SAVINGS AND ECONOMIC GROWTH IN PAKISTAN: AN ISSUE OF CAUSALITY

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Abstract. The objective of the paper is to investigate causal relationship between savings and output in Pakistan by using quarterly data for the period of 1973:1 to 2003:4. The co-integration and the vector error correction techniques are used to explore causal relationship between savings and economic growth. The results suggest bi-directional or mutual long run relationship between savings and output level. However, there is unidirectional long run causality from public savings to output (GNP and GDP), and private savings to gross national product (GNP). The results also indicate that the speed of adjustment in case of savings is stronger than that of level of output. The overall long run results of the study favour the capital fundamentalist's point of view that savings precede the level of output in case of Pakistan. The short run mutual relationship exists between gross domestic product (GDP) and domestic savings. The results also indicate unidirectional short run causality from gross national product (GNP) to national and domestic savings; and from gross domestic product (GDP) to public savings. The short run causality runs only from national savings to gross domestic product (GDP). So overall short run results favour Keynesian point of view that savings depend upon level of output.

I. INTRODUCTION

The relationship between savings and economic growth is not only an important but also a controversial issue for both academicians and policy makers. Many internationally reputed economists have analyzed this phenomenon as cause and effect relationship. A group of economists favours

capital fundamentalists point of view that savings cause growth but others are in favour of Keynesian theory that savings depend upon the level of output.

The importance of investigation of the causal relationship lies in the fact that it can be useful in isolating those variables which policy makers need to control in order to obtain the desired values of target variables such as economic growth. It might also be helpful in developing the econometric models and designing policies. If it turns out to be the case that savings causes economic growth, then it is necessary to enhance savings rate for achievement of high growth targets. If the results turn out the other way round, that high growth leads to more savings, then the Keynesian point of view is dominating: savings depends on income. Hence, in order to enhance growth, the policy prescriptions will be to emphasize the demand side of the economy. However, such a prescription according to Cohen (1997) is misleading and dangerous — that government needs not promote savings.

Solow (1956) suggested that savings affected the economic growth because higher savings led to capital accumulation, which in turn led to economic growth. Deaton (1995) argued that, "causation is important not just for understanding the process, but for the design of the policy." He provided support for the idea that savings was an important force for economic stability as well as growth. Hussein (1995) suggested that much of the differences in economic performance between Pakistan and the rapidly growing Southeast Asian countries, over the last two decades, were because of the low rates of savings and investment in Pakistan. Hence, it was emphasized that difference in the growth rate of developed and developing countries was primarily because of the difference in savings rates. Consequently, World Bank asked the developing countries to adopt policies which were conducive to savings in order to boost the economic growth (see Sinha and Sinha, 1998, p. 43). According to this view, savings is one of the key determinants of economic growth and it occurs before growth.

There is robust empirical evidence of positive correlation between savings and growth (see, for example, Modigliani 1970, 1990 and Madison, 1992). King and Levine (1994) showed the strong connection between the two variables by interpreting the evidence of a causal chain from savings to growth. These results did support 'capital fundamentalists'; according to which capital formation was the main driving force for high economic growth. According to *World Bank Policy Research Report* (1993), East Asian economies (Indonesia, Japan, Korea, Thailand, Taiwan and China) contradicted the above-mentioned results, *i.e.* income growth had been a

remarkably good predictor of increased savings, but savings had not been a good predictor of growth. Results were mixed for Hong Kong and Malaysia, and causation might run either way.

