PRODUCTION AND ACREAGE RESPONSE OF WHEAT IN THE NORTH WEST FRONTIER PROVINCE (NWFP)

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ABSTRACT

The aim of study was attempted to determine the influence of market price (price factor) and rainfall (non-price factor) on wheat production and acreage by employing Nerlovian Adjustment Model in time series data over a period of time (1981-82 to 2007-08) in NWFP. The result findings are obtained by applying Ordinary Least Squares (OLS) techniques of estimation, which reveal that positive and significant relationship (P<0.05) is observed between wheat production and rainfall. In case of wheat production, short and long run elasticities of market price was worked out 0.014 and 0.027 and of rainfall 0.130 and 0.256, respectively. While in case of wheat acreage, the short and long run elasticities of market price was estimated as -0.016 and -0.078 and of rainfall as 0.032 and 0.150, respectively. The larger value and positive sign of F-ratio reveals highly significant overall research findings (P<0.01). Merely market price announcement is not enough, but the adequate and timely supply of water mainly through rainfall has been proved vital input in achieving wheat production targets over a period of 27 years (1981-82 to 2007-08) in NWFP. The Government must shift their emphasis from market price announcement to the irrigation practices (mainly through rainfall) for wheat production enhancement.

Key Words: Wheat, price elasticity, rainfall, significance and model.


INTRODUCTION

Agriculture prices are essential to the cultivators of wheat in NWFP, as they help them in planning their sound agronomic practices on the farms. Agricultural prices also play crucial role in achieving efficient allocation of productive resources. Enhanced wheat producers’ income encourages savings and investment and adoption of advanced techniques. These are, at the same time, of considerable attention to traders, marketers, and merchants who deal in farm products; financial institutions who provide credits to growers for the purchase of agriculture inputs; government who prepare budget estimates; and ultimate consumers who procure what farmers produce for them. If the market prices are properly regulated and stabilized for farmers, then they adopt scientific and improved methods of cultivation and due to this, agriculture production especially in wheat production will be manifolds to meet not only domestic and national food requirements of the province and country, but also could be exported for foreign exchange earnings (Mohammad, et al. 2007). But in Pakistan in general and NWFP in particular, the market prices of wheat are highly unstable. Because of such instability, following issues, constraints and researchable problems are observed:

i. There are big fluctuations in the production and acreage of wheat.
ii. The uncertainty of farmers with regards to distribution and allocation of productive resources.
iii. There in inconsistency in short and long run price and non price elasticities of wheat.
iv. Because of financial constraints the small farmers are bound to sell their produce when market prices are falling, while landlords store the goods and wait till the price become stabilized or tend to rising in the market. Whereas the big middlemen deal the agriculture goods when there is sufficient increase in the market prices of agriculture goods.
v. Due to excess or absence of rainfall, the desired wheat production and acreage targets have been not met in NWFP.

In order to test more accurately the farmers’ responsiveness to the price and non price factors of wheat crop in NWFP, the Nerlovian Adjustment Model has been used which is very popular supply response model. By controlling area under crops, the supply of agriculture commodities can be increased or
considerably, this can be expected as; because the level about which the future wh
Since the expected wheat production (i.e \( Q^* \)) and expected wheat acreage (i.e \( A^* \)) are not observable, because the level about which the future wheat production and acreage are expected to fluctuate considerably, this can be expected as;

\[ Q^* = a_0 + a_1 MP_{t+1} + a_2 R_t + a_3 Q_{t-1} \]  
\[ A^* = b_0 + b_1 MP_{t+1} + b_2 R_t + b_3 A_{t-1} \]  

The objective of present study is to estimate the response of farmers by developing relationship between dependent variables (wheat production and acreage) and explanatory variables (market price and rainfall) with the help of Nerlovian Adjustment Model and Ordinary Least Squares (OLS) Techniques of estimation over a period of time (1981-82 to 2007-08) in NWFP (Nerlove, 1958).

