)emphasized on the following factors of production in agriculture i.e. land, labour, farm capital and current market inputs like seed, chemical fertilizer, pesticides, mechanical tools, credit etc.The issue of Sindh's Agricultural Sector Development has been studied by various authors and they used similar variables but the of them majority deal with the specific issue separately like S.N Zahid (1982) focused on factor markets and land tenure system in Sindh and the study is three decade old, Mehmood Hassan khan (1980) used the same kind of variables but it is a simple report with an overview on agricultural issues in Sindh. He suggested that a detailed study is needed on agric-development of Sindh to sort out the issues in its development. Of late, (SZAIBST 2001) work is also an overview except chapter of irrigation which is comprehensive. These studies used similar variables to test the hypothesis but have not touched feasible policy recommendations in detail for further development of the sector and the above studies have used descriptive statistical manners rather than current scientific methods, like use of econometric models to discover new facts and findings. On the other hand, when we look at the past development trends in Sindh agriculture sector with reference to above mentioned variables, we find the following evidence. The study of Dr Ishrat Hussain (1981) concludes that in the past history of Sindh, the Kalhora rule (1700 to1782 A.D) relieved the people from outside domination and maximized their energies / potential for self development and self expression with improvements in irrigation and agriculture economy. He adds that the Kalhora period was known as climax period of agricultural development and famous for textile export and other agricultural commodities, and this growth was only due to investment in irrigational development

schemes. Sir Delhost's study (1832) concludes that the agricultural development in the region mainly depends on improvement in water resources. So, water is considered as an important variable in earlier empirical studies but needs considerable and sustainable investment for improvement and desired results. The Talpurs' period (1783 to 1843 A.D) leaves much to be desired as far as agricultural and economic growth is concerned. Large tracts of fertile lands were literally converted into hunting grounds by the Talpur rulers due to their luxurious/ ostentatious life style and poor policies/lack of interest towards agriculture. "The land under cultivation nosedived by 50% in Talpurs regimes as compared to Kalhora regime."(Chablani, 1995, pp. 284). The reasons behind this were negligence of rulers towards investment in irrigational development schemes that reduces the expansion of land for cultivation, besides reducing share of agric- production in GDP and per capita income of the people. In conclusion, water and land expansion variables are interrelated work in tandem for increase in cropped area and farm productivity that lead to growth in the short run and development of the sector in the long run. The study of M. S. Kamdar, Professor at Sindh Agriculture University (1988-1996) concludes the following important evidence about agricultural development in Sindh during the British period (1843-1947). According to him, three unrivaled initiatives were taken in Sindh for the development of agriculture sector during the British period, (1) Construction of Sukkur Barrage (2) The institutional development in agricultural sector and (3) The development of means of communication. The construction work of Sukkur Barrage ushered in a new era in the life of Sindhi people and laid the foundation stone for agricultural and economic development in Sindh. The barrage forms the backbone of Sindh's economy, socio-economic condition of farming communities and irrigates over 7 million acre land. During Talpurs period, only one million acre land was under cultivation but following the commencement/ construction of the barrage, 52.5 lac acres of new land was brought under cultivation. Another great change that deserves some mention here was introduction in the British rule of agricultural development on capitalistic lines. Three key institutional changes introduced by the British are of consequence for landholdings and agricultural production. First, the institution of private property as the British understood was introduced in India in late eighteen and early nineteen centuries. Second, at the same time, a legal system was established that was closely related to the ownership of property. Third, the British established an efficient government. The area under cultivation dramatically increased the output of commodities shown signs of improvement, agricultural commercialization grew and, output markets developed. He adds "Sindh started to move towards a market directed society and the emergence of a market economy could be distinguished from the traditional economy of earlier time." (M. S. Kamdar 1988, pp, 28).He also suggests that the state should focus on policies of infrastructural development for the cause of agric-development. Infrastructural development schemes reduce distances, ensure easy market access to agric commodities, strengthen links with urban markets and also create land markets. So he stresses the need for investment in socio-economic infrastructural development in rural areas for the basic cause of agriculture sector development. The study of Akbar Zaidi (1999) concludes that the post Pakistan period (1947- to date) can also be divided in three phases i.e. phase–I or pre-green revolution period from 1947 to 1958, phase–I green revolution period from 1959 to 1969 and phase–III, post green revolution period form 1970 to date. In phase I, the agricultural growth was generally measured stagnant due to following problems. Problems of refuges form India, political instability in the country, policy makers' ignorance of agricultural and preference to industrial sector, lack of technological change and lack of reforms in agriculture sector. Allotment of land to non agriculturalist class in claims reduced the interests of farmers. In phase- II, shortage of food for growing population, importance of foreign exchange through agricultural production and need for raw material forced the policy makers across the world to change their policies towards agriculture. As a result, the green revolution policies were implemented land reforms were introduced in 1959, water resources were increased through tube-wells, construction of dams, mechanization was introduced through tractors and other tools and agricultural development corporation was established for credit. The growth of Sindh agriculture is further divided in three phases by Pervez Waseem (1999) who concludes the following important assumptions regarding Sindh agriculture sector that agricultural growth in Sindh mainly depends on investment in irrigational schemes that increase land expansion for major crops. Fluctuation in area and productivity is the major causes for the fluctuation in growth. That is why, instability in development process was observed; incessant fluctuation in area is only due to water scarcity, shortage of other inputs, natural calamities also affect growth and destabilize the development process further. As a result, not only did export volume reduce but serious food crisis forced the economic managers to import food items just like wheat and other commodities recently. It has been concluded on the basis of above mentioned studies regarding Sindh –Pakistan that sustainable agricultural growth has been a matter of concern in strategy of agricultural sector development. Instability in growth is one of the important decision parameters in development dynamics and more so in the context of agricultural production. Wide fluctuation in crop output not only affects price but also wide variations, in disposable income of the farmers that spread poverty among them particularly in rural economy. So if we require the stabilized development process that we need a policy change towards agricultural sector forms a backbone of economy like developing economy of Sindh- Pakistan with huge investment by private and public sector in rural infrastructure, irrigational development schemes for land expansion, industries sector for timely availability of seed, fertilizers, pesticides, mechanical tools industries, banking sector improvement for credit facility and several other purchase inputs and rural infrastructure for output market improvements and agro based industries at farm level for the sake of increase in farm productivity and export growth both have great significance in developed farming at global level. This is also concluded here that all earlier studies mostly used/employed similar type of variables with descriptive statistical analysis but there is a dire need to determine the process of agricultural sector development by employing econometric model to examine the development process on scientific methods to test and confirm the hypothesis and correlation of the variables of interest to observe the transformation / change process in the agriculture sector in the short and long run. Keeping in view the above discussion , this study considers the following variables of interest, the total agricultural output, total investment including public and private investment and total agricultural export using time series for the period of 35 years particularly for Sindh and generally for Pakistan to discover new facts and figures and also to observe long-run co-integration

relation between these variables as selected in the earlier studies with new methodology, the Johansen's (1988-95) procedure which is given below at length .