The World Bank report referred above made the economist to rethink about the relationship between savings and economic growth. With the work of Carroll and Weil (1994) something strange began to appear. Strong empirical evidence seemed to come out showing that higher savings followed higher growth. Jappelli and Pagano (1996) provided more evidence in favour of a positive causality from growth to savings, *i.e.* higher growth was necessary for higher savings. Hence, their results also contradicted the capital fundamentalist view on the aggregate level. The main findings of Blomstrom, Lipsey and Zejan (1996) were that gross domestic product (GDP) growth preceded capital formation. They did not find any evidence that capital formation preceded growth. Gavin et al. (1997) also raised doubts about the capital fundamentalist view that savings occurred before growth. They argued that "Higher growth rate precedes higher savings rather than the reverse" and that "the most powerful determinant of savings over the long run is economic growth" (p. 13). Sinha and Sinha (1998) suggested that the conventionally accepted view, *i.e.* higher savings rate caused higher economic growth, did not hold for Mexico, where the causality went in the opposite direction. Anderson (1999) conducted a study to investigate the causal relationship between real output and savings for Sweden, UK and USA. The results indicated mutual long run relationship between variables only for Sweden and UK. The result also indicated short run bidirectional causality for USA and unidirectional causality from saving to output for UK. No significant evidence of short run causality was found for Sweden. He concluded that the causal chain linking savings and output might differ across the countries. He also suggested that causality in the long run might go in different directions than causality associated with short-term disturbances. Saltz (1999) investigated the direction of causality between savings and growth rate of real GDP for 18 Latin American and newly industrialized countries for the period of 1960-1991. The results lent for greater support for the hypothesis that faster growth rate of real GDP caused higher growth rate of savings. Podrecca and Cormecci (1999) found that investment shares Granger caused growth rates and at the same time growth rates Granger caused investment shares. The Granger causality from investment shares to growth rates was found to be negative.

Vanhoudt (1998) suggested that recent Granger causality research on economic growth and accumulation rates which dismissed the validity of neoclassical growth models was based on a fallacy. He showed that the

finding of no or negative Granger causality was perfectly consistent with a neoclassical type of model. More precisely, such a model predicted negative Granger causality between medium run growth rates and investment shares, while there should not be Granger causality between these variables in the long run. Contrary to previous authors' intuition there was, therefore, no reason to reject the mechanical link between capital accumulation and growth, which was inherent to the neoclassical approach.

It is obvious from the above discussion that the causal relationship between savings and economic growth has been examined by various researchers for various countries but the issue of the direction of causation between savings and economic growth remained unresolved. No attempt has been made to investigate the causal relationship between savings and economic growth in Pakistan.[1] Some of the studies *inter alia*, Khan, Hasan and Malik (1992), Iqbal (1995), Hussein (1995); and Khan and Nasir (1998) have addressed the issue. Their findings were that the savings had long been regarded as a key factor in economic growth and the savings along with the incremental capital output ratio (ICOR) determined the growth rate of the economy. However these studies did not investigate causal relationship between savings and economic growth in Pakistan. In this paper we have made an attempt to investigate the direction of causation between of savings and output by using vector error correction model.

The rest of the paper is organized as follows: Section II consists of methodology employed in the paper. Nature and sources of data and various definitions of savings and level of output are explained in section III. Estimation procedures and empirical results are discussed in section IV. Finally, section V consists of conclusions and policy implications.

II. METHODOLOGY

To investigate the causal relationship between savings and economic growth, the following three-step methodology is applied:

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[1]We are thankful to the referee for pointing out a paper by Sinha (1998-99) on the subject. However our work is totally independent from his work. It is also notable that our work is a detailed analysis. He used aggregate annual data on GDP, total saving and private saving. Whereas we used quarterly data on GDP, GNP, domestic, national, public and private saving. In the paper he suggested to use disaggregated data on saving for further research. By chance we did that upto some extent in our paper. Our long run results don't support his findings.

UNIT ROOT TEST

Under this step the stationary properties of the variables are checked. A variable is said to be stationary if it's mean, variance and auto-covariance remains the same no matter at what point we measure them. The null hypothesis of non-stationarity is tested against alternative hypothesis of stationarity.

A number of tests are available in the literature to check the existence of the unit root problem both in the level of the variables as well as in their first difference, *i.e.* to determine the order of integration.[2] The Dickey Fuller (DF) test is applicable if error terms (U_t) are uncorrelated. In case the error terms (U_t) are correlated, DF test is useless. Augmented Dickey Fuller (ADF) test takes care of this problem by "augmenting" the equation(s) of DF test by adding the lagged values of the dependent variable(s). To test the unit root property of the variables, we employed Augmented Dickey Fuller test (ADF).[3] The equation for ADF test is as follows:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + u_t \qquad (1)$$

In equation (1) '*t*' is time period, U_t is a pure white noise error term and $\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$ and so on.

To check the white noise property of residuals and to prove that the residuals are well behaved, we applied Lagrange multiplier (LM) and auto-regressive conditional heteroskedasticity (ARCH) tests. The LM test is an alternative to the Q-statistics for testing serial correlation. The test belongs to the class of asymptotic (large sample) tests known as Lagrange multiplier (LM) test. Unlike the Durbin-Watson statistic for AR (1) errors, the LM test may be used to test for higher order ARMA errors, and is applicable whether or not there are lagged dependent variables. Therefore, LM test is recommended whenever we expect the possibility that our errors exhibit autocorrelation.