**MATERIALS AND METHODS**

The present study intends to estimate the supply response of wheat production and acreage-wise in NWFP over a period of time (1981-82 to 2007-08). The requisite information and time series data was obtained from authenticated published sources of Crop Statistics, 2007-08, Crop Reporting Services, NWFP, Peshawar, Agriculture Statistics of Pakistan, 2007-08 and Agriculture Marketing Information Services, Lahore and Pakistan Economic Surveys. To work out the farmer’s responsiveness to market prices and rainfall, the data for 27 years (i.e 1981-81 to 2007-08) have been statistically analyzed using Nerlovian Supply Response Model. The data used (Muchapondwa, 2009; Jati and Sfeir, 1983) in the previous study spans different pricing regimes to estimate the aggregate agricultural supply response to price and non-price factors. Regression analysis results have been worked out from autoregressive distributed lag equation through OLS design of Microfit.

**Nerlovian Adjustment Model**

Actual adjustment of production and acreage of wheat in one time period is indicated as proportion (\( \hat{a} \) and \( \hat{a} \)) of intended complete adjustment to the equilibrium wheat production (\( Q^* \)) and its respective acreage (\( A^* \)) (Matthew, 1999). Wheat production and acreage response functions explain how the quantity and acreage varies to relative influences of price factor (market price) and non-price factor (rainfall). Nerlove (1958) provided plenty of theoretical frame work in the agriculture supply responses studies.

Let the wheat production and acreage supply equations are;

\[ Q^*_t = a_0 + a_1 MP_{t+1} + a_2 R_t + a_3 Q_{t-1} \]  
\[ A^*_t = b_0 + b_1 MP_{t+1} + b_2 R_t + b_3 A_{t-1} \]  

Since the expected wheat production (i.e \( Q^*_t \)) and expected wheat acreage (i.e \( A^*_t \)) are not observable, because the level about which the future wheat production and acreage are expected to fluctuate considerably, this can be expected as;
Wheat Production and Acreage Adjustment Equations

\[ Q_t - Q_{t-1} = \hat{\alpha} (Q_{t-1}^* - Q_{t-1}) \]  
\[ Q_t = \hat{\alpha} Q_{t-1}^* + (1-\hat{\alpha}) Q_{t-1} \]  
\[ A_t - A_{t-1} = \hat{\alpha} (A_{t-1}^* - A_{t-1}) \]  
\[ A_t = \hat{\alpha} A_{t-1}^* + (1-\hat{\alpha}) A_{t-1} \]

Where as;

\( Q_t^* \) = Expected production of wheat in tonnes in year \( t \).
\( Q_t \) = Actual production of wheat in tonnes in year \( t \).
\( Q_{t-1} \) = Lagged production of wheat in tonnes in year \( t-1 \).
\( A_t^* \) = Expected acreage of wheat in hectares in year \( t \).
\( A_t \) = Actual acreage of wheat in hectares in year \( t \).
\( A_{t-1} \) = Lagged acreage of wheat in hectares in year \( t-1 \).

\( \hat{\alpha} \) = Coefficient of wheat acreage adjustment.

As the farmers make plan for taking appropriate decisions of sowing their wheat crop on the bases of expected market prices in NWFP. In this regard, equation (v) is pursued and the format of adjustment is same in respect of market price of respective wheat crop too;

\[ MP_t^* - MP_{t-1}^* = \hat{\varepsilon} (MP_t - MP_{t-1}^*) \]  
\[ MP_t^* = \hat{\varepsilon} MP_t + (1-\hat{\varepsilon}) MP_{t-1}^* \]  
\[ MP_t = \text{Expected market price in respect of wheat in year } t. \]
\( MP_{t-1}^* = \text{Long run equilibrium market price of wheat in year } t. \)
\( MP_t = \text{Actual market price in year } t. \)
\( \hat{\varepsilon} \) = Coefficient of market price adjustment.

