

Panel Model for Wheat Prices

Tanveer Akhlaq*

Muhammad Qaiser Shahbaz**

Abstract

A forecast models for wheat prices for the country is developed by taking production area and imports as independent variables for the data 1971 to 2004. Panel model technique is used to develop the models.

Introduction

Pakistan has a rich and vast natural resource base, covering various ecological and climatic zones; hence the country has great potential for producing all types of food commodities.

Agriculture is the hub of economic activity in Pakistan. It lays down foundation for economic development and growth of the economy. It directly contributes 25 per cent to Gross Domestic Product (GDP) and provides employment to 44 per cent of the total labour force of the country.

Wheat is the main Rabi crop it is the leading food grain of Pakistan and being the staple diet of the people it occupies a central position in agricultural policies .It contributes 12.5% of the value added in agriculture and 2.9%to GDP. Wheat was cultivated at an area of 7983 thousand hectares 2.4%lower then last year .The size of the wheat crop is provisionally estimated at 18475 thousand tones which is 2.9%lower then last year .The long dry spell effected the crop both in barani and irrigated area The yield per hectare also decreased by 0.5%. The increase in wheat production was mainly due to increase in area by 2% and yield 15%.

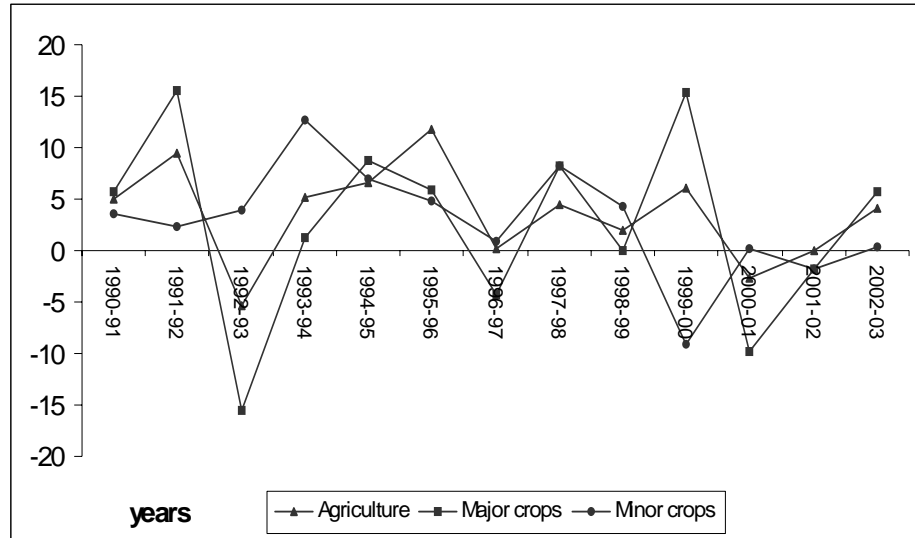
* Department of Statistics, Garrison Degree College, Lahore Cantt.

** Department of Statistics, Government College University, Lahore.

Table 1
AGRICULTURE GROWTH IN PAKISTAN (1990-2003)

YEAR	AGRICULTURE	MAJOR CROPS	MINOR CROPS
1990-91	4.96	5.69	3.51
1991-92	9.50	15.48	2.37
1992-93	-5.29	-15.60	3.95
1993-94	5.23	1.24	12.62
1994-95	6.57	8.69	6.91
1995-96	11.72	5.96	4.89
1996-97	0.12	-4.33	0.94
1997-98	4.52	8.27	8.13
1998-99	1.95	-0.02	4.23
1999-00	6.09	15.42	-9.10
2000-01	-2.64	-9.79	0.11
2001-02	-0.07	-1.83	-1.82
2002-03	4.15	5.80	0.41

Figure 1
AGRICULTURE GROWTH IN PAKISTAN (1990-2003)



2. PANAL DATA MODELS

The basic frame work for this discussion is a regression model of the form

$$y_{it} = X'_{it}\beta + z'_i\alpha + \varepsilon_{it}$$

2.1 FIXED EFFECTS

This formulation of the model assumes that differences across units can be captured in differences in the constant term. Each α_i is treated as an unknown parameter to be estimated.

Let y_i and X_i be the T observations for the i^{th} unit, I be a $T \times I$ column of ones and let e_i be associated $T \times I$ vector of disturbances, then

$$y_i = X_i\beta + i\alpha_i + \varepsilon_i$$

Cornwell and Schmidt (1984)

$$y = [X \quad d_1 \quad d_2 \quad \dots \quad d_n] \begin{bmatrix} \beta \\ \alpha \end{bmatrix} + \epsilon_i$$

Where d_i is a dummy variable indicating the i^{th} unit. Let the $nT \times n$ matrix

$$D = [d_1 \quad d_2 \quad d_3 \quad \dots \quad d_n].$$

$$y_i = X\beta + D\alpha + \epsilon$$

The least squares estimators of β as

$$b = [X' M_D X]^{-1} [X' M_D y]$$

$$a = [D'D]^{-1} D'(y - Xb)$$

$$\text{Var}(b) = s^2 [X' M_D X]^{-1}$$

The F ratio used for this test is

$$F(n-1, nT-n-K) = \frac{(R^2_{LSDV} - R^2_{pooled}) / (n-1)}{(1 - R^2_{LSDV}) / (nT-n-K)}$$