The autoregressive conditional heteroskedasticity (ARCH) test is a specification of heteroskedasticity. The ability to forecast financial time series, such as stock prices, inflation rates, foreign exchange rates, etc. varies

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[2]For detailed discussion of different tests to check the unit root problem and their robustness, please see Maddala and Kim (1998), Chapter 4.

[3]We also applied Phillip-Perron test. The results of both tests (ADF and Phillip-Perron) were same so we reported the results only of ADF test.

considerably from one time period to another. For some time periods the forecast errors are relatively small, for some time periods they are relatively large, and then they are small again for another time period. Since the behavior of forecast errors can be assumed to depend on the behavior of the (regression) disturbances u_t, one can make a case of autocorrelation in the variance of u_t. To capture this correlation, Engle developed the Autoregressive Conditional Heteroskedasticity (ARCH) Model. The key idea of ARCH is that the variance of u_t at time t ($= \delta^2_t$) depends on the size of the squared error term at time $(t - 1)$, that is on u^2_{t-1}.

CO-INTEGRATION

The concept of co-integration was introduced by Granger (1981) to protect the loss of long run information in the data due to differencing the series. If the linear combinations of variables of I (1) are I (0), then the variables are said to be co-integrated. Co-integration is the statistical implication of the existence of a long run relationship between economic variables. From statistical point of view, a long run relationship means that the variables move together over time so that short-term disturbances from the long-term trend will be corrected.

Co-integration procedure requires that a time series in the system to be non-stationary in their level. Similarly, it is imperative that all time series in the co-integrating equation have the same order of integration. To ascertain the long run relationship between savings and economic growth, we use vector autoregressive (VAR) model which was developed by Johanson (1988) and further extended by Johanson and Jusiluis (1990).[4]

To fix the idea, let s_t and y_t denote the logarithm of savings and of level of output respectively. Then let $Z_t = (s_t, y_t)$, $t = 1, \ldots, T$, define a vector of the time series which is generated by a pth order vector autoregressive (VAR):

$$\begin{bmatrix} s_t \\ y_t \end{bmatrix} = \begin{bmatrix} a^1_{11} & a^1_{12} \\ a^1_{21} & a^1_{22} \end{bmatrix} \begin{bmatrix} s_{t-1} \\ y_{t-1} \end{bmatrix} + \ldots + \begin{bmatrix} a^p_{11} & a^p_{12} \\ a^p_{21} & a^p_{22} \end{bmatrix} \begin{bmatrix} s_{t-p} \\ y_{t-p} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

or $Z_t = A_1 Z_{t-1} + \ldots + A_p Z_{t-p} + \varepsilon_t$

or $Z_t = A(L) Z_{t-1} + \varepsilon_t$ where $A(L) = \sum\limits_{i=1}^{p} A_i L^{i-1}$ (2)

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[4]The second model of Johansen is estimated.

Where L is the lag operator and error term, ε_t, is assumed to be *iid* $(0, \sigma^2)$. Equivalently, this model can be rewritten as:

$$\Delta Z_t = B\,(L)\,\Delta Z_{t-1} - \Pi Z_{t-1} + \varepsilon_t \tag{3}$$

Where $\Delta = 1 - L$ is the first difference operator, and

$$B(L) = \sum_{i=1}^{p-1} B_i\, L^{i-1},\ \ B_i = -\sum_{j=i+1}^{p} A_j\ \ i = 1, \ldots, p-1,\ \ \ \Pi = I - A,$$

The co-integration relationship is proportional to the column of β, and βZ_{t-1} is stationary variable. The vector α can be interpreted as a vector of adjustment coefficients, which measure how strongly the deviation from equilibrium feed back into the system. Testing for co-integration in the system (3) can be performed according to the Johansen (1988) approach where ΔZ_t and Z_{t-1} in (3) are first regressed on the other components of the VECM and the coefficients are then estimated using maximum likelihood subject to the constraint that $\Pi = \alpha \beta'$ for various assumptions of the column rank. Johansen procedure of co-integration provides two statistics. These include the value of the LR test based on the maximum eigenvalue of the stochastic matrix and the value of the LR test based on the trace of the stochastic matrix, where the testing is done sequentially so that the null of rank 0 is tested against the alternative of rank 1 first, and then rank 1 against rank 2.