However the equilibrium output \( (Q_t^*) \) is specified as the function of expected market price \( (MP_t^*) \) and the explanatory variable \( R_t \) (Rainfall), which influence supply too (Muhammad, 2008). Thus

\[ Q_t^* = a_0 + a_1 MP_t^* + a_2 R_t + U_t \]  

Since \( MP_t^* \) is unobservable, we assume that farmers make their planting decisions based on their memory about market price that prevailed in the preceding period \( MP_{t-1} \). Hence \( MP_{t-1}^* \) is taken as lagged price and as other variables (Rainfall and its own lagged value) which affect supply is inducted in equation (v), so

\[ Q_t^* = a_0 + a_1 MP_{t-1}^* + a_2 R_t + a_3 Q_{t-1} + U_t \]

By substituting equation (vii) into (iii) and (iv), following estimation equations of wheat and acreage are obtained in measurable and reduced forms;

\[ Q_t = a_0 + a_1 MP_{t-1} + a_2 R_t + a_3 Q_{t-1} + e_t \]  
\[ A_t = a_0 + a_1 MP_{t-1} + a_2 R_t + a_3 A_{t-1} + e_t \]

RESULTS AND DISCUSSION

The reduced form of the wheat production equation became:

\[ Q_t = a_0 + a_1 MP_{t-1} + a_2 R_t + a_3 Q_{t-1} + e_t \]

Where as;

\( Q_t \) = Actual production of wheat in tonnes in year \( t \).
\( \hat{\alpha} \) = Coefficient of wheat production adjustment.
\( MP_{t-1} \) = Lagged market price (Rs. per 40 kg) of wheat in year \( t-1 \).
\( R_t \) = Rainfall (in millimeters) in year \( t \).
\( Q_{t-1} \) = Lagged production of wheat in tonnes in year \( t-1 \).
\( e_t \) = Error term in year \( t \).

By applying logarithm on both sides of equation xi;

\[ \log Q_t = \log a_0 + \alpha_1 \log MP_{t-1} + \alpha_2 \log R_t + \alpha_3 \log Q_{t-1} + \log e_t \]

The results of the present study analysis are shown in Tables 1, II, III and IV, revealing the regression coefficients, standard errors, t-ratios, the coefficient of determination \( (R^2) \), F-ratio test result and the adjustment coefficients, and the short-run and long-run price along with non-price elasticities of supply for log linear models. The adjustment coefficient is derived by subtracting the coefficient of lagged variable...
from one. Short-run elasticities are the measured quantity of co-efficient through Ordinary Least Square estimation as shown in Table I, while long-run elasticities are calculated by dividing the short-run elasticities by one minus the coefficient of lagged production as reflected in Table II. It has been observed that Ordinary Least Squares regression seeks to maximize the goodness of fit of model with minimum number of exogenous variables (i.e market price and rainfall).

Regression estimates reported in Table I and Table II show positive and significant coefficients for $R_t$ and indicate positive but non-significant coefficients for $MP_{t-1}$ in wheat production equations. The size of $R^2$ is 50%, which is reasonable to show overall fitness of estimated equation. It indicates that 50% change in wheat production occurs due to timely and adequate rainfall. For wheat production, short run and long run market price elasticity was worked out as 0.014 and 0.027, while short run and long run rainfall elasticity was 0.130 and 0.256, respectively. This show positive and significant relationship between rainfall and wheat production, while there is no influence of market price on wheat production. These findings are in agreement with the previous results show that tinkering with price and market incentives have adverse affects on farmer’s response and in turn government objectives of making cassava a foreign exchange earner for the country (Jeffrey and Sumner, 2003; Nkang, et al. 2006). Since the adjustment coefficient ($\hat{\alpha}$) is relatively greater (0.50), indicating less technological and institutional constraints to prevent the farmers from realizing the desired wheat equilibrium production level in NWFP. Moreover, the value of $\hat{\alpha}$ estimated recommends that farmers were somewhat aware to adjust rationally to change in their economic environment, which is supported by previous study conducted by Mike, et al. 2003. The larger value and positive sign of $F$ for wheat production (7.830), indicates overall highly significant relationships ($P<0.01$).

The reduced form of the wheat acreage equation became:

$$A_t = \hat{\alpha} + \hat{\alpha}1 \text{MP}_{t-1} + \hat{\alpha}2 \text{R}_t + \hat{\alpha}3 \text{A}_{t-1} + e_t \quad \text{-------------------(xiii)}$$

Where:

- $A_t$ = Actual acreage of wheat in hectares in year $t$.
- $\hat{\alpha}$ = Coefficient of wheat acreage adjustment.
- $\text{MP}_{t-1}$ = Lagged market price (Rs. per 40 kg) of wheat in year $t-1$.
- $\text{R}_t$ = Rainfall (in millimeters) in year $t$.
- $\text{A}_{t-1}$ = Lagged acreage of wheat in hectares in year $t-1$.
- $e_t$ = Error term in year $t$.