2.2 RANDOM EFFECTS

$$y_{it} = x'_{it}b + (a + u_i) + \epsilon_{it}$$

Mundlak (1978)

Where there are K regressor including a constant and now the single constant term is the mean of the unobserved heterogeneity, $E[z'_i \alpha]$. The component is the random heterogeneity specific to the i th observation and is constant through time. And further more the assumption involve in this modeling are,

$$E[\epsilon_{it} / X] = E[\mu_i / X] = 0$$

$$E[\epsilon^2_{it} / X] = \sigma^2_{\epsilon}$$

$$E[\mu^2_i / X] = \sigma^2_{\mu}$$

$$E[\epsilon_{it} \epsilon_{js}] = E[\mu_i \mu_j] = 0 \quad \text{if } i \neq j \text{ and } t \neq s$$

The formulation of the model in blocks of T observations for group I, y_i, X_i, μ_i , and ε_i .

For these T observation, let

$$\eta_{it} = \varepsilon_{it} + \mu_i$$

And $\eta_i = [\eta_{i1}, \eta_{i2}, \dots, \eta_{iT}]'$

The covariance matrix is given below

$$\Sigma = \sigma_\varepsilon^2 I_T + \sigma_\mu^2 I_T I_T'$$

The generalized least square estimate of β is,

$$\hat{\beta} = [X' \hat{\Omega}^{-1} X]^{-1} [X' \hat{\Omega}^{-1} y]$$

Hsiao (1986)

$$\Omega = I_n \otimes \Sigma$$

Breusch and Pagan (1980) have devised a Lagrange multiplier test for the random effects model based on the OLS residuals for

$$H_0 : \sigma_\mu^2 = 0$$

$$H_1 : \sigma_\mu^2 \neq 0$$

And the following test statistics is distributed as Chi-Square with one degree of freedom is

$$LM = \frac{nT}{2(T-1)} \left[\frac{T^2 \bar{e}' \bar{e}}{e'e} - 1 \right]^2$$

2.3 RANDOM CO-EFFICIENTS MODELS

$$y_i = X_i \beta_i + \varepsilon_i$$

Hildreth and Houck (1968)

We find that Ω is a block diagonal matrix with

$$\Omega_{ii} = E[(y_i - X_i\beta)(y_i - X_i\beta)' | X_i] = \sigma^2 I_T + X_i \Gamma X_i'$$

we can write the GLS estimator as

$$\beta = (X' \Omega^{-1} X)^{-1} X' \Omega^{-1} y = \sum_{i=1}^n W_i b_i$$

where

$$W_i = \left[\sum_{i=1}^n (\Gamma + \sigma_i^2 (X_i' X_i)^{-1})^{-1} \right]^{-1} (\Gamma + \sigma_i^2 (X_i' X_i)^{-1})^{-1}$$

Swamy (1971)

3. ANALYSIS

The data is used for this purpose is form 1971 to 2004. The data is taken from “fifty years of Pakistan in statistics” and “statistical year book”. The prices are taken to be dependent variable, and area and production are taken to be independent variable.

The descriptive results for all the variables are given bellow

TABLE 2

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Price	136	.58	10.10	4.2009	2.90030
Production	136	68.60	16480.00	3431.5574	4353.83142
Area	136	134.50	6255.50	1858.1132	2093.58137

TABLE 3

RESULTS FOR POOLED MODEL

	Coefficient	St. error	T-ratio	P value
Area	-.003	0.000	-7.100	0.000

Production	.001	0.000	7.531	0.000
Constant	4.492	0.286	15.716	0.000

TABLE 4
RESULTS FOR PANELE MODEL

	Coefficient	St. error	Z	P value
Area	-.0026223	.0003779	-6.94	0.000
Production	.0012821	.0001864	6.88	0.000
Import	3.86e-07	1.81e-07	2.13	0.033
Constant	4.261012	.3023698	14.09	0.000

	Within	Between	Over all
R ²	0.3310	0.3542	0.3236

σ_u^2	σ_e^2
0.00000	2.4190407

4. CONCLUSION

From the table of descriptive statistics it can be seen that the average price of

Wheat is 4.2009 and the variation is 2.9003, for production the average is 3431.5574 and variation is 4353.83412

From the above analysis the pooled model for price of wheat is given bellow

$$w_{pit} = 4.492 + .001w_{pr} - 0.003w_a$$

And from the p value we it can be concluded that the area and production has significant effect on the price of wheat. Further more from the above analysis it can be conclude that the panel model for wheat price is

$$w_{pit} = 4.261012 + .0012821w_{pr} - .0026223w_a + 0.00000038w_i$$

Which shows that production has positive and area has negative influence on price of wheat, and from the p values it can be

concluded that and from the value of $\sigma_U^2 = 0$ we can conclude that the over all variation with in panel is zero. But from the value of $\sigma_e^2 = 2.4190407$ the conclusion is that the variation in the coefficients of wheat production and area are variable between the province i.e. Punjab, Sindh, N.W.F.P., Balochistan is at the rate of 2.4190, and all coefficient are highly significant, and overall variation controlled by independent variable is 0.3236.

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