2. Review of Literature

The Johansen's (1988-95) procedure has been immensely popular in a multivariate context results arrived from different studies have also been shown to be more robust by adopting the Engle-Granger(1969) approach to analyse and examine the sustainable growth / development process using time series data of long time ideally if the period of study is more than three decades.

Naveed .H.Naqvi (2002) uses the co-integrating VAR's model of Johansen (1988) to examine the relationship between economic growth, public investment and private investment. The analysis is conducted on 37 years data (1964-2000) of Pakistan. The analysis suggests that public investment has a positive impact on private investment, and that growth drives both private and public investment as predicted by the accelerator-based models. He further concludes that most studies of investment developing countries are single equation models based either on the neoclassical model extensions or various augmented versions of the flexible-accelerator model of investment. These models are generally based on the assumptions of stationarity of all variables and exogeneity of the explanatory variables. Where endogeneity is suspected, the usual single-equation methods, such as 2SLS, are used to correct it in a single-equation model. The relationship of two variables exports and growth, grounded in endogenous growth theory has also been tested for Pakistan by Ahmad, QM& MS But (2000); and Akbar .M and Z. F.Naqvi (2000) applying the same method.

Naveed .H Naqvi and Tsoukis (2003) also used the similar model and methodology in their study on six countries of south Asian region "Does Public Investment Crowd Out Private Investment" This analysis is based on Toda and Yamamoto(1995) and finds that no single relationship between public and private investment varies country to country. Kanwar (2000) suggests that in estimating the relation between agricultural and non-agriculture sectors, the former should not be assumed to be exogenous, rather this should first be established. He also criticizes the "neglect" of agricultural sector role in the development process of the less developed economies. In his study, the author studies the co-integration of the different sectors of the Indian economy in a multivariate vector auto regression framework to circumvent problems of spurious regressions given the presence of non-stationarity data. Henneberry, S. R., Khan, M. E. and Piewthongngam, K. (2000), for the case of Pakistan use the same techniques and conclude that the contribution of agricultural growth to economic development varies markedly from country to country and from one time period to another within the same economy.Yao, Shujie (2000) demonstrates how agriculture has contributed to China's economic development using both empirical data and a co-integration analysis. Two important conclusions are drawn. First, although agriculture's share in GDP declined sharply over time, it is still an important force for the growth of other sectors. Second, the growth of non agricultural sectors had little effect on agricultural growth. This was largely due to government policies biased against agriculture and restriction on rural population. Tiffin and Irz (2006) also use the Granger causality test and co-integration in the panel data for 85 countries and find evidence that supports the conclusion that agricultural value added is the causal variable in developing countries, while the direction of causality in developed countries is unclear. Katircioglu (2006) analyzes the relationship between agricultural output and economic growth in North Cyprus, a small island which has a closed economy using co-integration. This author uses annual data covering (1975-2002) period, to find the direction of causality in Granger sense between agricultural growth and economic growth. His empirical results suggest that agricultural output growth and economic growth as measured by real gross domestic product growth are in long-run equilibrium relationship and there is a feedback relationship between these variables that indicate bidirectional causation among them in the long-run period. The study also concludes that agriculture sector still has an impact on the economy although North Cyprus suffers from political problems and drought.

Houssem Eddine Chebbi and Lassaad Lachaal (2007) have used the similar model in their study titled "Agriculture sector and economic growth in Tunisia: Evidence from co-integration and error correction mechanism" a study of African Development Bank. The paper examines the agricultural sector role in the economic growth and its interactions with the other sectors using time-series co-integration techniques. The learned authors have used annual data from 1961 to 2005 to estimate a VAR model that includes GDP indices of five sectors in Tunisian economy. The empirical results from this study indicate that in the long-run, all economic sector tend to move together (co-integrate). But, in the short-run, the agricultural sector seems to have a limited role as a driving force for the growth of other sectors of the economy. In addition, the growth of agricultural output may not be conducive directly to non-agricultural economic sector in the short-run. Dr.Abhijit .Sharma, an eminent professor of econometrics and reader of this study suggests that most empirical work on investment, growth and development has identified the use of Johnson frame work (1988-1995) and Granger causality (1969). He advises to use the similar model specifically in this study due to its great significance and wider use in such kind of development studies. This study also chooses to analyse the cointegration relationships between variables of interest by employing Johansen's multivariate cointegration frame work (1988). The Granger causality test (1969) is also used in the study. The sample autocorrelation coefficient is calculated to test the hypothesis of non-stationarity. It is a maximum likelihood estimation procedure which allows researchers to estimate simultaneously the system involving two or more variables. Therefore, the study also seeks to extend the research in two directions by using cointegration techniques pioneered by Johansen (1988) and further developed in applied work by Granger causality (1969) to look for evidence of feedback among agriculture output and investment, public investment, private investment and agric-export growt It is also important to mention here that recent advances in the theory of econometrics of time series advocate the usage of more sophisticated procedures to investigate the properties of the time series data. So keeping in view the above during the testing of unit roots the Augmented Dickey-Fuller (ADF) (1979, 1981) τ_t–statistic corresponding to the parameter ρ for the individual series of Pakistan and Sindh has been employed in the study to make the study fine too. Such kind of analysis would be very useful and such regression based results could prove to be highly publishable

3. Methodologies for Estimation of the Model

This study is a unique piece regarding analytical methodology employed in the study. In this sense, a dual strategy has been employed to produce a fine and different document from previous studies. In the first analytical strategy, the Johansen's co integration framework (1988) has been used to find out the long-run relationship between variables of interest, i.e. agriculture output, total investment, public investment, private investment and agriculture export in Pakistan and Sindh. To explore this relationship empirically, the method of Granger causality (1969) is also employed to investigate the causality of two variables to check the feedback for further validation. The study employs different procedures to investigate the properties of an individual time series to produce new facts and figures for comprehensive and valid results. The first procedure plots the data series against time.