By applying logarithm on both sides of equation xiii:

$$\log A_t = \log \hat{\alpha} + \hat{\alpha}1 \log \text{MP}_{t-1} + \hat{\alpha}2 \log \text{R}_t + \hat{\alpha}3 \log \text{A}_{t-1} + \log e_t \quad \text{-------------------(xiv)}$$

### Table I  
Log-linear response functions for wheat production in NWFP over a period of time (1981-82 to 2007-08)  
(27 observations used for estimation from 1981-82 to 2007-08)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-Ratio [Prob]</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{\alpha}$</td>
<td>6.159</td>
<td>2.123</td>
<td>2.901 [0.008]***</td>
</tr>
<tr>
<td>$\log \text{MP}_{t-1}$</td>
<td>0.014</td>
<td>0.031</td>
<td>0.450 [0.657]**</td>
</tr>
<tr>
<td>$\log \text{R}_t$</td>
<td>0.130</td>
<td>0.057</td>
<td>2.268 [0.033]**</td>
</tr>
<tr>
<td>$\log \text{Q}_{t-1}$</td>
<td>0.493</td>
<td>0.160</td>
<td>3.081 [0.005]***</td>
</tr>
</tbody>
</table>

$R^2 = 0.505$ F-stat, $F(3, 23) = 7.830 [0.001]$***

**Significant of 5%  
*** Significant of 1%  
ns = Non-significance

### Table II  
Adjustment Coefficients and short and long run price along with non-price elasticities for log linear equation of wheat production

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Adjustment Coefficient ($\hat{\alpha}$)</th>
<th>Price Elasticities (Market Price)</th>
<th>Non-Price Elasticities (Rainfall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{Q}_t$</td>
<td>0.507</td>
<td>0.014</td>
<td>0.027</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.130</td>
<td>0.256</td>
</tr>
</tbody>
</table>

Regression estimates reported in Table I and Table II show positive and significant coefficients for $R_t$ and indicate positive but non-significant coefficients for $\text{MP}_{t-1}$ in wheat production equations. The size of $R^2$ is 50%, which is reasonable to show overall fitness of estimated equation. It indicates that 50% change in wheat production occurs due to timely and adequate rainfall. For wheat production, short run and long run market price elasticity was worked out as 0.014 and 0.027, while short run and long run rainfall elasticity was 0.130 and 0.256, respectively. This show positive and significant relationship between rainfall and wheat production, while there is no influence of market price on wheat production. These findings are in agreement with the previous results show that tinkering with price and market incentives have adverse affects on farmer’s response and in turn government objectives of making cassava a foreign exchange earner for the country (Jeffrey and Sumner, 2003; Nkang, et al. 2006). Since the adjustment coefficient ($\hat{\alpha}$) is relatively greater (0.50), indicating less technological and institutional constraints to prevent the farmers from realizing the desired wheat equilibrium production level in NWFP. Moreover, the value of $\hat{\alpha}$ estimated recommends that farmers were somewhat aware to adjust rationally to change in their economic environment, which is supported by previous study conducted by Mike, et al. 2003. The larger value and positive sign of $F$ for wheat production (7.830), indicates overall highly significant relationships ($P<0.01$).
Table II

Log-linear response functions for wheat acreage in NWFP over a period of time (1981-82 to 2007-08)

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>T-Ratio [Prob]</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>2.764</td>
<td>1.722</td>
<td>1.605 [0.122]**</td>
</tr>
<tr>
<td>Log MP(_t)</td>
<td>-0.017</td>
<td>0.011</td>
<td>-1.481 [0.152]**</td>
</tr>
<tr>
<td>Log R(_t)</td>
<td>0.032</td>
<td>0.021</td>
<td>1.508 [0.145]**</td>
</tr>
<tr>
<td>Log A(_t)</td>
<td>0.789</td>
<td>0.125</td>
<td>6.322 [0.000]***</td>
</tr>
</tbody>
</table>

\(R^2 = 0.684\) F-stat. (3, 23) = 16.574 [0.000]***

*** Significant of 1%
ns = Non-significance

Table IV

Adjustment coefficients and short and long run price along with non-price elasticities for log linear equation of wheat acreage

