*Anadolu İktisat ve İşletme Dergisi, 5 (2) 2021, 115-133*
*Anatolian Journal of Economics and Business, 5 (2) 2021, 115-133*

# The Relationship among Agricultural Output, Inflation Rate, Fiscal Deficit and National Savings: Evidence from Pakistan

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***Abstract***

*The objective of the study is to explore the impact of agricultural output, fiscal deficit and inflation rate on national savings in Pakistan for the period of 1973-2020. To address the objective, autoregressive distributed lag (ARDL) model and error correction model (ECM) are applied for co-integration and short-run dynamics respectively. The findings of the study endorse that agricultural output and rate of interest have a significant positive effect on national savings while inflation rate and fiscal deficit negatively affect national savings both in the long and short term. The sign and value of the coefficient of the lagged error correction term helps us to conclude that 69% of the impact of the shocks occurring in the economy is eliminated within a year. It is recommended that effort should be made to improve the productivity of the agricultural sector and curtail deficit and inflation rate to increase savings in Pakistan.*

***Keywords**: National savings, Agricultural output, Fiscal deficit, Inflation rate, ARDL*

***JEL Classification**: E21, E31, H62, Q10*

# Tarımsal Çıktı, Enflasyon Oranı, Mali Açık ve Ulusal Tasarruf İlişkisi: Pakistan'dan Kanıtlar

***Özet***

*Bu çalışmanın amacı, Pakistan'da 1973-2020 dönemi için tarımsal üretim, mali açık ve enflasyon oranının ulusal tasarruflar üzerindeki etkisini incelemektir. Bu amaçla çalışmada, eşbütünleşme ve kısa dönem dinamikler için sırasıyla otoregresif dağıtılmış gecikme (ARDL) modeli ve hata düzeltme modeli (ECM) uygulanmıştır. Sonuçlar hem kısa hem de uzun dönemde tarımsal üretimin ve faiz oranının ulusal tasarruflar üzerinde önemli bir pozitif etkiye sahip olduğunu, enflasyon oranı ve mali açığın ise ulusal tasarrufları olumsuz etkilediğini göstermektedir. Gecikmeli hata düzeltme teriminin katsayı işareti ve değeri, ekonomide meydana gelen şokların etkisinin %9'unun bir yıl içinde ortadan kalktığını desteklemektedir. Ülkede tasarrufların artırılması için tarım sektörünün verimliliğinin artırılması, bütçe açığı ve enflasyon oranının azaltılması için çaba gösterilmesi gerektiği önerilmektedir.*

***Anahtar Kelimeler**: Ulusal tasarruf, Tarımsal çıktı, Mali Açık, Enflasyon Oranı, ARDL*

***JEL Sınıflandırması**: E21, E31, H62, Q10*

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Geliş Tarihi / Received: 30.03.2021
Kabul Tarihi / Accepted: 26.05.2021

## 1. Introduction

Savings is a part of disposable income which is not utilized for consumption purposes (Carroll, 2006). It is a public virtue only if the propensity to invest is equally high; otherwise, it becomes a public vice. The investment capability of any country puts up largely on the amount of savings generated by its economy which in turn affect the interest rate and investment. The saving rate in Pakistan has increased but substantial fluctuations are also observed from period to period. During 1960s, national savings was about 10% of GDP that increased to 15% in 2000s and turndown to 12% in 2015-2016. It further declined to 10.2% in 2016-17 (Govt. of Pakistan, 2018-19). About 50% of the national savings locates its mode into the financial sector. The rest is used in real estate or capital formation (Ali, 2016). By viewing the past drift in saving momentum and its current fall, there is a need to understand factors that affect savings in Pakistan. It is, therefore, a pertinent question that why national savings in Pakistan is low and fluctuates over time.

Several determinants of savings in Pakistan have been pointed out in the literature. Economic theory argues that saving is an increasing function of income. However, in a macroeconomic context savings, like other economic variables, depends on number of factors such as income, age dependency ratio, interest rate, fiscal deficit, inflation rate and financial development. Savings is also expected to depend on the overall health of the economy represented by the growth of the real GDP. The importance of the agriculture sector can be assessed form the fact it is the backbone of Pakistan's economy since it contributed about 19.3 percent to annual GDP and is by far the largest sector to absorb most labour directly and indirectly (Govt. of Pakistan, 2019-2020).

The importance of the savings cannot be over emphasized since it plays a critical role in capital accumulation and economic development. The economic growth of the country can be influenced by the level of savings; higher level of savings leads to capital accumulation that further leads to growth of the economy (Solow, 1956). Capital formation depends upon 'will to save' as well as 'capacity to save'. The capacity to save is more important in capital accumulation than will to save. Leibenstein (1957) is of the view point that "the saver" is one of the growth agents who is necessary for the process of economic development. The Life Cycle model of Modigliani (1966) also emphasized how savings could be used to transfer purchasing power of the people from one phase to other phase of life. The importance of the saving in the growth of an economy provides a rationale for conducting a research on its determinants in Pakistan. The theoretical relationship of variables under consideration with savings in Pakistan is discussed below.