VECM: A TEST OF CAUSALITY

In economics, systematic testing and determination of causal directions only became possible after an operational framework was developed by Granger (1969) and Sims (1972). Their approach is crucially based on the axiom that the past and present may cause the future but the future cannot cause the past (Granger, 1980). In econometrics the most widely used operational definition of causality is the Granger definition of causality, which is defined as follow:

"X is a Granger cause of Y (denoted as $X{\rightarrow}Y$), if present Y can be predicted with better accuracy by using past values of X rather than by not doing so, other information being identical" (Charemza and Deadman, 1992).

Since we are interested in testing the direction of causation between savings and growth, we can rewrite (3) in a more explicit form, where the assumption of co-integration has been added:

$$\begin{bmatrix} \Delta_{st} \\ \Delta_{yt} \end{bmatrix} = \begin{bmatrix} b_{11}^1 & b_{12}^1 \\ b_{21}^1 & b_{22}^1 \end{bmatrix} \begin{bmatrix} \Delta s_{t-1} \\ \Delta y_{t-1} \end{bmatrix} + \ldots\ldots + \begin{bmatrix} b_{11}^{p-1} & b_{12}^{p-1} \\ b_{21}^{p-1} & b_{22}^{p-1} \end{bmatrix} \begin{bmatrix} \Delta s_{t-p-1} \\ \Delta y_{t-p-1} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} \begin{bmatrix} \beta_1 \beta_2 \end{bmatrix} \begin{bmatrix} s_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix}$$

The null hypotheses of non-causality of *s* on *y* can be expressed as restrictions on the parameters in the following way:

$$b_{21}^1 = \ldots = b_{21}^{p-1} = 0, \alpha_2 = 0$$

The two parts of the test have been labeled as the tests of 'short-run' and 'long-run' Granger causality in the literature. Long run should not be interpreted in a temporal sense here; deviation from equilibrium is of course partially corrected between each period but in a "mechanical" sense. If there is unidirectional causality, say form savings to GDP, then in the short term deviations from the long-run equilibrium implied by the co-integrating relationship will feed back on changes in GDP in order to re-establish the long-term equilibrium. If GDP is driven directly by this equilibrium error, then it is responding to this feedback. If not, it is responding to short-term stochastic shock. The test of the elements in *B* (equation 3) gives an indication of the short-term causal effects, whereas significance of the relevant element in Π indicates long-term causal effects. (Masih and Masih, 1996).

III. NATURE AND SOURCES OF DATA

In this section the nature and sources of the data used in the analysis are discussed. Regarding the nature of the data, all the time series are quarterly observations of the variables for period 1973:1 to 2003:4. Different measures of savings and level of output are used.

For savings, we used national savings (NS) which is the sum of public and private savings. Private savings (PTS) consists of savings made by the household and the business organization. Public savings (PS) is the savings made by the government sector which is based on the budgetary condition of the government and it has negative relationship with the budget deficit. Domestic savings (DS) is obtained by subtracting net factor income form the national savings. Regarding the source of data, the annual data on all measures of savings are taken from annual reports of the State Bank of Pakistan. For level of output real gross domestic product (GDP) and gross national product (GNP) at the base year of 1980-81[5] are used. The annual

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[5]Anderson (1999) has examined the causal relationship between savings and Economic growth by using level of output instead of growth rate of output.

data on GDP and GNP are taken from Pakistan Economic Survey. The quarterly data on the variables discussed above are not available. The annual data are first converted into quarterly data by using method given by Khan and Raza (1989). To avoid fluctuations in the data natural logarithms of all the variables are used. LNGDP denotes logarithm of GDP and so on. The prefix "D" with variables denotes the first difference of the variables.

IV. ESTIMATION AND INTERPRETATION OF RESULTS

The investigation of stationarity (or non-stationarity) of a time series is related to the test for unit root. Existence of unit root in a series denotes non-stationarity. The null hypothesis of non-stationarity of savings and output is tested against the alternative hypothesis of stationarity. In order to test stationarity of the variables in the data set, we employed ADF test. The results of this test are reported in the Table 1.