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Adjustment Coefficient ((a))</th>
<th>Price Elasticities (Market Price)</th>
<th>Non-Price Elasticities (Rainfall)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A_t)</td>
<td>0.211</td>
<td>Short Run -0.016 Long Run -0.078</td>
<td>Short Run 0.032 Long Run 0.150</td>
</tr>
</tbody>
</table>

Table V

Showing Wheat Production (in tonnes), Lagged Market Price (Rs. per 40 kg), Rainfall (in millimeters) and Lagged wheat production (in tonnes) over a period of time (1981-82 to 2007-08)

<table>
<thead>
<tr>
<th>Year</th>
<th>Wheat production (in tonnes)</th>
<th>Lagged Market Price (Rs. per 40 kg)</th>
<th>Rainfall (in millimeters)</th>
<th>Lagged wheat production (in tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981-82</td>
<td>962218</td>
<td>60</td>
<td>326.1</td>
<td>940808</td>
</tr>
<tr>
<td>1982-83</td>
<td>998426</td>
<td>62</td>
<td>710.2</td>
<td>962218</td>
</tr>
<tr>
<td>1983-84</td>
<td>859809</td>
<td>67</td>
<td>523.9</td>
<td>998426</td>
</tr>
<tr>
<td>1984-85</td>
<td>872119</td>
<td>71</td>
<td>340.6</td>
<td>859809</td>
</tr>
<tr>
<td>1985-86</td>
<td>906526</td>
<td>77</td>
<td>415.9</td>
<td>872119</td>
</tr>
<tr>
<td>1986-87</td>
<td>959449</td>
<td>82</td>
<td>342.5</td>
<td>906526</td>
</tr>
<tr>
<td>1987-88</td>
<td>899205</td>
<td>80</td>
<td>366.9</td>
<td>959449</td>
</tr>
<tr>
<td>1988-89</td>
<td>1003728</td>
<td>85</td>
<td>252.3</td>
<td>899205</td>
</tr>
<tr>
<td>1989-90</td>
<td>1102061</td>
<td>93</td>
<td>453.8</td>
<td>1003728</td>
</tr>
<tr>
<td>1990-91</td>
<td>1148427</td>
<td>102</td>
<td>384.3</td>
<td>1102061</td>
</tr>
<tr>
<td>1991-92</td>
<td>1163383</td>
<td>121</td>
<td>579.8</td>
<td>1148427</td>
</tr>
<tr>
<td>1992-93</td>
<td>1183011</td>
<td>134</td>
<td>466.4</td>
<td>1163383</td>
</tr>
<tr>
<td>1993-94</td>
<td>1134250</td>
<td>139</td>
<td>642.3</td>
<td>1183011</td>
</tr>
<tr>
<td>1994-95</td>
<td>1180192</td>
<td>170</td>
<td>618.0</td>
<td>1134250</td>
</tr>
<tr>
<td>1995-96</td>
<td>1202518</td>
<td>176</td>
<td>668.1</td>
<td>1180192</td>
</tr>
<tr>
<td>1996-97</td>
<td>1064384</td>
<td>185</td>
<td>473.6</td>
<td>1202518</td>
</tr>
<tr>
<td>1997-98</td>
<td>1355971</td>
<td>273</td>
<td>572.6</td>
<td>1064384</td>
</tr>
<tr>
<td>1998-99</td>
<td>1221827</td>
<td>259</td>
<td>417.8</td>
<td>1355971</td>
</tr>
<tr>
<td>1999-00</td>
<td>1067844</td>
<td>261</td>
<td>255.0</td>
<td>1221827</td>
</tr>
<tr>
<td>2000-01</td>
<td>764006</td>
<td>297</td>
<td>236.9</td>
<td>1067844</td>
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<td>2002-03</td>
<td>1064446</td>
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<td>547.5</td>
<td>890452</td>
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<tr>
<td>2003-04</td>
<td>1025156</td>
<td>305</td>
<td>775.0</td>
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<tr>
<td>2004-05</td>
<td>1091075</td>
<td>388</td>
<td>678.0</td>
<td>1025156</td>
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<tr>
<td>2005-06</td>
<td>1100637</td>
<td>471</td>
<td>327.0</td>
<td>1091075</td>
</tr>
<tr>
<td>2006-07</td>
<td>1091075</td>
<td>420</td>
<td>794.2</td>
<td>1100637</td>
</tr>
<tr>
<td>2007-08</td>
<td>1071823</td>
<td>432</td>
<td>624.0</td>
<td>1160447</td>
</tr>
</tbody>
</table>