The second procedure is concerned with calculation of simple auto correlation and coefficient of the time series to test the non-stationery of hypothesis. In third procedure for testing unit roots in the empirical analysis, the recent advances in the theory of econometrics of time series has been employed to make the study more sophisticated to investigate the properties of the time series data. In this sense, the Augmented Dickey-Fuller (ADF) (1979, 1981) τt–statistic corresponding to the parameter ρ for the individual series of Pakistan and Sindh has widely been used to make the thesis more viable and analytical one. For further analysis, to test the hypothesis that the $\rho=0$, the calculated t-values are compared with the τt values given in Mackinnon (1991) to find out best results in analytical methods. In the fourth procedure, casualty of two variables in Pakistan and Sindh has been tested.In the last and fifth procedure, cointegration test has been conducted to summarize the results to complete the objective of the analytical method used in the study to make it logical and comprehensive according to modern econometrics approach with a hope that this study is the first of its kind in analytical attempt towards Sindh agriculture sector.

4. Data Set for Econometrics Model

The study covers the data of Pakistan national income accounts for the period of 35 years as a pre-requisite for the above mentioned model. The secondary data of 35 yearly issues (1972-2007) of "Pakistan Statistical year book" are used for agriculture output (AGOUT) and total investment (INV) Including Government Investment (GINV) and Private Investment (PINV). For the Agriculture Export Component (AGEXP) the published data of 35yearly issues of "Agricultural Statistics of Pakistan" an annual data book of ministry of food, agriculture and livestock government of Pakistan Islamabad (MINFAL) have been used for country based analysis. The Sindh province level data collection was really a difficult task due to lack of proper work on Provincial Gross Domestic Product (PGDP). This is due to low capacity of Sindh Bureau of Statistics and negligence of federal government institutions i.e. Federal Bureau of Statistics so that different variables of Sindh data set is collected in fragmentations conditions from different reliable sources. The similar set is based on various issues of "Development Statistics of Sindh", "Agricultural Statistics of Sindh" and "Sindh Basic Facts /Sindh at a Glance" for the same period of 35 years as already taken at country level. Above pubations of Sindh bureau of statistics, planning & development department. The data of Ist draft of proposed study on (PGDP) titled "Economic Survey of Sindh (1972-2008), a joint work of College of Business Management-IOBM Karachi and Government of Sindh which is in publishing process; and reliable institutional data of board of investment, trade development authority and agriculture department is also used for the mentioned variables i.e. Sindh Agriculture Output (SAGOUT) Sindh Total Investment (SINV) Sindh Government investment (SGINV) as well as for Sindh Private Investment (SPINV) and Sindh Agriculture Export (SAGEXP) in course of data analysis. The author also uses the E-views-5.1 version software package in model for the above mentioned time series analysis. This procedure is independent of the choice of the indigenous variables.

5. Introduction of the Model

The estimation of the long run relationship between agriculture output, export and investment in Pakistan and Sindh is one objective of this study. To explore this relationship, empirically, the method of cointegration and Granger causality testing is employed. As a prerequisite to the analysis of cointegration the knowledge of the data generation process (DGP) of individual time series is required. This analysis could be done by number of ways. As a first step, towards modeling the agriculture output in Pakistan and Sindh, the hypothesis of stationarity of individual series is tested. The following section plots the individual series. Section 5.2 gives the results of the sample autocorrelation coefficients of the series. The results of the ADF unit root test are discussed in the section 5.3, while the section 5.4 discuss cointegration test and 5.5 provides result of Granger causality test. Sub section 5.6 also discusses result of Johansen's multivariate test.

5.1 Plot of the Series

To investigate the properties of an individual time series different procedures are used. The first procedure plots the data series against time. All series are log form. Figures 1-10 shows the plots of the time series from 1972-73 to 2006-07. These series include agriculture output, agriculture export, total investment, government investment and private investment. All series are for overall Pakistan and Sindh level. On close inspection these graphs shows the existence of strong time trend in the data.