**Agricultural Output and Savings:** The fundamental assumption of the life-cycle hypothesis is that an individual seeks to maximize the present value of lifetime utility subject to the budget constraint. The hypothesis divides the lifetime of a consumer into working period and retirement period. They are assumed to be net savers during the working period and dis-savers during the retirement period. Consequently, growth in per capita income will increase aggregate savings rate because it increases the lifetime earnings and savings of younger age groups relative

to older age groups. Thus, countries with higher per capita growth rate are expected to have higher savings rate than countries with lower growth rates. However, there is another view which indicates that the size of this effect is likely to decline as per capita income rises and may even become negative for countries where investment opportunities and growth rate are relatively lower.

**Inflation and Savings:** The life-cycle model says that the inflation influences savings through its role in determining the real returns (real interest rate) to savings. This postulate is based on the implicit assumption of inflation neutrality (the absence of money illusion) in savings behavior and the absence of the real balance effect of inflation. The negative association between inflation rate and national savings may also be due to the fact that with the increase in inflation, consumers have to pay higher prices which may give rise to low private savings; so national savings decreases as private savings is a part of national savings. There are, however, good reasons for doubting the validity of these assumptions. First, inflation brings about uncertainty in future income streams and can thus lead to higher savings on precautionary grounds. This may be particularly true for households in developing countries whose income prospects are much more uncertain than their counterparts in developed countries. Second, inflation can influence savings through its effect on real wealth. If consumers attempt to maintain a target level of wealth or liquid assets relative to income, savings will rise with inflation. It is also argued in the literature that small savers cannot protect their savings against inflation in the inflationary environment. This state of affairs makes them to decrease savings and increase consumption, while the increase in demand accelerates inflation even more. For these considerations, we include the inflation rate as an additional explanatory variable of national savings in Pakistan. The study helps us to point out that which of the viewpoints is valid for Pakistan.

**Fiscal Deficit and Savings:** The theory of **Ricardian equivalence** posits that rational households might prefer to save more to offset government dissaving or borrowing. If Ricardian equivalence holds, then in the national savings and investment identity, an increase in fiscal deficit would be completely offset by a corresponding increase in private savings. As a result, increase in government borrowing would have no effect at all on national savings. The non-Ricardian are of the view point that increase in fiscal deficit means public savings decreases, which in turn decreases the national savings so there may be negative association between fiscal deficit and national savings. So, the present study is an attempt to check the actual association between fiscal deficit and national savings

**Rate of Interest and Savings:** The effect of interest rate on savings can either be negative or positive depending upon the relative power of the income and substitution effects. Higher interest rates persuade more savings. To lift up the level of savings in the economy activists for financial liberalization favor, particularly, decontrol of interest rate in order to stimulate the prospective savers to save more (McKinnon, 1973). Low or negative real rate of interest depresses savings and reduces loanable funds which shrink investment. Consequently, the economic growth diminishes (McKinnon-Shaw, 1980). To bring the effect of interest rate

liberalization on private savings in Pakistan, the rate of interest is included in the model.

No endeavor has been made to explore the impact of agricultural output on national savings in Pakistan. The literature review also makes it clear that no consensus is found about the effect of inflation rate and fiscal deficit on national savings in Pakistan. Some of the studies are of the view that inflation rate and fiscal deficit have positive association with national savings while other studies document negative influence of inflation rate and fiscal deficit on national savings. The present study attempts to analysis the impact of agricultural output on national savings in Pakistan. It also attempts to examine the association of national savings with inflation rate and fiscal deficit in the presence of agricultural output. To achieve the objectives, the study adopts the unit root and ARDL co-integration test and error correction model which allow for the heterogeneity in parameters and dynamics to examine the long run and short run determinants of national savings in Pakistan.

The rest of the study is prepared as follow. Section 2 reviews some of the critical studies conducted on the determinants of savings for Pakistan and other countries of the world. Model and Data set are explained in section 3. The research methodology applied for investigation is elaborated in section 4. The results are discussed in section 5. The last section concludes the article and proposes recommendations.

## 2. Literature Review

A number of studies have been conducted to investigate the behaviour of national savings in developing and developed countries of the world. Some studies are based on time series data of macroeconomic variables while other use cross sectional data for analysis purpose. The present study is an attempt to analyze the relationship between national savings and its determinants using time series dataset which is more consistent with the objectives of the study. We presented the review of those studies which have analyzed factors of savings related to our study. The review of literature is categorized into two sections. The first section reviews those studies which are conducted on countries other than Pakistan while studies carried out on Pakistan are reviewed in second section.

### 2.1. Review of Studies Which Investigate Savings Behavior for Countries Other Than Pakistan

Anyanwu and Oaikhenan (1995), exploring the determinants of national savings in Nigeria, conclude that the level of income, rate of interest, inflation rate, expectations about inflation rate, savings facilities, the instinct for precaution, the desire for bequest, habits and cultural factors are major contributors to national savings in Nigeria. Agrawal et al (2009) analyze savings behavior in five South Asia countries. The results show that income, access to banking institutions, foreign savings rate and dependency rate are the main determinants of savings in South Asia countries. The impact of the real interest rate on savings is minor and inconclusive in direction. Further, the direction of causality is primarily from

income or growth to the savings rate in South Asia. Horioka and Hagiwara (2012) conclude that key determinants of savings are income level, level of financial development and age dependency ratio. The real interest rate is not stable in sign and totally insignificant. They find that population ageing is a key determinant for future inclination in household savings rate in developing Asia.

