Sectoral Linkages; Identifying the Key Growth Stimulating Sector of the Pakistan Economy

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Abstract

This paper investigates growth linkages among agriculture, industry and different segments of the service sector with a view to identifying the main growth stimulating sector with the highest level of backward and forward linkages in the economy. Time series data is used for the period 1971 to 2002. We estimate growth linkages through OLS regression analysis, also the Granger causality test is used to determine the direction of causality between growth of the different sectors of the economy for Pakistan. Our results suggest that the industrial sector plays an important role in determining the overall growth rate of the economy. The industrial GDP growth rate and service sector GDP growth rate both cause the growth rate of agricultural GDP. This verifies the neoclassical arguments that the higher productivity techniques in industry, (particularly in manufacturing) tend to spill over to agriculture, so encouraging convergent tendencies in sectoral productivity levels.

1. Introduction

For designing economic development policies the evaluation of sectoral economic performance and sectoral growth linkages are both very important issues. Sectoral interaction is one of the most important sources of economic expansion in a competitive economy. A sector with high backward and forward linkages should be the focus of the development effort and there is a strong case for concentrating investment in this sector. The expansion of this sector will have a significant impact on increasing output, per capita income and employment levels through out the economy.

Experiences of the developed economies have shown that sectoral growth process is highly unbalanced {see, D V S Sastry and Balwant Sing, 2003}. The key sector would stimulate greater economic activity in other sectors and thus have a larger multiplier effect on growth and development. Therefore, a proper understanding of sectoral linkages is necessary for designing appropriate long-run strategies to achieve a sustainable growth rate in real GDP.

Economic development can be characterized as a process of successive and moving disequilibria. Lewis (1954), Chenery (1979) and Kuznets (1965) found that economic development is a structural transformation from agriculture to industrial activities. Neoclassical theories of growth and development have also incorporated this aspect {e.g., Feder 1986; Dowrick and Gemmell 1991, etc.} A number of studies have been done to analyze these structural changes and to provide an empirical basis for models illustrating structure changes in the economy {e.g., Chenery and Syrquin 1979; Oshima 1986, etc.}. The process of sectoral linkages can be divided into three phases as follows:

In phase 1, the agriculture sector is the main sector of the economy. This sector provides the food, labor, capital, foreign exchange and other inputs, which must play a crucial role in establishing the framework for industrialization {e.g., Fei and Ranis 1961}. Kuznets (1965) has claimed that in the earlier stage agriculture plays a vital role in industrial sector development through the outflow of capital from the agriculture sector, the outflow of surplus labor, agriculture tax revenue and through a movement in the sectoral terms of trade[1]. Agricultural exports are a source of foreign exchange which can be used to import key industrial intermediate or investment goods. Thus faster agriculture GDP growth causes faster growth in the industrial sector (see, Hwa 1989).

In phase 2, the relative share of agriculture in GDP declines sharply while the industry share increases significantly and provides the leading role in the economic growth of the economy. Rising industrial wages, on one side, can foster growing agriculture product demand. On the other side, higher wages is a cause of a decline in the share of the labor force in the agriculture sector. Linkages involving service activities are also documented {see Fuchs 1968; Blades 1974; Bhagwati 1984, etc.}. The contribution of intermediate

[1] Empirical evidence (see for example, Sudrum, 1990) confirms that as per capita income rises productivity tends to rise across all major sectors but relatively faster in agriculture.

services such as distribution, and retailing to both agriculture and industry are apparent and frequently observed to increase over time.

In phase 3, as the economy grows and linkages between the sectors become more prominent, there is bidirectional linkage operating between the agriculture and non-agriculture sectors. Modern, chemical-biological agriculture requires heavy investment in irrigation and water control projects. It, therefore, becomes necessary to stem or even reverse the recourse outflow from agriculture if agriculture is to be sustainable under the pressure of structural and productivity change {e.g., Georgescu-Roegen 1969}. These two-way linkages produce forward and backward supply-demand effects.

Sangeeta Dhawan and K K Saxena (1992) used input-output tables to quantify forward and backward sectoral linkages of the Indian economy. The backward indices were calculated using the demand side Leontief model while the forward linkages indices were calculated using the supply side Ghosh model. His results indicate that Sugar, Wool, Food Product, Transport Equipments & Misc, Fertilizers and Agriculture Machinery sectors have high backward linkages while Crude Petroleum, Natural Gas, Basic Heavy Chemicals, Fertilizers and Forestry sectors have high forward linkages.