Source:
1. Crop Statistics, 2007-08, Crop Reporting Services, Agric. Livest. and Cooperative Deptt. NWFP
3. Agric. Statistics of Pakistan, 2007-08
Regression estimates reported in Table III and Table IV reveal negative and non-significant coefficients for $MP_{t-1}$ and indicate positive but non-significant coefficients for $R_t$ in wheat acreage equations (Mamingi, 1996). The size of $R^2$ is 68%, which is appropriate to indicate overall fitness of estimated wheat acreage equation. For wheat acreage, short run and long run market price elasticity was worked out as -0.016 and -0.078, while short run and long run rainfall elasticity was 0.032 and 0.150, respectively. This shows that there is negative influence of market price and non-significant influence of rainfall on wheat acreage, which are in agreement with previous study conducted by Kanwar, (2004). While the lagged wheat acreage $t$-ratio result (6.322) has been shown highly significance ($P<0.01$) influence on area under wheat crop in NWFP. The significant influence of the lagged dependent variable on acreage allocation also seems to urge for measures conducive for better performance of crops in terms of acreage (Chaudhary, 2000). Since the adjustment coefficient ($\phi$) is relatively smaller (0.21), it means there are greater technological and institutional constraints to prevent the farmers from realizing the desired wheat long run equilibrium acreage level in NWFP (Mendez, et al. 2003). Hence, the regression results indicate that non-significant relationship is noticed of the market price and rainfall with the level of wheat acreage in NWFP. Moreover, the value of $\phi$ estimated shows that farmers were not speedy to adjust rationally to change in their economic environment. The larger value and positive sign of $F$-ratio for wheat acreage (16.574), indicates overall highly significant relationships ($P<0.01$), which are in agreement with Mohammad, (2005).

**CONCLUSION AND RECOMMENDATIONS**

Positive and significant relationship of rainfall is observed with the wheat production, while non-significant relationship of the market price is observed with the production and acreage of wheat in NWFP over a period of time series data from 1981-82 to 2007-08. Two separate single equation Nerlovian adjustment models each for wheat production and acreage are formulated and estimated through ordinary least squares technique. The numeric of quantitative analysis estimated through Nerlovian Adjustment...
model, indicate that short and long run elasticities in wheat production for market price as 0.014 and 0.027 and for rainfall as 0.130 and 0.256, respectively, while in case of wheat acreage, for market price as -0.016 and -0.078 and for rainfall as 0.032 and 0.150, respectively. The adjustment coefficient for wheat production is 0.50, indicating relatively less technological and institutional constraints, while for wheat acreage adjustment coefficient is 0.21, indicating relatively more technological and institutional constraints to prevent the farmers from realizing the desired equilibrium level in NWF. Moreover, the overall value of constant coefficient estimated recommends that farmers were attempted to regulate realistically to change in their economic environment. The larger value and positive sign of F-ratio for wheat production (7.830), for wheat acreage (16.574) show overall highly significant relationships (P<0.01) between dependent variables (wheat production and acreage) and exogenous variables (lagged market price, rainfall and own lagged values). Hence in order to meet the growing demands of wheat crop at domestic, national and international level, it is quite essential to announce market price in the time and manner by the government by determining sound market price mechanism, which should be acceptable for farmers with the objective of attaining self sufficient in wheat crop. Price determination in itself is essential but not sufficient. On the input front, adequate and timely rainfall has been considered only crucial non-price factor in achieving wheat production targets over a period of 27 years (1981-82 to 2007-08) in NWF. Thus for attaining sustainable production and acreage of wheat crop, Pakistan in general and NWF in particular, requires crop-water high investment plans for economical and efficient use of natural rainfall in order to achieve desired long run equilibrium wheat production and acreage levels.

REFERENCES