Samantaraya and Patra (2014) contend that GDP, interest rate, dependency ratio, and inflation rate have significant effect, both in the short and long run, on household savings in India. Idiaye et al (2014) investigate the effect of agricultural output along with some other variables on national savings in Nigeria. They find that the government's recurrent expenditures, money supply and population positively influence the national savings while the debt servicing by the government, unemployment rate and imports of goods has a negative association with national savings in Nigeria. Agricultural GDP was found not to be a significant determinant of national savings in Nigeria despite the sector holding most of the country's labor force and being a significant contributor of GDP. This might be traceable to the fact that much of the increase in agricultural output experienced through the years in Nigeria have come as a result of sudden jumps in the number of participants trying to take advantage of previous season increases in commodity prices or favorable policy changes and not as a result of productivity improvements of the average farmer which would more likely have influenced national savings positively; while interest rate is found significant variable of national savings in Nigeria. Akram and Akram (2015) analyze the savings behavior in Muslim and Non-Muslim Countries for the period of 1975-2012. They find that the real interest rate has no effect on savings in Muslim countries whereas it has positive impact for Non-Muslim countries. The findings of the study also indicate that foreign savings, age dependency and inflation rate have negative while financial sector development, openness, and per capita GDP exhibit positive effect on savings in both types of countries. The main outcome of Onwuasoeze and Kirori (2016) reveals that the lower inflation rate raises savings through growth in Kenya.

Ogren (2018) shows that the GDP per capita and real interest rate have positive significant effect on the household savings rate. Of OECD countries The outcome of budget deficit increases the household savings while inflation rate does not have significant effect on household savings behavior. Nagawa et al (2020) analyze determinates of gross domestic savings in Uganda by using an autoregressive distributed lag (ARDL) approach. The results reveal that GDP growth rate, FDI and M2 has positive while current account balance and gross national expenditures have negative effect on gross domestic savings. In the long run, deposit interest rate is found to be statistically unimportant determinant of gross domestic savings in Uganda while in the short run deposit interest rate and GDP growth rate have statistically significant adverse influence on savings.

### 2.2. Review of Studies Which Investigate Savings Behavior in Pakistan

Sajid and Sarfraz (2008) analyze causal relation between savings and output level in Pakistan by means of quarterly data from 1973:1 to 2003:4. The outcome of their study shows mutual or bidirectional long-term association between savings and

economic growth. Single sided long-term causality exists in public savings to GNP and private savings to output. Azam et al (2010) concluded that per capita income and past savings rate are positively related whereas inflation rate is negatively related to national savings in Pakistan. Chaudhry et al (2010) resolve that interest rate; government consumption, consumer price index, workers' remittances and exports positively affect the national savings while savings is found negatively related to public loans in the long term. Their results regarding the effect of CPI and interest rate on national savings are supported by Faridi and Arif (2012). Globalization plays an important role to enhance savings is explored by Faridi and Arif (2012). Government deficit has an inverse relationship with savings. They also find that workers' remittances have a direct and significant influence on all types of savings in Pakistan.

Ahmad and Mahmood (2013) maintain that inflation rate and exchange rate negatively while money supply, trade openness and lagged value of exchange rate are positively associated with national savings in Pakistan. Jilani et al (2013) provide an evidence that government consumption, growth rate and fiscal deficit are positively while the inflation is negatively related to national savings. Khan et al (2013), investigating determinants of private savings in Pakistan, conclude that per capita income, financial deepening, and level of education are positively associated with savings rate while savings rate has negative association with dependency ratio. Shaikh and Shaikh (2013) specify that the national savings rate is positively linked to GDP and market capitalization growth rates and negatively associated to federal inflation and debt growth. Chaudhry et al (2014) conclude that inflation rate, government expenditures and deposit rate are positively correlated with national savings both in the short and long term. The budget deficit and M2 have significant and negative impact on national savings in the long term. Ahmad (2015) suggests that fiscal deficit, exchange rate, industrial production, financial development, dependency ratio, inflation rate and GDP per capita have significant positive association with private savings in the long term and M2 has negative relationship with savings in Pakistan. The outcomes of the study suggest that financial development and GDP per capita negatively affect private savings in the short run. Aleemi et al (2015) find that national savings is negatively affected by interest rate, government expenditure and inflation rate.

Akram and Akram (2016) examine macro and socioeconomic determinants of savings in Pakistan for the period of 1973 to 2013. The outcomes of the study show that foreign savings, age dependency and inflation negatively affect all type of savings while economic growth and financial sector development enhance savings in Pakistan. The interest rate has significant positive impact on public savings. The study also concludes that taxes discourage private savings; however, it positively affects public savings. Kalim and Hassan (2016) discover that increase in exports and, remittances, and depreciation of domestic currency increase national savings whereas increase in interest payments against external debt and imports discourage national savings in Pakistan.

The literature review made above helps us to deduce that no attempt has been made to explore the influence of agricultural output on national savings in Pakistan. The findings of some of the studies made on Pakistan reveal that inflation rate and fiscal deficit has negative influence on national savings while some others are of the view that inflation rate and fiscal deficit has positive impact on national savings. It means that the results of the existing studies about the effect of inflation rate and fiscal deficit on national savings are inconclusive. This study is an effort to fill the above-mentioned gap in the literature by introducing the agricultural output as a determinant of national savings in Pakistan by utilizing data set from 1973 to 2020.