Khorshed Chowdhury and Mamta B. Chawdhury (1995) applied the standard Granger causality tests to examine the growth linkages between agriculture and industry sectors for thirteen Asian countries. They used annual data for the period 1968 to 1988. For China, Malaysia and Sri Lanka they found that agriculture sector growth rates leads industry sector GDP growth rates. In contrast, for Thailand, Pakistan, Austria and Bangladesh they found that industry sector growth rates cause agriculture growth rates. There is a feedback linkage between agriculture and industry growth rates for the Philippines' economy. Finally, their results show independence in sectoral growth for South Korea, Japan, India Indonesia and Nepal[2].

D V S Sastry, Balwant Sing, Kaushik Bhattacharya, and N K Unnikishnan (2003) analyzed the linkages of growth among the agriculture, industry and services sectors for the Indian economy, using both an input-output and a simple regression framework. Their results based on input-output tables depict that the agricultural sector plays an important role in determining the overall growth rate of the economy through demand linkages with other sectors of the economy. A rise in agricultural output is likely to raise the demand for industrial goods, both for consumption and investment. Further, they found that any endogenous or exogenous shock in the services sector is likely to influence the demand for industrial goods.

Muhammad Saleem, Tariq Mahmood, Nighat Perveen and M. Ali Qasim (1983) and Federal Bureau of Statistics (1993) estimated input-output tables for the Pakistan

[2] The present study will differ from that study in the following three ways:
1. The study includes the service sector.
2. The study covers sample period after separation of East Pakistan.
3. The study estimates simple OLS regression equations to find the long-run linkages between sectoral growths.

economy. These tables are estimated at industry level (including 118 industries). These tables do not provide information about overall sectoral linkages. Therefore, sectoral linkages exploration is necessary for designing macro strategies to achieve a sustainable growth rate in real GDP.

The rest of the paper is organized as follows. Section 2 gives a brief overview of the changes in the sectoral contribution of GDP in Pakistan. Section 3 deals with the data. The sectoral growth rate estimation and the methodological framework for estimation of linkage of growth among agriculture, industry and services sectors of the economy are also discussed in this section. Section 4 presents the empirical results and the final section presents conclusions of the study and policy implications.

2. Sectoral Contributions to GDP

Prior to exploring the sectoral linkages for the Pakistani economy, it would be useful to discuss the changes in the sectoral share of gross domestic product. Sectoral composition of gross domestic product, at constant factor cost of 1980-81, is presented in Table 1.

Table 1: Sectoral Shares of GDP at Constant Factor Cost of 1980-81

Share in GDP (Per Cent)

	1970s Average	1980s Average	1990s Average	1970 to2000 Average
Agriculture	34.50	27.61	25.17	24.67
Industry	16.36	19.68	22.26	21.69
Service	49.13	52.70	52.57	53.63

Source: Pakistan Economic Survey

Table 1 presents changes in the share of the agriculture, industry and service sectors in GDP over the past three decades. Agriculture's share has declined consistently from an average of 34.50 per cent in the 1970s to 25.17 per cent in the 1990s. As against this, the share of both industry and services has increased. The increase in industry share is most marked from an average of 16.4 per cent in the 1970s to about 23 per cent in the 1990s a rise of over a third in the sectoral share of industry over the past three decades.

Table 2 provides standard deviation and average per annum growth rate in respect of different sectors of the economy. Industry has grown more rapidly than agriculture and services in each of the three decades with an average growth of over 6 per cent per annum during 1970-71 to 2000.