TABLE 1

Results of Unit Root Test

ADF Test in Levels			ADF Test in 1st Differences		
Regression with an intercept and trend			Regression with an intercept		
Variables	Lags	Calculated ADF value	Variables	Lags	Calculated ADF value
LNGDP	3	0.192	DLNGDP	3	−3.74
LNGNP	3	−0.909	DLNGNP	3	−4.06
LNDS	3	−3.265	DLNDS	3	−7.74
LNNS	4	−3.084	DLNNS	4	−7.32
LNPS	4	−2.97	DLNPS	3	−12.32
LNPTS	3	−3.237	DLNPTS	3	−8.54

NOTE: In case of levels of the variables critical value at 5% is −3.4 and all the calculated values are significant at 5% significance level. In case of first differences of the variables critical value at 5% is −2.88 and all the calculated values are significant at 5% significance level. This critical value is taken from McKinnon (1991). Lags are chosen according to Akaik Information Criterion and Schwarz Bayesian Criterion.

Table 1 shows that in case of levels of the series, the null hypothesis of non-stationarity cannot be rejected for any of the series. Therefore, all series are non-stationary at levels. Application of the same test at first differences to determine the order of integration; the critical values are less (in absolute terms) than the calculated values of the test statistics for all series. This shows that all the series are integrated of order one, *i.e.* I (1), and become stationary after differencing once. It is also to be noted that at first differences of the variables the trend becomes insignificant so the ADF test is used with an intercept only.

Residuals are also proved to be white noise at these lags by employing serial correlation LM and ARCH tests. The results of LM and ARCH tests are given in Tables 2 and 3.

TABLE 2

The Results of LM and ARCH Tests in Level

VARIABLES	LAGS	LM TEST		ARCH TEST	
		χ^2	Prob.	χ^2	Prob.
LNGDP	3	107.06	0.29	49.86	0.47
LNGNP	3	104.12	0.36	53.48	0.34
LNDS	3	98.26	0.53	53.47	0.34
LNNS	4	112.62	0.18	2.98	0.99
LNPS	4	105.03	0.34	50.54	0.45
LNPTS	3	103.43	0.87	38.83	0.87

Table 2 shows that at these lags the residual terms are pure white noise, *i.e.* they are well behaved and the null hypothesis of no autocorrelation and no heteroskedasticity among residuals is accepted in both Lagrange Multiplier Test and Auto Regression Conditional Heteroskedasticity as shown by the insignificant χ^2 values.

The results in Table 3 indicate that residuals are also well behaved at first differences of the variables. It is indicated by the insignificant χ^2 values.

The null hypothesis of no autocorrelation in case of LM test and null hypothesis of no heteroskedasticity in case of ARCH test are accepted.

TABLE 3

The Results of LM and ARCH Tests with first Difference

VARIABLES	LAGS	LM TEST		ARCH TEST	
		χ^2	Prob.	χ^2	Prob.
DLNGDP	3	107.88	0.40	43.36	0.73
DLNGNP	3	97.79	0.54	54.62	0.30
DLNDS	3	97.36	0.55	60.12	0.15
DLNNS	4	89.51	0.76	54.14	0.31
DLNPS	3	104.12	0.36	49.84	0.47
DLNPTS	3	77.78	0.95	41.87	0.78

CO-INTEGRATION

Co-integration relationship is investigated by using Johansen technique. We calculate the trace statistics and the maximum eigenvalue statistics. The null hypothesis of no co-integration vector is tested against the alternative hypothesis of one co-integrating vector.

Trace test is used to check whether there exists co-integration between variables or not. The results of the test are reported in Table 4. The results indicate that co-integration relationship between savings and level of output exist. To find out the exact number of co-integrating vectors we use maximum eigenvalue test. The results of λ max test are also given in Table 4.

The results of the Johansen test show that the null hypothesis of no co-integration is rejected at 5% significance level in all of the cases. However, the null hypothesis of one co-integration cannot be rejected for all of the cases. The existence of co-integration relationship between savings and level of output suggests that there is long run relationship between the two series and the residuals obtained from the co-integrating vectors are stationary at their levels, *i.e.* I (0).