## 3. Model Specification and Data Set

On the basis of the discussion made in the introduction section and following Tesha (2013), the national savings can be modeled as:

$$\mathrm{LNNS} = \mathrm{f}(\mathrm{ADR}, \mathrm{LNAGR}, \mathrm{FSD}, \mathrm{INF}, \mathrm{GDP}, \mathrm{RI}) \quad (1)$$

Where LNNS is natural log of national savings, ADR is age dependency ratio, LNAGR is natural log of value-added of agricultural output, FSD is fiscal deficit as a percentage of GDP, INF is inflation rate measured by growth rate in consumer price index (CPI), GDP is growth rate of GDP and RI is one- year Govt. bond yield.

Annual time-series data for the period of 1973-2020 is employed to address the objectives. The data is taken from Handbook of Statistics on Pakistan Economy, World Development Indicators (WDI), Pakistan Economic Survey and International Financial Statistics (IFS).

## 4. Research Methodology

It consists of (i) checking the presence of unit root in time series (ii) testing co-integration (iii) error correction model

### 4.1. Unit Root Test

Time series usually has problems of unit-root, autocorrelation / serial correlation. It is vital to check them. If time-series is non-stationary, the results of the traditional methods will be spurious (Shrestha and Chowdhury, 2005). The various tests are available in the literature, for instance, Fuller (1976) test, Dickey and Fuller (1979), Augmented Dickey-Fuller (ADF) and Phillips-Perron (1988) test to check unit root. The Augmented Dickey Fuller (ADF) test is applied in this study because it takes into account of serial correlation in the error terms by summing up the lag variation terms of the regressand. Dickey-Fuller (1976) test is originated upon following simple auto regression:

$$y_t = \mu + \alpha y_{t-1} + \varepsilon_t \quad (2)$$

Where $y_t$ is the dependent variable. $\mu$ and $\varepsilon_t$ are intercept and error term respectively.

If the error term $\varepsilon_t$ in equation (2) is consecutively correlated, it can be removed by changing the Dickey-Fuller as the Augmented Dickey-Fuller (ADF) test which can be specified as

$$\Delta y_t = \mu_1 + \mu_2 t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-1} + \varepsilon_t \quad (3)$$

Where $\delta = \alpha - 1$, m is chosen such that $\boldsymbol{\varepsilon_t}$ is "white noise error term" and

$\Delta y_t = (y_t - y_{t-1})$, $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$

$H_0: \delta \geq 0$ (Unit Root), $H_1: \delta < 0$ (Stationary)

If $H_0$ is rejected, it implies that time series is stationary otherwise the time series has unit root / is non-stationary.

### 4.2. Auto Regressive Distributed Lag (ARDL) Model:

Several methods such as Box-Jenkins Auto Regressive Integrated Moving Average (ARIMA) (Box and Jenkins, 1970) approach, Vector Auto Regressive (VAR ) (Sim, 1980) approach, Engle and Granger (1987) approach, Fully Modified Least Squares (FM-OLS) regression by Phillips and Hansen's (1990), Johansen and Juselius (1990), Maximum Likelihood in a Fully Specified Error Correction Model (MLECM) by Johansen (1988; 1991; 1995) and Error Correction Model (ECM) by Sargan (1961) are available in the literature to test the occurrence of co integration among the determinants (Shrestha and Chowdhury, 2005). This study applies Auto Regressive Distributed Lag (ARDL) approach to examine the short- and long-term association among the determinants. The ARDL approach is considered suitable for the empirical exercise for that of the subsequent accounts: Firstly, the set of variables used in empirical exercise is probably the blend of $I(0)$ and $I(1)$ variables. Secondly, it is appropriate for the limited period and small sample data (Pesaran et al (2001). Thirdly, to recognize the nature of correlation among the factors, the ARDL approach is appropriate to handle the possible endogeneity problems. Fourthly, this model has advantage over other co-integration tests is that it achieves more reliable statistical results by using unlimited error correction model. The ARDL model can be presented in the following manner:

$$\Delta LNNS = \lambda_0 + \lambda_1 LNNS_{t-1} + \lambda_2 ADR_{t-1} + \lambda_3 LNAGR_{t-1} + \lambda_4 FSD_{t-1} + \lambda_5 INF_{t-1} + \lambda_6 GDP_{t-1} + \lambda_7 RI_{t-1} + \varepsilon_t \quad (4)$$

Where $\Delta$ is the first difference operator, LN is the logarithmic value of the variables.$\lambda_0$ is drift component and $\varepsilon_t$ are white noise errors. The first part of the equation with$\lambda_1$,$\lambda_2$, $\lambda_3$, $\lambda_4$, $\lambda_5$, $\lambda_6$ and $\lambda_7$ represent the long term dynamics of the model, Pesaran et al. (2001) presented two critical values of Wald test which are used to assess the occurrence of long run relationship among the determinants of interest. The bounds test for co integration is derived from the F-statistics of Wald test. The null and alternative hypotheses of the test are in this manner:

Null Hypothesis: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = \lambda_6 = \lambda_7 = 0$ (there is no co-integration)

Alternative Hypothesis: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq \lambda_6 \neq \lambda_7 \neq 0$ (there is co integration)

The first step for the estimation of ARDL model is to evaluate F statistic through the critical values for the hypotheses testing; initiated by Pesaran et al (2001) and

Narayan (2005). The critical value of lower bound supposes that the exogenous factors are integrated of $I(0)$, whereas critical value of the upper bound supposes that they are $I(1)$. The $H_0$ is not rejected if the computed F-statistics is less than the lower bound, regardless of the orders of integration of variables. The $H_0$ is rejected, if the calculated F-statistics exceeds the critical value of upper bound. It means that long term association exists among the determinants. The association among the determinants is indecisive if the estimated value of F-statistics lies inside the lower and upper bound regardless of the order of integration of the underlying factors.