Table 2: Sectoral Growth Rates of GDP at Constant Factor Cost of 1980-81

Sector	1970-71 to 1979-80		1980-81 to 1989-90		1990-91 to 1999-00		1970-71 to 1999-00	
	Average	S.D	Average	S.D	Average	S.D	Average	S.D
Agriculture	2.366	2.941	4.071	3.966	4.071	4.173	3.503	3.693
Industry	6.13	4.018	7.76	2.015	4.77	2.15	6.222	3.042
Service	4.836	2.41	6.623	1.687	4.493	1.783	5.856	2.417
Overall GDP	4.836	2.415	6.143	1.424	4.493	1.783	5.157	1.987

Source: Pakistan Economic Survey

Industrial growth has been more volatility than the growth of the service sector. In each of three decades the standard deviation of industrial sector growth has been higher than the standard deviation of service sector growth rate and standard deviation of overall GDP growth rate. Volatility of agricultural growth has been greater than that of industrial growth during the 1980s and 1990s. These figures provide some evidence of the industrial sector's inherent dynamism: a theme which is explored in the next section.

3. Methodological Framework

Traditionally, input-output analysis and the subsequent measurement of linkage coefficients have been used excessively for the identification of key economic sectors in the economy. Since the pioneering work of Chenery and Watanabe (1958) and Hirschman (1958), a number of studies employing input-output techniques have relied on linkages analysis to describe the interdependent relationships between economic sectors and to assist in the formulation of economic development strategies.

Over time the methodological framework has been improved and expanded in several ways. The standard Granger causality tests and sector wise econometric models are also used to examine linkage in the growth of various sectors. Empirical results based on Granger causality tests are generally focused on identifying the key/causal sectors while estimated models can be further used for generating dynamic forecasts and policy simulations.

The aim of this paper is to explore the relationship between sectoral growth rates so as to identify the key growth stimulating sector of the Pakistan economy. To examine the linkage of growth among the agriculture, industry and services sectors the study uses annual data for the period 1970-71 to 2001-02. The data is obtained from various issues of the Pakistan Economic Survey and 50 Years of Pakistan[3].

[3] The variables that are used in the present study are described in Table A.2 in the Annexure.

We use OLS regression technique to estimate linkages between sectoral growth rates. This leads to estimation of growth elasticity showing one sector's response to growth in other sectors. Then in order to test for direction of causation among sectors growth rates we employ the standard Granger causality test[4]. Below we present a brief introduction of growth rate estimation and Granger causality test.

Growth Rate Estimation

We assume that the agriculture GDP ($AGDP_t$) time series can be approximated by the exponential growth equation:

$$AGDP_t = AGDP_0 \exp(g_t + e_{1t}) \qquad \{1\}$$

where g denotes the agriculture sector's growth rate and e_1 is an error term with zero mean and constant variance. Similarly we assume that the time series of the GDP industry ($IGDP_t$) and the time series of the GDP service sector ($SGDP_t$) follow the exponential equations:

$$IGDP_t = IGDP_0 \exp(h_t + e_{2t}) \qquad \{2\}$$

$$SGDP_t = SGDP_0 \exp(f_t + e_{3t}) \qquad \{3\}$$

Where h and f denote the growth rate of the industrial and service sectors respectively, and e_2 and e_3 are error terms with zero mean and constant variance.

First, by taking the logarithm transformation of these exponential specifications and then taking the first difference of the logarithms of these variables we obtain the following expressions:

$$AGDPR_t = \log(AGDP_t) - \log(AGDP_{t-1}) = g + u_1 \qquad \{4\}$$

$$IGDPR_t = \log(IGDP_t) - \log(IGDP_{t-1}) = h + u_2 \qquad \{5\}$$

$$SGDPR_t = \log(SGDP_t) - \log(SGDP_{t-1}) = f + u_2 \qquad \{6\}$$

where $AGDPR_t$, $IGDPR_t$, and $SGDPR_t$ denote the current annual growth rates of agricultural GDP, industrial sector GDP and service sector GDP respectively. These rates fluctuate around the long-run annual growth rates of the original time series[5].

[4] If the cointegrating relationship exists between the said variables then to examine the issue of causation we can employ error-correction modeling approach.

[5] The growth rate of all other variables is estimated using this approach.