TABLE 4

Results of Johansen Co-integration Test

Variables	Lags	λ trace test			λ max test		
		H_0	H_1	Trace Statistics	H_0	H_1	Maximum Eigen values
LNGDP LNDS	1 3	r = 0	r > 0	28.86**	r = 0	r = 1	22.32**
		r ≤ 1	r > 1	6.48*	r = 1	r = 2	6.48*
LNGDP LNNS	1 2	r = 0	r > 0	31.532**	r = 0	r = 1	27.225**
		r ≤ 1	r > 1	4.307*	r = 1	r = 2	4.307*
LNGDP LNPS	1 2	r =0	r > 0	32.428**	r = 0	r = 1	27.104**
		r ≤ 1	r > 1	5.324*	r = 1	r = 2	5.324*
LNGDP LNPTS	1 2	r = 0	r > 0	31.339**	r = 0	r = 1	27.709**
		r ≤ 1	r > 1	3.63*	r = 1	r = 2	3.63*
LNGNP LNDS	1 6	r = 0	r > 0	25.48**	r = 0	r = 1	20.95**
		r ≤ 1	r > 1	4.53*	r = 1	r = 2	4.53*
LNGNP LNNS	1 3	r = 0	r > 0	31.56**	r = 0	r = 1	27.12**
		r ≤ 1	r > 1	4.44*	r = 1	r = 2	4.44*
LNGNP LNPS	1 3	r = 0	r > 0	40.28**	r = 0	r = 1	34.32**
		r ≤ 1	r > 1	5.88*	r = 1	r = 2	5.88*
LNGNP LNPTS	1 2	r = 0	r > 0	33.57**	r = 0	r = 1	27.225**
		r ≤ 1	r > 1	4.67*	r = 1	r = 2	4.67*

NOTE: In case of λ trace test the critical values for the hypothesis r = 0 at 5% and 1% significance levels are 15.19 and 6.936 respectively.

**indicates the rejection of the null hypothesis at 5% significance level.

*indicates acceptance of null hypothesis at 1% significance level.

In case of λ max test the critical values for the hypothesis r = 0 at 5% and 1% significance levels are 14.036 and 6.936 respectively.

**indicates rejection of null hypothesis at 5% significance level.

*indicates acceptance of null hypothesis at 1% significance level

Lags are chosen according to Likelihood Ratio Test.

VECTOR ERROR CORRECTION: A TEST OF CAUSALITY

Vector error correction model (VECM) is estimated to examine the causal relationship between savings and level of output in Pakistan. The long run causality is checked by using the t-ratios of the error correction terms. They are basically the coefficient of speed of adjustment which shows how

TABLE 5

Long Run Causality Results

REGRESSIONS	't' VALUES OF α
DLNDS DLNGDP	3.67*
DLNGDP DLNDS	2.10**
DLNNS DLNGDP	3.79*
DLNGDP DLNNS	−2.84*
DLNPS DLNGDP	−3.30*
DLNGDP DLNPS	1.02
DLNPTS DLNGDP	1.75***
DLNGDP DLNPTS	−2.61*
DLNDS DLNGNP	3.71*
DLNGNP DLNDS	2.13**
DLNNS DLNGNP	4.28*
DLNGNP DLNNS	−1.99**
DLNPS DLNGNP	2.97*
DLNGNP DLNPS	−0.99
DLNPTS DLNGNP	2.64*
DLNGNP DLNPTS	−1.15

NOTE: *indicates significant values at 1% significance level.

  **indicates significant values at 2.5% significance level.

  ***indicates significant values at 5% significance level.

strongly the deviation from equilibrium feed back into the system. The short run causality is determined by the t-values of the coefficients of the lagged terms of independent variables. This procedure is particularly attractive over the standard VAR because it permits temporary causality to emerge from (1) the lagged coefficients of the explanatory differenced variable and (2) the coefficient of the error correction term. In addition the VECM allows causality to emerge even if the coefficients of lagged differences of the explanatory variables are not significant. It must be pointed out that the standard Granger causality test omits the additional channel of influence, *i.e.* the significance of the coefficient of error correction term.

TABLE 6

Short Run Causality Results

Regressions	Lags	't' values of coefficients of lagged independent variables
DLNNS DLNGDP	1 2	−1.83*** (1)
DLNGDP DLNPTS	1 4	−1.97*** (4)
DLNGNP DLNNS	1 2	1.56*** (1)
DLNDS DLNGDP	1 4	−1.48**** (4)
DLNGDP DLNDS	1 4	−2.27* (4)
DLNGNP DLNDS	1 4	−4.106* (4)

NOTE: Figures in brackets indicate lag at which 't' values are significant. The regressions having insignificant results are not reported.

*indicates significant values at 1% significance level.