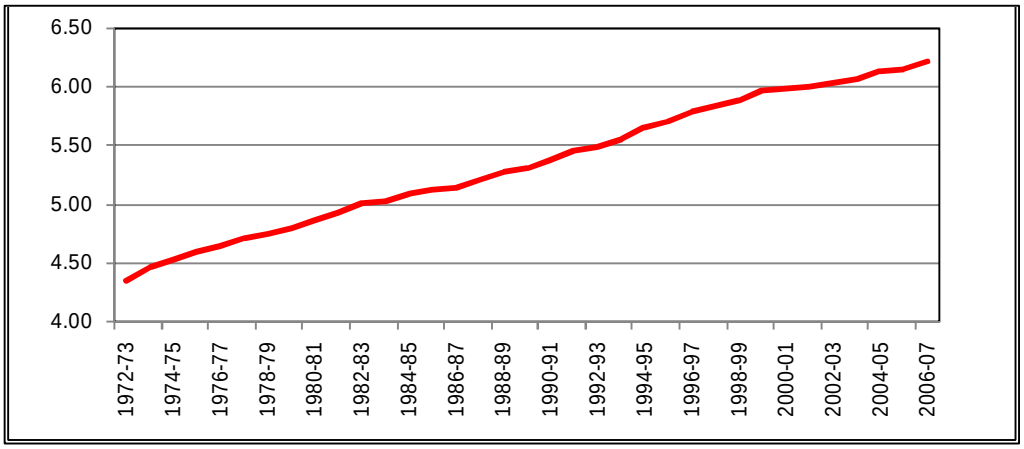

Figure 1: Log of Agricultural Output – Pakistan

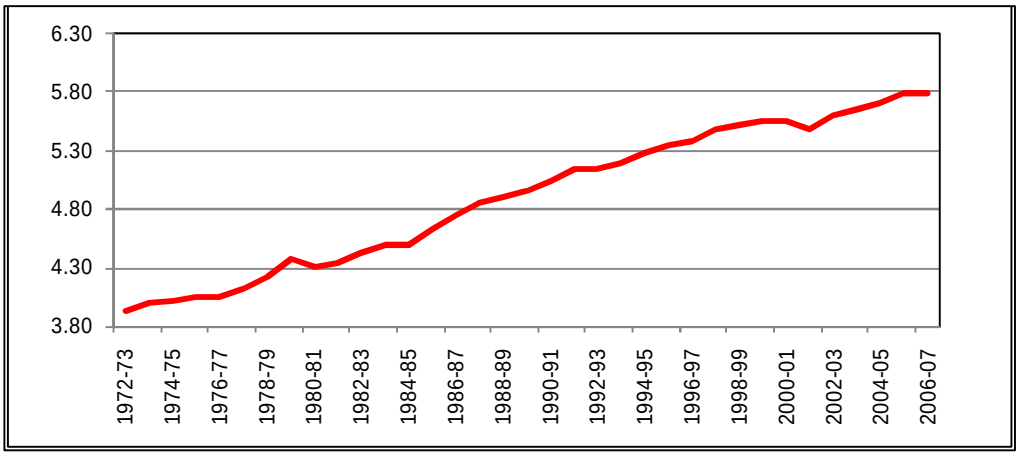

Figure 2: Log of Agricultural Export – Pakistan

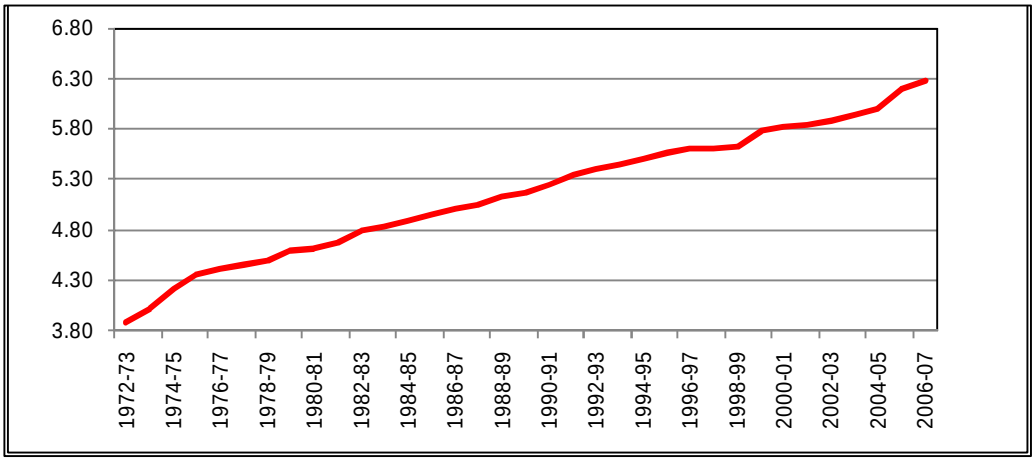

Figure 3 Log of Total Investment - Pakistan

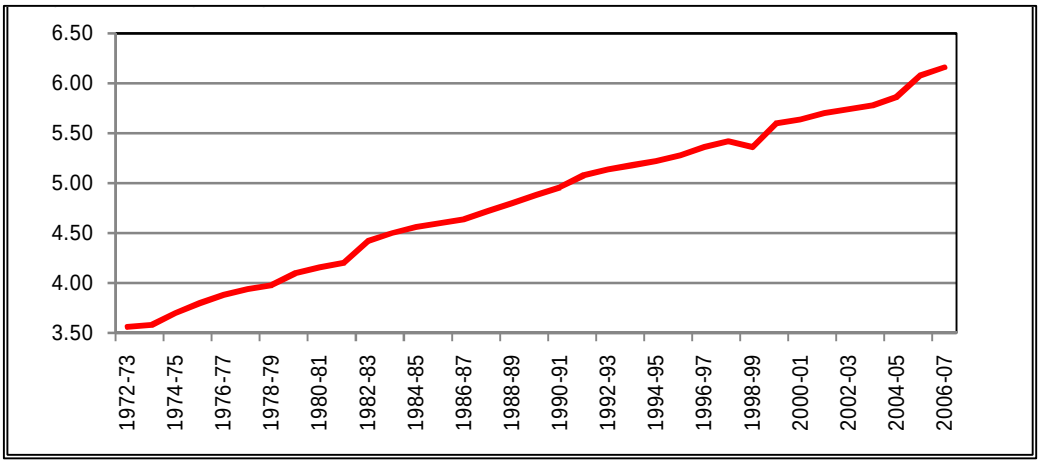

Figure 4: Log of Government Investment - Pakistan

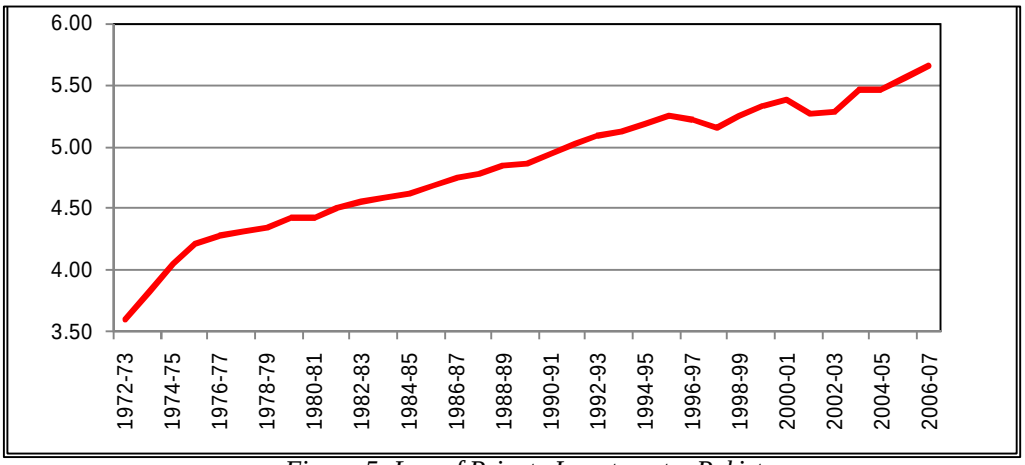

Figure 5: Log of Private Investment – Pakistan

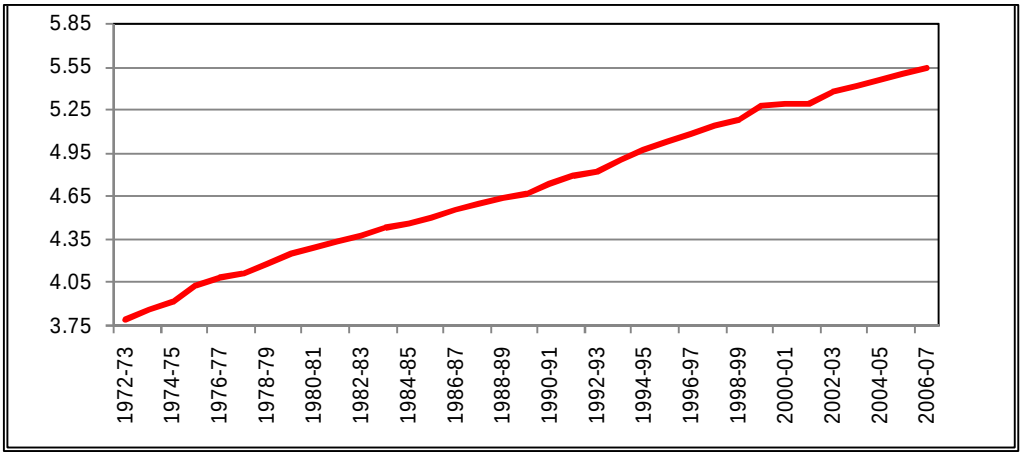

Figure 6: Log of Agricultural output - Sindh

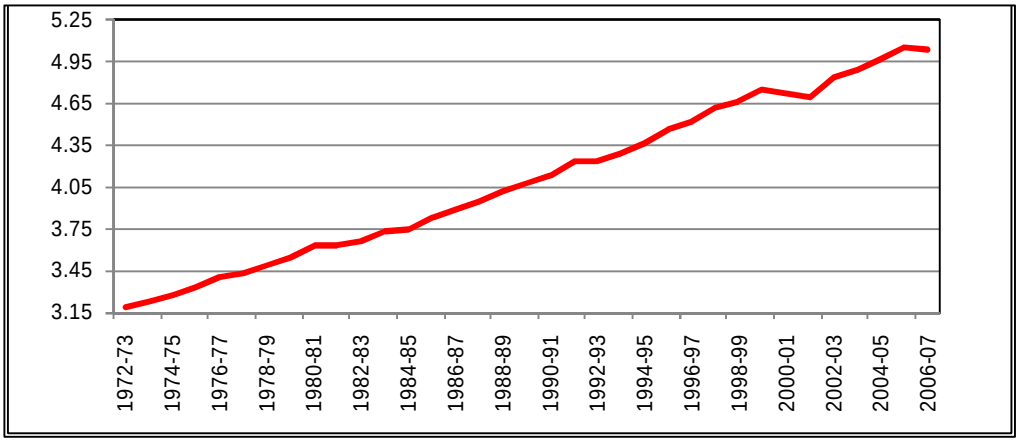

Figure 7: Log of Agricultural Export – Sindh

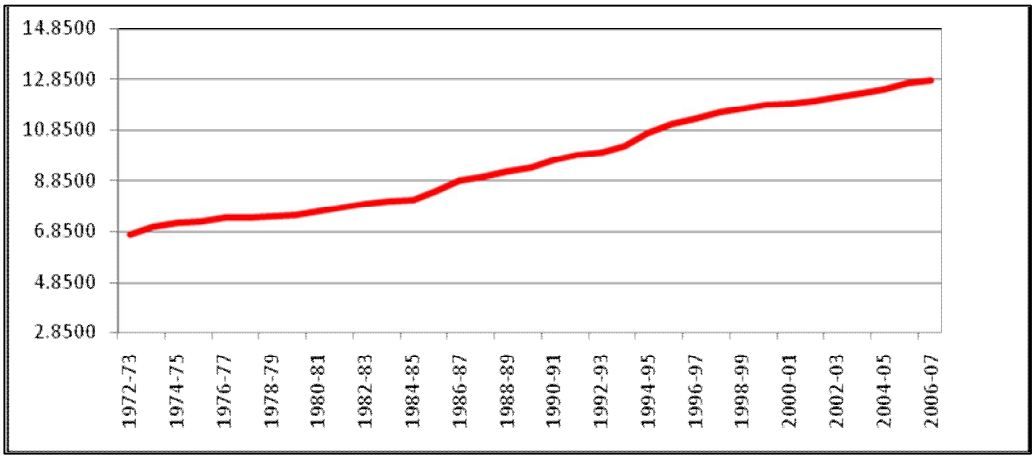

Figure 8: Log of Total Investment – Sindh

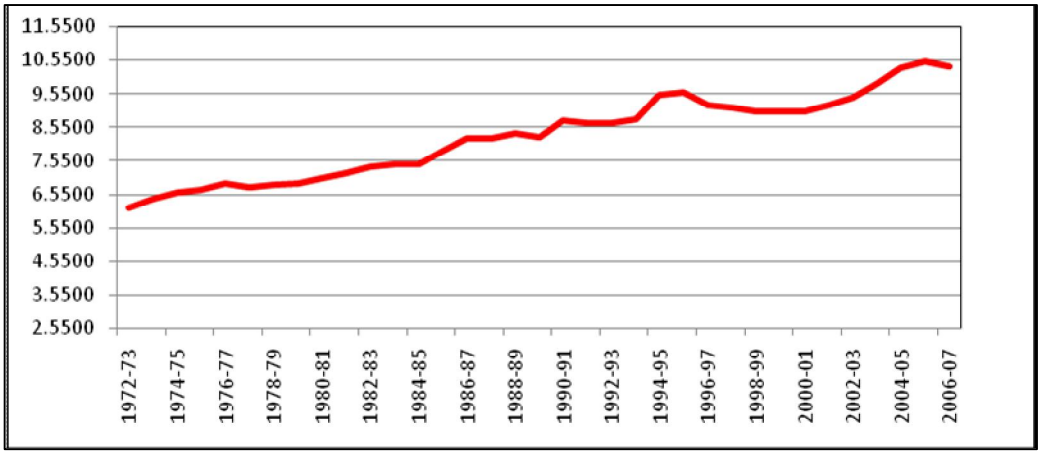

Figure 9: Log of Government Investment - Sindh

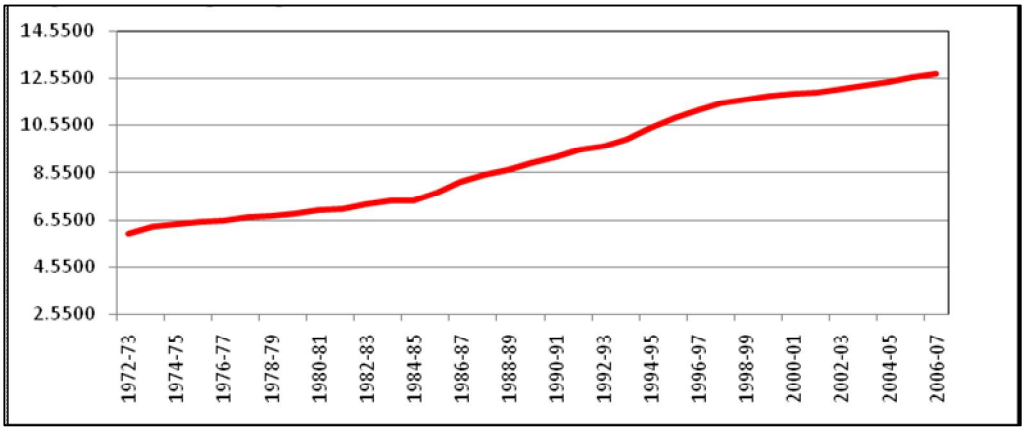

Figure 10: Log of Private Investment - Sindh

5.2 Simple Autocorrelation Coefficient:

The second procedure in concerned with the calculation of the simple autocorrelation coefficient (SAC)[1] of the time series. In the case of stationary series, the sample autocorrelation coefficient has the property of dying down quickly. The sample autocorrelation coefficient is calculated to test the hypothesis of non-stationarity. Table 1a shows the calculated sample autocorrelation coefficients of all series for Pakistan and Table 1b presents the sample autocorrelation coefficients for all series pertain