Granger Causality Test

The Granger (1969) definition for causality of two stationary time series X_t and Y_t: X_t cause Y_t if the past values of X_t can be used to predict Y_t more accurately than only using the past values of Y_t. Formally, X_t is said to cause Y_t if:

$$\Pr\left(Y_t^m / Y_t^{-k}\right) \neq \Pr\left(Y_t^m / Y_t^{-k}, X_t\right)$$

If the equality in above equation holds, then X_t does not Granger-cause Y_t. In present study we are using three variables namely, the agricultural DGP growth rate, the industrial sector GDP growth rate and the service sector GDP growth rate. To analyzing the causal linkages among said variables we adopt the following equations:

$$AGDPR_t = \alpha_1 + \sum_{i=1}^{m} \beta_{1i} AGDPR_{t-1} + \sum_{i=1}^{n} \gamma_{1i} IGDPR_{t-1} + \sum_{i=1}^{p} \eta_{1i} SGDPR_{t-1} + \varepsilon_{1t} \qquad \{7\}$$

$$IGDPR_t = \alpha_2 + \sum_{i=1}^{k} \beta_{2i} AGDPR_{t-1} + \sum_{i=1}^{l} \gamma_{2i} IGDPR_{t-1} + \sum_{i=1}^{j} \eta_{2i} SGDPR_{t-1} + \varepsilon_{2t} \qquad \{8\}$$

$$SGDPR_t = \alpha_3 + \sum_{i=1}^{u} \beta_{3i} AGDPR_{t-1} + \sum_{i=1}^{h} \gamma_{3i} IGDPR_{t-1} + \sum_{i=1}^{g} \eta_{3i} SGDPR_{t-1} + \varepsilon_{3t} \qquad \{9\}$$

Hypothesis tests

By using the simple OLS technique, we will estimate equation (7), equation (8) and equation (9). In our case the Granger Causality test procedure involves six separate hypothesis tests that are as follows:

1. Null hypothesis[6]:

$IGDPR_t$ does not Granger-cause $AGDPR_t$

$$\gamma_{11} = \gamma_{12} = ... = \gamma_{1n} = 0$$

Alternative hypothesis:

$IGDPR_t$ Granger-cause $AGDPR_t$

At least one $\gamma_{1i} \neq 0$

2. Null hypothesis:

$SGDPR_t$ does not Granger-cause $AGDPR_t$

$$\eta_{11} = \eta_{12} = ... = \eta_{1p} = 0$$

Alternative hypothesis:

$SGDPR_t$ Granger-cause $AGDPR_t$;

At least one $\eta_{1i} \neq 0$

[6] The restricted model consists of the regression of AGR_t against lagged values of it and only lagged values of SCR_t and the unrestricted model regresses AGR_t against lagged values of it and also lagged values of SCR_t and lagged values of $INDR_t$.

3. Null hypothesis:

$AGDPR_t$ does not Granger-cause $IGDPR_t$

$$\beta_{21} = \beta_{22} = ... = \beta_{2k} = 0$$

Alternative hypothesis:

$AGDPR_t$ Granger-cause $IGDPR_t$

At least one $\beta_{2i} \neq 0$

4. Null hypothesis:

$SGDPR_t$ does not Granger-cause $IGDPR_t$

$$\gamma_{21} = \gamma_{22} = ... = \gamma_{2l} = 0$$

Alternative hypothesis:

$SGDPR_t$ Granger-cause $IGDPR_t$

At least one $\gamma_{2i} \neq 0$

5. Null hypothesis:

$AGDPR_t$ does not Granger-cause SCR_t

$$\beta_{31} = \beta_{32} = ... = \beta_{3u} = 0$$

Alternative hypothesis:

$AGDPR_t$ Granger-cause $SGDPR_t$

At least one $\beta_{3i} \neq 0$

6. Null hypothesis:

$IGDPR_t$ does not Granger-cause $SGDPR_t$

$$\gamma_{31} = \gamma_{32} = ... = \gamma_{3h} = 0$$

Alternative hypothesis:

$IGDPR_t$ Granger-cause $SGDPR_t$

At least one $\gamma_{3i} \neq 0$

The hypothesis tests are usually performed using the statistic:

$$F_{(m,\ T-k)} = \frac{(RRSS - URSS)/m}{URSS/(T-k)}$$

$$= \frac{RRSS - URSS}{URSS} \times \frac{(T-k)}{m}$$

where RRSS are called the restricted residual sum of squares, URSS are called the unrestricted residual sum of squares, m is the number of linear restriction regression, k is the number of parameters in the unrestricted regression and T is the number of observations.