The second step for the ARDL analysis is the estimation of the long run coefficients of the model. Once an evidence of co integration is found, equation (4) is estimated: To estimate ARDL model, optimal lag length of variable is required. A number of criteria such Final Predicted Error (FPE), Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC) and Hannan-Quinn Information Criteria (HQ), are available in the literature to determine the optimal lag length. We prefer to employ Schwarz Bayesian Criteria (SBC) to choose the optimal lag length. This criterion is preferable to others because of its tendency to illustrate more prudent specifications (Pesaran and Shin, 1998).

### 4.3. Error Correction Model (ECM)

After estimating the long-term coefficients, the dynamic parameters of the short term are obtained by estimating the error correction model which is presented below:

$$\Delta LNNS = \sum_{c=1}^{a} \beta_1 \Delta LNNS_{t-c} + \sum_{d=0}^{b} \beta_2 \Delta ADR_{t-d} + \sum_{e=0}^{f} \beta_3 \Delta LNAGR_{t-e} + \sum_{i=0}^{g} \beta_4 \Delta FSD_{t-i} + \sum_{j=0}^{h} \beta_5 \Delta INF_{t-j} + \sum_{k=0}^{s} \beta_6 \Delta GDP_{t-k} + \sum_{l=0}^{m} \beta_7 \Delta RI_{t-l} + \phi ECT_{t-1} + \varepsilon_t \quad (5)$$

Whereas β's are the short run dynamic coefficients and ϕ is the coefficient of error correction term ($ECT_{t-1)}$ which denotes the speed of adjustment from short term disequilibrium to long run. The expected sign of ϕ is negative and its statistical significance is interpreted as further evidence of co-integration. The coefficient of $ECT_{t-1}$ demonstrates how speedily the system comes back to equilibrium if it faces a shock. It must be less than one with negative sign and statistically significant.

## 5. Results and Their Discussion

By applying the methodology discussed in section 4 is applied to data set. The results are obtained which are discussed in this section.

### 5.1. Results of Unit Root Test

ADF test is carried out with intercept, intercept and trend and no intercept and no trend to check whether the determinants are stationary or non-stationary. Optimal lag length of ADF test is selected on the basis of SIC. The results of ADF test are represented in table 1 which show that null of unit root is rejected for age dependency ratio (ADR), GDP growth rate and inflation rate (INF) at level since their ADF test statistics exceeds the critical values even at 1% significance level which indicates that the ADR, GDP, and INF are stationary at level i.e., $I(0)$. The

statistics for national savings (LNNS), agricultural output (LNAGR), fiscal deficit (FSD) and rate of interest (RI) are nonstationary at level since their ADF values are below the critical value at 1% significance level, but these determinants turn into stationary at first difference which means that they are integrated of order I(1).

The results of ADF test show that the set of variables used in empirical exercise is the blend of I(0) and I(1) variables so ARDL approach is considered suitable for the empirical exercise.

Table 1: The Results of Augmented Dickey–Fuller (ADF) Test

| Variables | Structure of the Test | At Level | At 1st Difference |
|---|---|---|---|
| LNNS | Trend and Intercept | -3.0991 | -8.6902*** |
| ADR | None | -4.7130*** | —— |
| LNAGR | Trend and Intercept | -1.9593 | -7.9486*** |
| FSD | Intercept | -2.6786 | -7.8207*** |
| INF | Intercept | -3.3419** | —— |
| GDP | Intercept | -4.4199*** | —— |
| RI | Intercept | -3.5789 | -5.6175*** |

Note: *** 1%, ** 5%, * 10% express the level of significance

### 5.2. Results of Autoregressive Distributed Lag (ARDL) Model

To estimate Autoregressive Distributed Lag (ARDL) model, optimal lag length of variables is required which is chosen on the basis of minimum value of SIC which turns out 1. Based on the optimal lag length, following equation of ARDL is estimated for exploring the co-integration among variables:

$$\Delta LNNS = \lambda_0 + \lambda_1 LNNS_{t-1} + \lambda_2 ADR_{t-1} + \lambda_3 LNAGR_{t-1} + \lambda_4 FSD_{t-1} + \lambda_5 INF_{t-1} + \lambda_6 GDP_{t-1} + \lambda_7 RI_{t-1} + \varepsilon_t \quad (6)$$

As it is discussed in methodology section, two steps involve in the estimation of ARLD model. The first step involves conducting the F-test for co-integration among the determinants and the second step estimates long term parameters. The outcomes are presented in Table 2.