to Sindh. The close inspection of these tables shows that the coefficients of the sample autocorrelation die down at high lags. This property indicates that these series are not stationary in levels. These series require first differencing to become stationary. This confirms the conclusion drawn from the plots of these series, that is, the presence of time trend in the series.

Table 1a

The Estimated Sample Autocorrelation Coefficients - Pakistan

	Lagout	**Lagexp**	**Linv**	**Lginv**	**Lpinv**
1	0.846	0.862	0.802	0.822	0.793
2	0.711	0.738	0.652	0.68	0.636
3	0.589	0.63	0.537	0.561	0.534
4	0.472	0.52	0.437	0.455	0.437
5	0.372	0.410	0.359	0.369	0.364
6	0.286	0.318	0.282	0.287	0.285
7	0.213	0.238	0.212	0.214	0.209
8	0.156	0.174	0.154	0.152	0.148
9	0.113	0.113	0.106	0.101	0.097
10	0.082	0.061	0.066	0.057	0.058

Table 1b

The Estimated Sample Autocorrelation Coefficients – Sindh

	Lsagout	**Lagexp**	**Lsinv**	**Lsginv**	**Lspinv**
1	0.839	0.840	0.853	0.805	0.862
2	0.694	0.694	0.723	0.632	0.738
3	0.566	0.575	0.607	0.531	0.622
4	0.451	0.463	0.496	0.459	0.508
5	0.355	0.363	0.393	0.389	0.400
6	0.272	0.283	0.302	0.301	0.307
7	0.205	0.219	0.232	0.226	0.235
8	0.155	0.165	0.177	0.161	0.177
9	0.116	0.126	0.132	0.099	0.131
10	0.086	0.093	0.096	0.041	0.096

Table 1

[1] The autocorrelation function of the x_t series at lag s is defined as

5.3. Testing for Unit Roots