Determination of optimal Lags

Given the above specifications of the model and hypotheses we now wish to consider how the lags length (m, n, p, k, l, j, u, h and g) are determined. This is very important since it has been shown that the results from the Granger approach are sensitive to these lag lengths. In present study we employ Akaike's Information Criteria (AIC) to select the optimal lag length.

4. Empirical Results

Prior to testing for co-integration, unit root tests are performed on each of the sectoral growth rates series and other relevant variables to determine the order of integration of these series. We employed the Augmented Dickey-Fuller test[7] and the Phillips-Perron test, with and without a deterministic trend[8], to conduct the unit root tests. The tests are performed for the entire sample at the levels and table A.1 reports the results of these tests.

Table A.1 predicts that the null hypothesis of a unit root in the level series can be rejected for all said variables[9]. This indicates that all series are stationary at level and integrated of order zero, i.e., I(0). This means we do not need to apply cointegration tests to analyze the long-run sectoral growth linkages. Therefore, we can estimate a simple regression using ordinary least square method (provided the residuals satisfy all usual properties) and explore the long-run link by simply testing the statistical significance of the relevant slope coefficient.

Agriculture Sector

We begin by regressing agriculture output on the following independent variables:

1. Average level of rainfall (RIF).
2. Capital stock in agriculture sector (KAG).
3. Industrial growth rate (IGDPR), and
4. Lagged value of agriculture growth rate.
5. GDP in trade, hotels, transport, storage and communication ($SGDP_1$), and
6. GDP in finance, insurance, real estate business services and social and personal services ($SGDP_2$).

[7] The optimal lag length was selected based on the criteria first suggested by Campbell and Perron (1991). Their recommended procedure works as follows: we estimated the ADF equation with a long lag order (say 6) and tested the significance of the last lag. If it was found significant we assumed this to be the optimal lag length. If the coefficient of the last length was insignificant we dropped the last lag and re-estimated the ADF equation with one less lag order and tested the significance of the last lag order. This procedure was repeated until we get the last coefficient significant.

[8] We report the results of these tests with deterministic trend if the trend in the DAF equation was found to be significant. Otherwise, we report the results without trend.

[9] The results of the other variables are not reported here but are available from the author upon request.

All variables are used in log form. The estimated equation is as follows:

Sample: 1970-71 to 2001-02

$$\text{Log}(AGDPR_t) = \underset{(1.024)}{4.58} + \underset{(2.42)}{0.221}\,\text{Log}(KAG_{t-1}) + \underset{(4.005)}{0.541}\,\text{Log}(IGDPR_t) + \underset{(1.37)}{0.033}\,\text{Log}(RIF_t)$$

t

$$+ \underset{(3.08)}{0.40}\,\text{Log}(AGDPR_{t-1}) - \underset{(-3.72)}{0.262}\,\text{Log}(SGDPR_{2t}) + \underset{(1.40)}{0.10}\,\text{Log}(SGDPR_{1t})$$

Adjusted R-squared = 0.990 D.W = 2.27

The empirical results show that the growth rate of agriculture sector is positively significantly associated with a one time period lag value of capital formation in agriculture sector, the growth rate of industrial sector, and the lagged value of the agriculture sector growth rate. It is interesting to note the highest coefficient value is that of the industrial sector growth rate. A one percent increase in industrial growth rate leads to 0.54 per cent growth in agriculture.

This equation also shows that there is no significant association between the growth in trade, hotels, transport, and storage and agriculture sector growth. On the other hand, the growth in other service sector is negatively and significantly related to growth in agriculture indicating that perhaps investment in finance, real estate, and social and personal services is an alternative to investment in the agriculture sector. The average level of rainfall has no significant impact on agriculture output because in Pakistan high rained areas are not thickly cultivated.

Industrial Sector

The industrial sector growth rate ($IDGPR_t$) is estimated in terms of agriculture growth rate ($AGDP_t$), service sector growth rate ($SGDPR_t$), capital stock in industrial sector (KIN_t), exchange rate (EXR), and volume of exports to exchange rates $(EXPORT/EXR)_t$. The estimated regression is shown below:

Sample: 1970-71 to 2001-02

$$\text{Log}(IGDPR_t) = \underset{(-8.620)}{-9.130} + \underset{(5.360)}{0.151}\,\text{Log}(KIN_{t-1}) + \underset{(2.417)}{0.322}\,\text{Log}(AGDPR_t)$$

t

$$+\underset{(10.726)}{1.483}\,\text{Log}(SGDPR_t) + \underset{(2.14)}{0.093}\,\text{Log}(EXPORT_t/EXR_t) - \underset{(3.021)}{0.112}\,\text{Log}(EXR_{t-1})$$

Adjusted R-squared = 0.97 D.W = 1.50

Empirical results of the equation indicate that industrial sector growth is positively related to capital formation in the industrial sector, agriculture sector growth, and real exports and negatively associated with exchange rate.