Table 2: Results of ARDL Model

| Variables | Coefficient | t-Statistics |
|---|---|---|
| C | -62.3558 | -3.8601*** |
| LNNS(-1) | -0.7827 | -4.7060*** |
| ADR(-1) | -0.0157 | -2.6297** |
| LNAGR(-1) | 2.6607 | 4.0870*** |
| FSD(-1) | -0.0602 | -1.9946* |
| INF(-1) | -0.0284 | -3.5154*** |
| GDP(-1) | 0.0053 | 0.1530 |
| RI(-1) | 0.0345 | 2.7093** |
| D(LNNS(-1)) | -0.0218 | -0.1524 |
| D(ADR) | 0.1010 | 1.3649 |

| | | |
|---|---|---|
| D(LNAGR) | 1.0699 | 1.3553 |
| D(LNAGR(-1)) | -1.9820 | -2.2146** |
| D(FSD) | -0.0462 | -2.0393* |
| D(INF) | -0.0160 | -2.2769** |
| D(GDP) | 0.0239 | 1.2034 |
| D(GDP(-1)) | 0.0162 | 1.1767 |
| D(RI) | 0.0237 | 1.9811* |

Note: *** 1%, ** 5%, * 10% express the level of significance

### 5.3. Results of Post-Estimation Diagnostic Tests:

The results of diagnostic tests are presented in table 3. The results exhibit that no serial correlation is present in the residuals of the model. The model is correctly specified. No heteroscedasticity and serial correlation inside the error terms. The errors are normally distributed. Hence all the tests validate the model. We also do not find the problem of multicollinearity among the exogenous determinants.

Table 3: The Results of Residual Diagnostic Tests

| Issues | Diagnostic Test | Statistics | Probability |
|---|---|---|---|
| Serial correlation | LM test | Chi-Sq (1) | 0.2004 |
| Functional Form | Ramsey RESET | t-value (24) | 0.1447 |
| Hetroskedasticity | B-P-Godfrey test | Chi-Sq (16) | 0.4805 |
| Normality | JB test | JB 0.6655 | 0.1599 |

The model employed in the study must be stable. For the time-series data, when one is uncertain about whether the structural change may have occurred or not, the suitable test to check the stability of the model is the CUSUM test. After validating the model, the stability of the model is checked by cumulative sum (CUSUM) test. The null hypothesis is that all coefficients are stable in the model against the alternative that they are not stable in each time. The test statistics of CUSUM are drawn alongside the critical bound at 5% level of significance in figure 1 and if the plotted test statistics lie inside the critical bound at 5% level of significance, the null hypothesis is accepted which states that the model is stable.

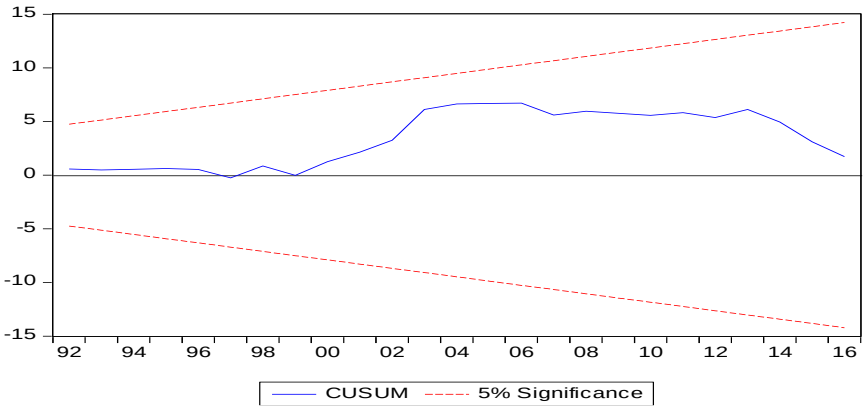


Figure 1: Plot of CUSUM of Recursive Residuals

**5.4. Testing Co-integration (Long Term Association)**:

After validating the model, Wald test is applied to investigate the co-integration among variables. Table 4 provides the outcome of the Wald test. The result of the test reveals that co-integration exists among variables as Wald-test computed value with unrestricted intercept and no trend is 4.020. The value is greater than the critical value of lower and upper level of the bands i.e. (2.45) and (3.61) at 5% significance level.

Table 4: Results of Wald Test

| F-Statistics | Lag | Significance Level | Bound Critical Values I(0) | I(1) |
|---|---|---|---|---|
| 4.020727** | 1 | 1% | 3.15 | 4.43 |
| | | 5% | 2.45 | 3.61 |
| | | 10% | 2.12 | 3.23 |

Note: *** 1%, ** 5%, * 10% express the level of significance

Having found co-integration among the determinants, the next step is to evaluate the long-term dynamics of the variables.

**5.6. Long Run Coefficients of Autoregressive Distributed Lag (ARDL) Model:**

Having found co-integration among the variables, the coefficients of the variables are estimated to evaluate the long-term dynamics of the variables. The estimates of the long-term coefficients are reported in table 5. The table depicts that the coefficient of age dependency ratio is not only negative but also statistically significant at 1 % significance level. It denotes that one unit rise in age dependency ratio brings to 2.005 % decrease in national savings. The cause of this negative association might be that as the change in savings depends upon savings generated by the working-age population relative to the dissaving of the old and young generations, so if age dependency ratio is higher, the savings of a country is lower. The outcomes of our study are in line with outcomes of Khan et al (2013 and 2016) and Akram and Akram (2016) but did not support results of Ahmad (2015).