Recent advances in the theory of econometrics of time series advocate the usage of more sophisticated procedures to investigate the properties of the time series data. Table 3.2 repots the Augmented Dickey-Fuller (ADF) (1979, 1981) τt–statistic corresponding to the parameter ρ for the individual series of Pakistan and Sindh. To test the hypothesis that the ρ=0, the calculated t-values are compared with the tabulated τt values given in Mackinnon (1991).These statistics shows that all variables levels and I (0) in the first difference at 5 percent level of significance. To confirm this finding of I(1) variables, the ADF test is also performed on first difference of the data. The results are reported in Table 2 column two.

	Level -τt	**Ist Diff.-τt**
Pakistan		
Lagout	-1.7020	-6.2125
Lagexp	-0.7130	-5.7640
Linv	-1.4582	-4.5295
Lginv	-0.0646	-7.5225
Lpinv	-2.9286	-4.8326
Sindh		
Lsagout	-1.3826	-5.2496
Lsagexp	0.0429	-6.1512
Lsinv	0.5530	-3.8254
Lsginv	-0.5630	-4.8996
Lspinv	0.3518	-3.1390

Table 2: The ADF Test for Unit Root
Note: The 5 % rejection region for ADF test is –2.95 (Mackinnon 1991)

The univariate analysis supports the hypothesis that time series being used in this study are not stationary in their level. All the series for both Pakistan and Sindh level require first differencing to become stationary.

5.4. Testing for Cointegration

At this stage of analysis we move towards investigation of the cointegrating relationship between two variables. Two methods are used for this analysis.