Industrial growth is significantly and positively related to service growth. The value of the coefficient of service sector growth is high. Against this a one unit increase in agriculture growth leads to only 0.32 per cent growth in industry. Also increase in exports has a minor effect on industrial growth and the impact of investment on industrial sector growth is low.

Service Sector

We have divided the service sector into two parts $SGDP_1$ includes trade, hotels, transport, storage and communication. $SDGP_2$ is defined as GDP in finance, real estate, business services and personal and social services. The estimated equation is as follows:

Sample: 1970-71 to 2001-02

$$\text{Log}(SGDPR_{1t}) = 2.20 + 0.012\ \text{Log}(AGDPR_{2t}) + 0.811\ \text{Log}(IGDPR_t)$$

t (1.71) (1.45) (5.8)

Adjusted R-squared = 0.97 D.W = 1.81

The estimated regression equation relating growth in SGDP1 to sectoral growth finds a stronger and significant positive association between it and the growth of the industry sector. A one per cent growth in the industrial sector leads to 0.81 per cent growth in $SGDP_1$. As against this, there is no significant positive relationship between agriculture growth and growth of $SGDP_1$. The coefficient of the agriculture sector growth variable is also very low.

Sample: 1970-71 to 2001-02

$$\text{Log}(SGDPR_{2t}) = 11.341 + 0.51\ \text{Log}(AGDPR_{t-1}) + 1.54\ \text{Log}(IGDPR_t)$$

t (8.31) (5.58) (10.38)

Adjusted R-squared = 0.96 D.W = 1.58

Once again we find a strong positive association between industrial sector growth and growth in $SGDP_2$. A one per cent increase in industrial sector growth leads to 1.54 per cent growth in $SGDP_2$. There is also significant positive association between the growth in agriculture sector and $SGDP_2$ growth. But the value of agriculture sector coefficient is once again much lower than the coefficient of industrial sector growth. Industrial sector growth thus exerts a stronger influence on service sector growth.

Granger Causality Tests

The results of Granger tests are reported in Table 3 for optimal lag order[10]. These results give some fascinating information about sectoral growth linkages. It appears that agriculture GDP growth does not play any leading role in the growth of other sectors. Agriculture sector growth rate neither leads industry growth rates nor leads service sector growth. Industrial growth rate on the other hand has a significant influence on (Granger causes) agriculture sector growth. The Granger causality test shows that the hypothesis of industrial growth rate does not lead agriculture growth informally is rejected as is the hypothesis that industrial growth rate does not lead services sector growth. The service sector growth rate influences agriculture growth rate but does not Granger cause growth within the industrial sector. This shows that the industrial sector is the leading sector of the economy. It has strong forward linkages with the growth of agriculture sector and the service sector. On the other hand, the backward linkages with agriculture and service sector are weak and we can think of the industrial sector as the major growth stimulant within the economy.

Table 3: Granger Causality Test Results

Null hypothesis	F-statistics	Decision
IGDPR does not lead AGDPR	2.417**	Reject
SGDPR does not lead AGDPR	3.067*	Reject
AGDPR does not lead IGDPR	0.165	Do not reject
SGDPR does not lead IGDPR	2.10	Do not reject
AGDPR does not lead SGDPR	0.948	Do not reject
IGDPR does not lead SGDPR	6.136*	Reject

Significance Levels: 1% (*); 5% (**)

Table 4 depicts the direction of causation between sectoral growth and GDP growth. The hypothesis of Granger causing total GDP growth rate is not rejected in the case of industrial sector growth alone. It is emphatically rejected in the case of service sector growth and the probability of its acceptance in the case of agriculture growth rate is 0.11.

[10] The optimal lag values are presented in Table A.2 in the Annexure.