***indicates significant values at 5% significance level.

****indicates significant values at 10% significance level.

The results of long run Granger causality are reported in Table 5. The results indicate that there is mutual long run causality between savings and level of output because of the significant 't' values of the speed of adjustment coefficient. There is unidirectional long run causality from public savings to output (GNP and GDP) and from private savings to only GNP. It is also to be noted that savings adjust strongly from the disequilibria into

equilibrium system than the level of output. It means speed of adjustment in case of savings is stronger than that of level of output.

The short run causality between the variables is checked by the t-values of the coefficient of lagged terms of independent variables in VECM. The results of short run causality are reported in Table 6. Akaike information criterion (AIC) and Schwartz Bayesian information criterion (SBIC) are used to choose optimum lag length of the variables included in the VECM. There is mutual short run causality between GDP and domestic savings. The results also indicate the presence of short run unidirectional causality from output (GNP) to national and domestic savings, GDP to private savings. The short run causality runs only from national savings to GDP. No evidence of short run causality is found in other cases. It shows that if simple Granger test is used to check the causality, it would not extend any support to causal relationship between savings and level of output. However, the use of vector error correction technique proves that both these variables cause each other in the long run through the error correction term.

V. CONCLUSIONS AND POLICY IMPLICATIONS

The objective of the paper is to investigate causal relationship between savings and output in Pakistan. The co-integration and vector error correction techniques are used to explore direction of causality for the period 1973:1-2003:4. The results of ADF test show that all measures of savings and level of output are integrated of order one. It means that these variables are stationary at their first differences. Once it is found that all the variables used in the analysis are integrated of the same order, we apply Johansen's co-integration test to check whether the variables have long run relationship. The results of the co-integration test show that there is long run equilibrium relationship between different measures of savings and level of output. The residuals obtained from these co-integrating vectors are also stationary at their levels.

The results of the VECM suggest a long run bi-directional relationship between different measures of savings and level of output. However there is unidirectional long run causality from public savings to both measures of output (GNP and GDP) and from private savings to GNP only. The speed of adjustment in case of savings is stronger than that of level of output. There is mutual short run causality between gross domestic product (GDP) and domestic savings. The unidirectional short run causality runs from output (GNP) to national and domestic savings and from GDP to private savings. Only the national savings causes the GDP in the short run.

The results of the paper are mixed for both long run and short run causality. In case of long run there is mutual causality between savings and level of output and if there is any unidirectional causality, it runs from savings to level of output and not the other way. So, in the long run our results favour capital fundamental's point of view that savings causes economic growth. There is mutual short run causality between domestic savings and GDP. The results also suggest unidirectional short run causality from level of output (GNP) to national and domestic savings. Unidirectional short run causality runs only from national savings to GDP. So, overall short run results favour Keynesian point of view, *i.e.* savings depends upon level of income. Our results are in line with conclusions of Anderson (1999) that causality in the long run might go in different directions than causality associated with short-term disturbances. Deaton (1995) pointed out that "the causation is important, not just for understanding the process, but for the designing of policy. If savings is the mover of growth then policies should be implemented which give savings incentive, such as tax breaks, compulsory savings in employee provident funds. The results imply that policies should be implemented which are in favour of savings. The savings and then economic growth can be promoted by implementing following policies:

1. Creation of stable and predictable economic environment that rewards savers for thrift and reduces the fear that inflation or a collapsing of financial system will lead to expropriation of their savings. This implies stabilizing inflation, strengthening domestic financial institutions, and increasing the role of market signals in the allocation of savings and investment, *i.e.* the elimination of financial repression.

2. The government has been a major dis-saver therefore it is necessary to reverse this habit and to render public savings positive. This requires strong improvement on the fiscal balance, particularly the revenue balance. Another promising way to increase national savings is to concentrate on household savings which accounts for roughly three-fourth of national savings. Several long term savings instruments may be developed to increase household savings. There is also need to expand network of National Savings Schemes, microfinance institutions, banks and postal savings to far flung areas of the country. There is also need to launch a comprehensive campaign to explain the value of savings to Pakistanis. Macroeconomic stability combined with solid prudential regulations of financial institutions may create an environment in which would raise savings.

3.   The Central Directorate of National Savings needs to be converted into an autonomous body which would improve the performance of the savings centers. A system of paying commission to those centers who mobilizes more savings may also enhance savings in the country.

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