- The Granger causality test
- Johansen's multivariate cointegration test

5.5. The Granger Causality Test

Causality in econometrics is somewhat different to the concept in everyday use; it refers more to the ability of one variable to predict (and therefore cause) the other. Granger (1969) developed a test for case of two stationary variables. To investigate the causality between two variables of time series is used in this study, combinations of two variables were estimated for both Pakistan and Sindh level. The combinations for both Pakistan and Sindth are: lagout vs linv (lsagout vs lsinv), lagout vs lagexp (lsagout vs lsagexp), lagout vs lginv (lsagout vs lsginv) and lagout vs lpinv (lsagout vs lspinv). The result of granger causality revealed that none of the above combinations have bivariate causality. The results of rejection of null hypothesis of granger causality are as follows:

Pakistan : Reject the following Ho:	
	LAGEXP does not Granger Cause LAGOUT
	LAGOUT does not Granger Cause LINV
	LAGOUT does not Granger Cause LPINV
Sindh : Reject the following Ho:	
	LSINV does not Granger Cause LSAGOUT
	LSPINV does not Granger Cause LSAGOUT

The above result shows the cointegration relation exists in lagout, lagexp, linv, lpinv for Pakistan though it is unidirectional causality not bivariate. However for Sindh the cointegration relation exists in lsagout, lsinv and lspinv.

5.6 Johansen's Multivariate Cointigration Test

Now to test the long-run relationship between the variables used in this study, we apply the multivariate cointegration test developed by Johansen's (1988). Both trace and eigen vale test indicates one cointegration relationship between lagout, lagexp, lginv and lpinv. Test result and estimated equation for Pakistan is as follows:

Null	Alternate	Maximal Eigenvalue	Trace
$r = 0$	$r \geq 0$ $r = 2$	29.68 *	52.68 *
		13.48	23.00
* shows significant at the 5 percent level			
The variables included are lagout, lagexp, lginv and lpinv			

Table 3a: Cointegration Test

Standard Error: (12.01) (11.00) (10.33)

However for Sindh only trace test indicates one cointegration relationship between lsagout, lsagexp, lsginv and lpinv. Test result and estimated equation for Sindh is as follow

Null	Alternate	Maximal Eigenvalue	Trace
		27.18	53.32 *
$r \leq 0$	$r = 2$	19.26	28.15
* shows significant at the 5 percent level			
The variables included are lsagout, lsagexp, lsginv and lspinv			

Table 3b: cointegration Test

Standard Error: (0.14) (0.08) (0.07)

6. Conclusion & Policy Recommendetions

The estimation of the long run relationship between agriculture output, export and investment including government and private investment in Pakistan and Sindh is one objective of this study to make the study unique one and a feasible policy document in all respects. As a first step, towards modeling the agriculture output in Pakistan and Sindh, the hypothesis of stationarity of individual series is tested .All series are log form and of the time series from 1972-73 to 2006-07.

I. The close inspection of graphs shows the existence of strong time trend in the data

II. The close inspection of the data also shows that the coefficients of the sample autocorrelation die down at high lags and indicates that these series are not stationary in levels and confirms the presence of time trend in the series.

III.The ADF test (1979) is also performed on first difference of the data and concluded that all variables are I (1) in their levels and I (0) in the first difference at 5 percent level of significance

IV. The result of granger causality test (1969) revealed that none of the above combinations has bivariate causality. The result shows the cointegration relation exists in lagout, lagexp, linv, lpinv for Pakistan though it is unidirectional causality not bivariate. However for Sindh the cointegration relation exists in lsagout, lsinv and lspinv.

V. The multivariate cointegration test of Johansen's (1988) concludes that both trace and eigen vale test indicates one cointegration relationship between lagout, lagexp, lginv and lpinv. However for Sindh only trace test indicates one cointegration relationship between lsagout, lsagexp, lsginv and lpinv.

The results indicate that there is stance of long run relationship between estimated variables and their positive impact on the sector, So more public and private investment is needed for agric- development, to avert the serious food crisis in Sindh- Pakistan and also to meet future challenges of globalization.

The public sector investment in infrastructures like roads, dams, education, health, social development encourages private sector to invest in far-flung areas. This process accelerates agric- development process with export potentials. It is recommended that both kinds of investment are essential and complimentary in their nature and also interdependent but public investment has more significance as 'seed money' and widely encourages private sector investment in the rural area .

The World Bank's report 'Agriculture for Development'(2007) also suggested the dire need of greater investment in agriculture sector particularly in developing countries if they wish to control spread of extreme poverty and hunger. "Agriculture has served as a basis for growth and reduced poverty in many countries, but more countries could benefit if governments and donors were to reverse years of policy neglect and remedy their underinvestment and misinvestment"(WB,3007pp.05).

The sector should get extra priority in the entire world at sustainable policy planning and implementation level to overcome the menace of food crisis and food inflation. The report further claimed that GDP growth originating in agriculture has been four times more effective in reducing poverty. Therefore serious efforts should be made to boost investment not in productivity of farm sector but in other sub sectors i.e. Horticulture, poultry, and aquaculture and dairy markets also.

Substantial and consistent investment flow is needed in rural infrastructures, farming, dairy and agro based industries at village level. The policy makers need to revisit investment policy in this respect.

There is dire need of liberal investment policies with new incentives i.e. Tax relaxation on investment in social sector services, infrastructures schemes, agricultural export and import of capital goods.

The foreign direct investment, state of the art technology and managerial skills should be encouraged with reduction of tariff and non tariff barriers due to their overriding importance in agric / economic development.

The investment in technology revolution and markets improvement is also mandatory to explore the untapped potential in Sindh – Pakistan.