Table 5: Long Run Coefficients of Autoregressive Distributed Lag Model

| Variables | Coefficient | t-Statistics |
|---|---|---|
| ADR(-1) | -0.0201 | -2.7017** |
| LNAGR(-1) | 3.3992 | 15.6580*** |
| FSD(-1) | -0.0770 | -1.9810* |
| INF(-1) | -0.0363 | -3.9733*** |
| GDP(-1) | 0.0067 | 0.1549 |
| RI(-1) | 0.0441 | 3.4128*** |

Note: *** 1%, ** 5%, * 10% express the level of significance

Table 5 also indicates that agricultural output is positively and highly significantly associated with national savings. One percent increase in agricultural output increases about 3.4 % of national savings in the long term. It is because agriculture is the main sector of Pakistan's economy. Higher the agricultural production, the

higher will be the overall savings in the economy. Any activity that boosts agricultural output, it will increase savings. Our results do not verify findings of Samantaraya and Patra (2014) for India; Idiaye et al (2014) for Nigeria.

The coefficient of fiscal deficit is not only negative but also significant at 10 %. It means that one percent increase in fiscal deficit as a percent of GDP, the national savings decreases by about 0.077 %. The rationale of negative association maybe that increases in fiscal deficit means public savings decreases, which in turn decreases the national savings. The results in table 5 help to conclude that inflation rate in Pakistan creates disincentive for citizen to save. The coefficient of inflation rate is significant at 1% level of significance. It indicates that one percent point increase in inflation rate causes 0.036% decrease in national savings. The reason for this negative association between inflation rate and national savings may be that with the increase in inflation, consumers ought to pay higher prices which may give rise to low private savings; so national savings decreases as private savings is a part of national savings. Our results do not support the outcomes of the studies carried out by Ahmad (2015), Chaudhry et al (2014) which assert the presence of positive association between inflation and savings. Our outcomes about the impact of inflation rate on national savings are in line with the outcomes of Kazmi (2001), Azam et al (2010); Jilani et al (2013), Shaikh and Shaikh (2013); Aleemi et al (2015), Akram and Akram (2016) and Shah et al (2016).

Table 5 also reveals that the coefficient of interest rate not only has expected sign but also significant which implies that a one percent increase in interest rate produces 0.044% increase in national savings. The reason of the positive effect of interest rate on national savings in Pakistan maybe that change in interest rate can affect savings through income effect and substitution effect, with opposite effects on savings behavior of agents. The net effect on savings depends upon the relative size of the effects. In case of Pakistan, the rate of interest positively influences savings which means that substitution effect outweighs income effect. The outcome of this study about the association between interest rate and national savings supports the findings of Kazmi (2001) who concludes that an increase in interest rate increases savings. Our findings are inconsistent with results of Idiaye et al (2014) and Aleemi et al (2015). We can conclude that our results support the classical theory of savings in the long term.

### 5.7. The results of Error Correction Model (ECM):

The following error correction model (ECM) is estimated to find the short run coefficients:

$$\Delta LNNS = \beta_1 \Delta LNNS_{t-1} + \beta_2 \Delta ADR_{t-0} + \beta_3 \Delta LNAGR_{t-0} + \beta_{3'} \Delta LNAGR_{t-1} + \beta_4 \Delta FSD_{t-0} + \beta_5 \Delta INF_{t-0} + \beta_6 \Delta GDP_{t-0} + \beta_{6'} \Delta GDP_{t-1} + \beta_7 \Delta RI_{t-0} + \phi\, ECT_{t-1} + \varepsilon_t \quad (7)$$

The outcomes of the model are presented in table 6. It is clear from the table that the value of adjusted R-square (Ad-$R^2$) is not exceeding the DW statistics which is an indication of non-spurious regression results.

Table 6: Short term Estimates of Error Correction Model (ECM)

| Variables | Coefficient | t-Statistics |
|---|---|---|
| C | 0.1813 | 3.5663 |
| D(LNNS(-1)) | -0.0240 | -0.2036 |
| D(ADR) | 0.0338 | 1.1784 |
| D(LNAGR) | 1.2078 | 1.8067* |
| D(LNAGR(-1)) | -1.5785 | -2.2697** |
| D(FSD) | -0.0226 | -1.7623* |
| D(INF) | -0.0168 | -3.4602*** |
| D(GDP) | 0.0220 | 1.9091* |
| D(GDP(-1)) | 0.0064 | 0.6335 |
| D(RI) | 0.0198 | 2.2595** |
| ECT(-1) | -0.6945 | -5.1824*** |

Note: *** 1%, ** 5%, * 10% express the level of significance

The estimates of ECM indicate that agricultural output, interest rate and GDP growth rate have positive and significant effect on national savings in the short term. The estimated coefficient of agricultural output and GDP growth rate indicate that one percent increase in agricultural output and GDP growth rate cause about 1.21% and 0.022% increase in national savings in the short term. Therefore, there is need to embark on the policies that increase the agricultural output to improve agriculture productivity to enhance national savings in Pakistan. Fiscal deficit and inflation rate negatively affect national savings. The estimates indicate that a 1% increase in fiscal deficit and inflation rate decrease national savings by 0.023% and 0.017% respectively. The coefficient of the lagged error correction term is not only negative but also significant at 1% level of significance. It helps us to conclude that the model will correct the disequilibrium position about 69 % annually.