Table 4 also shows that total GDP growth rate does not Granger cause sectoral growth in agriculture, industry or service. Therefore, the relationship between industrial sector and total GDP growth rate is unidirectional running from industry to total GDP.

Table 4: Pair wise Granger Causality Tests

Null Hypothesis	# of Lag	F-Statistics	Probability
INDR does not Granger cause TGDPR	2	7.784	0.002
TGDPR does not Granger cause INDR	2	0.325	0.725
AGR does not Granger cause TGDPR	1	2.651	0.115
TGDPR does not Granger cause AGR	1	0.194	0.663
SCR does not Granger cause TGDPR	3	0.722	0.549
TDGPR does not Granger cause SCR	3	1.627	0.213

5. Conclusion and Policies Implications

We thus provide strong evidence to show:

1. Industrial sector growth Granger causes aggregate GDP growth.
2. Industrial sector growth Granger causes agriculture growth.
3. Industrial growth Granger causes service sector growth.
4. Agriculture and service sector growth rate do not cause industrial sector growth.
5. Service sector growth causes agriculture sector growth rate.

This shows that the industrial sector is the leading sector of the Pakistan economy. The decline in industrial sector growth rate from 7.76 percent in 1980s to 4.77 per cent in 1990s (a fall of almost 40 per cent) is the major cause of the decline of average overall GDP growth rate from 6.14 per cent in 1980s to 4.5 per cent in 1990s (a fall of almost 30 per cent).

Reviving industrial sector growth is thus of vital importance for enhancing overall growth performance and therefore eliminating poverty. It is particularly alarming to note that total factor productivity has been declining for several decades in Pakistani manufacturing (see, Wizarat, 2002), despite the fact that the industrial labor force has shrunk significantly. Long-term bank credit to manufacturing firms is not enough to meet real depreciation needs. More tragically public sector investment has virtually disappeared from the manufacturing sector and initiatives for technological upgrade within the manufacturing sector are non existing. Unless these trends are reversed manufacturing sector growth evident in 2002 and 2003 will not be sustainable and evidence presented in this paper shows that neither the agriculture nor the service sector can take up the slack caused by decline in the industrial sector growth rate. Quite the contrary, service sector growth and agriculture sector growth will themselves decline in sympathy with fall in industrial growth. There is therefore an urgent need to prioritize industrial revival and to develop macro and meso strategies for achieving sustainable high industrial sector growth in Pakistan.

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Annexure

Table A.1: Unit Root Tests at Level

Variables	# of Lag	ADF-statistics	PP-statistics
AGDPR	1	-4.768*	-7.821*
IGDPR	0	-3.546**	-3.546**
SGDPR	1	-3.154**	-4.396*
TGDPR	0	-5.56*	-5.538*

Critical values: 1% (*) -3.5153 and 5% (**) 2.8986

Table A.2

No	Variable	Description	Unit
1	GDP	Gross domestic product	Rs million at constant factor cost of 1980-81
2	AGDP	Gross domestic product in agriculture and allied activities	"
3	IGDP	GDP in mining, manufacturing, electricity, gas, and water supply	"
4	SGDP	GDP in service sector (SGDP = GDP – AGDP – IGDP)	"
5	SGDP1	GDP in trade, hotels, transport, and storage and communication	"
6	SGDP2	GDP in finance, insurance, real estate and business services and, community, social and personal services	"
7	EXPORT	Total export volume	"
8	KAG	Capital stock in agriculture (cumulative capital formation 1970-71 onwards)	"
9	KIN	Capital stock in industry (cumulative capital formation 1970-71 onwards)	"
10	EXR	Exchange rate (rupee per USA dollar)	Rate
11	RIF	Average rainfall	
12	AGDPR	Agriculture GDP growth rate $\{Log(AGDP) - Log(AGDP_{-1})\}*100$	Rate
13	IGDPR	Industrial sector GDP growth rate $\{Log(IGDP) - Log(IGDP_{-1})\}*100$	Rate
14	SGDPR	Services sector GDP growth rate $\{Log(SGDP) - Log(SGDP_{-1})\}*100$	Rate

Table A.3: Optimal Lags

m* = 4	K* = 1	u* = 2
n* = 1	l* = 4	h* = 1
p* = 3	j* = 1	g* = 7