7. Refernces

1. Ahmad, Q, M; Muhammad Sabihuddin Butt and Saeed Alam (2000), "Economic growth, Export, and External Debt Causality": The Case of Asian Countries. The Pakistan Development Review. Vol., 39.4, pp.591-608.
2. Akbar .M and Z. F.Naqvi (2000), "Export Diversification and Structural Dynamic Growth Process, The Case of Pakistan." Islamabad. The Pakistan Development Review. Vol.39, No.4, pp.573-589.
3. Del Hoste E.P (1832), Memoir on Sindh. Bombay, Secrete and Political Department Report No. 571 of (1832), Bombay India.
4. Dr.Chablani S.P (1995) Economic History of Sindh. Jamshoro: Sindhi Adbi Board Jamshoro Sindh Pakistan.pp.284.
5. Dickey, D. A. and Fuller, W. A. (1979), "Distribution of the estimators for autoregressive time series with a unit roots. Journal of the American Statistical Association. Vol. 74, No.15, pp.427-431.
6. Dickey, D. A. and Fuller, W. A. (1981) "Likelihood ratio statistics for autoregressive time series with a unit root". Econometrica, Vol. 49 (4), pp. 1057-1072.
7. Granger C.W.J (1969), "Investigating Causal Relations by Econometrics Models and Gross-Spectral methods," Econometrica, Vol.34, pp.424- 436.
8. Houssem Eddine Chebbi and Lassaad Lachaal (2007), "Agriculture sector and economic growth in Tunisia: Evidence from co-integration and error correction mechanism" a study of African Development Bank.
9. Ishrat Hussain Dr. (1981), Economy Of Modern Sindh. Institute Of Sindhology University of Sindh Jamshoro, pp.7- 267.
10. Henneberry, S. R., Khan, M. E. and Piewthongngam, K. (2000), "An analysis of industrial –agricultural interactions: a case study of Pakistan", Agricultural Economics, Vol. 22, pp.17-27
11. Hamzo khan Tagar "Major obstacles in agricultural development of Sindh and their remedies: a case study of Sindh" Ph.D dissertation submitted to department of Economics University of Karachi. (Unpublished, 2009, page 51-71)
12. James. Mackinnon (1991), "Critical Values of Cointegration Tests in Long Run Economic Relationships: Readings in Cointegration" in eds.Rob Engle and C.W.J Granger. New York Oxford University Press Chapter 13.
13. John W. Mellor (1966), The Economics of Agricultural Development. Ithaca, New York: Cornell University Press, pp, 10-44.
14. Johansen, Soren (1988), "Statistical Analysis of Cointegrating Vectors," Journal of Economic Dynamic and Control, Vol.12, pp. 231-54.
15. James. Mackinnon (1991), "Critical Values of Cointegration Tests in Long Run Economic Relationships: Readings in Cointegration" in eds.Rob Engle and C.W.J Granger. New York Oxford University Press Chapter 13.
16. Khan Mehmood Hassan, (1980), Agriculture in Sindh. Karachi, Sindh Regional Plan Organization Planning and Development Department, pp. 36-94
17. Kanwar, S. (2000), "Does the dog wag the tail or the tail the dog? Cointegration of Indian agriculture with nonagriculture". Journal of Policy Modeling, Vol. 22 (5), pp. 533-556.
18. Katircioglu, S. T. (2006), "Causality between agriculture and economic growth in a small nation under political isolation: A case from North Cyprus", International Journal of Social Economics, Vol. 33 (4), pp. 331-343.
19. Kwiatkowski, D. Phillips, P., Schmidt, P. and Shin, Y. (1992), "Testing the null hypothesis of stationarity against the alternative of unit root" Journal of Econometrics, vol. 54, pp159-178.
20. M. S. Kamdar (1988), Occasional Paper Agrarian Relations And Modes Of Production In Sindh A Historical Survey. Sindh Agriculture University Tando Jam Sindh, Pakistan.pp.04.
21. M.S. Kamdar (1996), Development of Capitalism In Agriculture (A case Study of Sindh). Post Doctoral Thesis submitted at Minismpotima University U. S.A. 28.pp.30, 31, 32.
22. Masih, A.M.M., and Masih (1995b), "Temporal causality and the dynamic interaction among macro economic activity within multivariate cointegrated system: Evidence from Singapore and Korea". Weltwirtschaftliches Archive, pp.39-50.
23. Naqvi, Naveed, H. and Christopher Tsoukis (2003), "Does Public Investment Crowd Out Private Investment? Evidence on Investment and Growth in Asia, 1971-2000" European Research Studies, Vol.6, No.12 pp.65-79.
24. Naqvi, Naveed, H. (2002), "Crowding-in 0r Crowding- Out? Modelling the Relationship between Public and Private fixed capital Formatio UsingCo-integration Analysis: The Case of Pakistan 1964-2000" Pakistan Development Review, Vol.41, No. 3, pp.255-276.
25. Pakistan Government of (1972-2006), Agriculture Statistics of Pakistan. 35 yearly Issues Islamabad, Ministry of Food Agriculture and Livestock. (Economic Wing).
26. Pakistan Government of (1972-2006), Economic Survey of Pakistan. Various Issues Islamabad, Ministry of Finance & Economic Affairs Division. pp.2, 13, 20, 21, 23.

27. SZABIST (2001), Agriculture In Sindh Issues & Option. Karachi, Center For Information & Research Sindh, pp.65, 74, 85-131.
28. Sindh Government of (1972-2006), Development Statistics Of Sindh. Various issues, Karachi, Bureau of Statistics, Planning & Development Department pp.34, 38, 73, 96-98, 127,141,147,149.
29. Sindh Government 0f & IOBM-CRIS (2009), Economic Survey of Sindh (1972-2008) Ist Draft of Estimated (PGDP).Karachi, Institute of Business Management IOBM- Centre for Research in Sindh (CRIS) Korangi Creek Karachi Sindh.
30. S .Akbar Zaidi (1999), Issues in Pakistan Economy. Oxford University Press Karachi pp.3-15-23.
31. Shjaat Ali (2005) "Total Factor Productivity Growth and Agricultural Research and Extension: An Analysis of Pakistan Agricultural 1960-1996" The Pakistan Development Review. No.44:4part II pp.729-746
32. Tota, H.Y and T. Yamamoto (1995), "Statistical Inference in Vector Auto- regressions with possibly integrated processes" Journal of Econometrics. No. 66, pp.225-50
33. World Bank (2007), Agriculture For Development: World Development Report 2008. Washington, D.C pp.2-25.
34. Waseem Pervez (1999), "Growth Rate and Fluctuation in Sindh Agriculture" Pakistan Economic and Social Review, Vol.XXXVII.,pp.160-165.
35. Waseem Pervez (1995), "An Analysis of Growth, Instability and Acreage Response of Rapeseed and Mustard in Sindh – Pakistan". Indian Journal of Quantitative Economics, Vol.10, No 2, pp. 53-71.
36. Yao Shujie (2000), How Important is Agriculture in China's economic growth? Oxford Development Studies, Vol. 28(1), pp.33-50.