### 5.8. The Results of Post-Estimation Diagnostic Tests

The outcomes of the diagnostic tests are reported in table7. The outcomes exhibit that there is no serial correlation within the residuals of the model. The functional form of the model is correctly specified. No heteroscedasticity and autocorrelation inside the error terms is present. The errors are normally distributed. So the short term model is also validated.

Table 7: Estimates of Residual Diagnostic Tests

| Issues | Diagnostic Test | Statistics | Probability |
|---|---|---|---|
| Serial correlation | LM test | Chi-Sq (1) | 0.2672 |
| Functional Form | Ramsey RESET | t-value (30) | 0.1457 |
| Hetroskedasticity | B-P-Godfrey test | Chi-Sq (10) | 0.6960 |
| Normality | JB test | JB 4.32016 | 0.1153 |

It is binding that model used in the study must be stable which is examined by the CUSUM test. The statistics of CUSUM test which lies inside the critical bound at 5% level of significance, are provided in figure 2. It means that the ECM model is also stable.

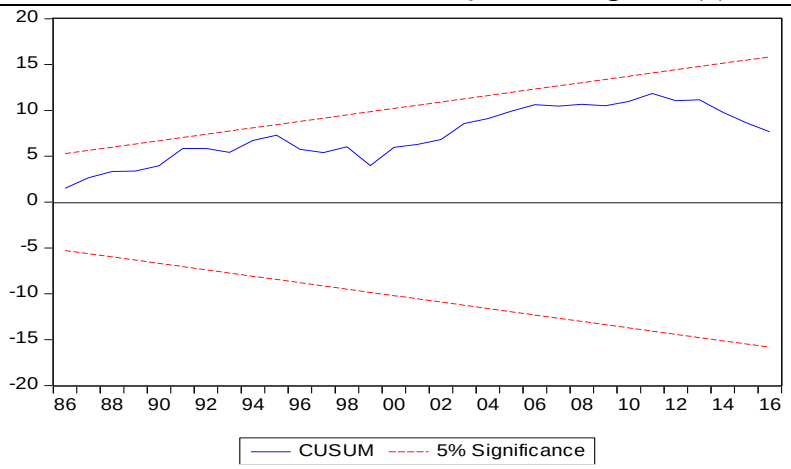


Figure 2: Plot of CUSUM of Recursive Residuals

## 6. Conclusions and Policy Recommendations

The study explores the impact of agricultural output, fiscal deficit and inflation rate on national savings in Pakistan for the period of 1973-2020. The autoregressive distributed lag (ARDL) model and error correction model (ECM) are applied for investigating the long run and short run relationship respectively between variables under consideration. The advantage of ARDL method over other tests is that it analyzes long run and short run relationships between variables. That is why, this method is used to analyze the relationship between variables. The short run dynamics of the model indicates that one percent increase in agricultural output causes about 1.21 percent increase in national savings whereas the estimates of fiscal deficit and inflation rate point out that a 1 percent increase in fiscal deficit and inflation rate decrease national savings by 0.023 percent and 0.017 percent respectively. The outcome of ECM reveals that the mechanism of national savings adjusts toward long-run equilibrium with 69 percent speed of adjustment in each period. The findings of the study evidence that variables are co-integrated in the long run. The results obtained reveal that national savings increases about 3.4 percent in the long term with 1 percent increase in agricultural output. One percent increase in fiscal deficit decreases national savings by about 0.077 percent while inflation rate causes national savings to decrease by 0.036 percent in the long run.

The findings of the study help us to conclude that agricultural output has significant positive impact on national savings while inflation rate and fiscal deficit discourage national savings in Pakistan both in the short run and long term. The age dependency ratio in the long term while GDP growth rate in the short term negatively and positively respectively affect national savings in Pakistan. According to the results obtained, the most favorable effect on national savings both in the short run and long run is due to the increase in agricultural output. Our findings also observed that the most unfavorable effects on national savings in Pakistan both in the short term and long term are due to the changes in the fiscal deficit. Unrestricted government borrowing and the resultant increase in debt servicing hamper national savings; a situation which has serious repercussions for

economic growth since investment, which play a vital role in growth, is a direct consequence of low savings in an economy.

Productivity of agriculture and its value-added portion is required to be boosted up with the provision of new agriculture technologies, superior seeds, other agriculture inputs and loans to the cultivators at concessional rate to rebuild the cultivated areas. Strategies should be geared up to boost growth by improving infrastructure facilities for agriculture and innovation in the agriculture sector. Agro-based industries should be developed which will provide incentives for farmers to increase agricultural output.

It will provide the job opportunities in the rural areas[3].The literate farmers can have higher productivity than that of illiterate so the revolutionary steps and strategic plan should be introduced which promote the education of farmers, particularly, small farmers'[4].It will enhance agriculture productivity which is the main source of their income and it will increase savings in Pakistan. In addition to boost agricultural productivity, the findings also help to recommend reducing fiscal deficit and inflation rate in the country.

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[3] Badar et al (2017) found that the agro-based industries in Pakistan had effectively played a major role in the development of the economy by providing road from market to farmers for their agricultural produce.

[4] Yasmeen et al (2011) observed that agricultural product was positively related with education that boosted up the income of the farmers.

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