

Support Price: A Growth Rate Model of Cotton Production in Pakistan

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Abstract: Cotton is an important cash crop of Pakistan which serves as a mainstay in agriculture sector of the country. Each year government announces support price for the crop aimed to save cotton producers as well as to achieve the targeted quantity of the produce. The research shows that the average growth rate of area, production and yield under the crop was estimated 1.9, 5.2 and 3.2% since, 1979-80 to 2008-09. It further reveals that support price has positive effect on production of cotton crop with by increasing yield at the rate of 0.03% annum⁻¹ where area under cotton crop with respect to support prices increasing at the rate of 0.2% annum⁻¹. Finally on the basis of results, the recommendation measures has been drawn to enhance cotton production in the country.

Key words: Cotton, Growth Rate Model, support price, target quantity, production, Pakistan

INTRODUCTION

Agriculture accounts for nearly 22% of Pakistan's total national output and employs 44% of its workforce. Agriculture also supplies raw material to Pakistan's industries, notably textile industry, the largest industrial sub-sector of the economy. Most importantly, 65.9% of country's populations living in rural areas are directly or indirectly dependent on agriculture for their livelihood (Government of Pakistan, 2005). Given its importance to national economy, the government attaches high priority to raising agricultural productivity with a view to promoting faster agricultural growth and hence, raising farmers income (Rind, 2000).

Cotton is an important non-food cash crop and a significant source of foreign exchange earning in Pakistan. It accounts for 8.6% of the value added in agriculture and about 1.6% to Gross Domestic Product (GDP) (Government of Pakistan, 2005). In addition to providing raw material to the local textile industry, the surplus lint cotton is exported. In year 2008-09, the crop was sown on the area of 2820 thousand ha, about 8% less than last year. In 2007-2008, area under cotton crop in Pakistan was 3 million ha and cotton yield was 649 kg ha⁻¹, cotton production in current year seemed higher than precedent year (Government of Pakistan, 2005). Factors responsible for this rise in cotton production include; higher ball bearings, use of improved quality of pesticide resulting in low pest pressures and favourable weather condition for growth and development of the cotton crop (Bakhsh *et al.*, 2005). The cotton belt of Pakistan extends from Northeast to Southwest (Kousar *et al.*, 2006) about 700 miles long (Sharma and Dhindsa, 1996). The climate is arid and sub-tropical maximum with 100 mm of average

rainfall. The best and suitable soil and environment of the country disclose good quality and desirable production of the cotton crop (Lohano, 1994). The long, extremely late Summer is well suited for growing cotton crop in Pakistan (Kirshan, 1994). It is a labour-intensive crop and provides labour to the rural poor, especially to women for its 3-5 pickings (Lokhande *et al.*, 1995).

There are 1221 ginning factories in Pakistan of which 1075 are in the Punjab and remaining 146 are in Sindh. The total production of ginned cotton is 10 million bales suggested an access capacity of ginning in the country. Ginning is the sector which is first in the process of value addition leading to readymade garments or other textile products (Government of Pakistan, 2003).

Due to contribution of cotton in GDP, employment, foreign exchange earnings and for income support to farmers, every year government announces support price for cotton crop to achieve the targeted quantity of cotton production. For formulating a viable policy on price support for cotton crop government need to quantify the effects of support price and other variables on cotton production.

Support price has positive effect on total production of cotton crop as support price increases farmers sow more acres of cotton crop and they also improve the input use for achieving higher cotton yield, the factors that affects the cotton production including rainfall, water availability, fertilizer and other variables. Estimation of the effects of support price and other variable on cotton production will be useful for forecasting the cotton production and future planning for achieving the government targets. The main goal of the proposed study was to estimate effects of support price of cotton production.

MATERIALS AND METHODS

The study was mainly based on the secondary data. Time series were collected for the period from the financial year 1979-80 to 2008-09. For this period, data on cotton production, area, yield and support price were collected from various government publications.

Growth Rate Model: Time series data on production, area and yield of cotton crop were analyzed to estimate their growth rate by using the following growth model:

$$g_x = \left(\frac{X_T}{X_0} \right)^{\frac{1}{T}} - 1$$

Where:

- g_x = Average growth rate
- X_0 = Initial value of variable X
- X_T = Final value of variable X
- 0 = Base year
- T = Final year

Regression Model and Estimation Method: Regression Model was first used by Sir Francis Galton towards the end of 19th century in his study Regression towards Mediocrity in Heredity stature (Iqbal, 1963). The general Regression Model may be specified as:

$$y = f(x) + \epsilon$$

Where:

- y = Dependent variable
- x = An independent variable
- ϵ = An unobserved random variable called error term

For this study, the Regression Model for cotton yield was specified as:

$$\ln y = \alpha_0 + \alpha_1 t + \epsilon \tag{1}$$

Where:

- y = Yield of cotton crop
- α_0 = Intercept
- α_1 = Slope coefficient
- t = Time index for the year
- ϵ = Error term

The Regression Model for estimation the effect of cotton support price on the area sown under cotton was specified as:

$$\ln A = \beta_0 + \beta_1 \ln P + \epsilon \tag{2}$$

Where:

- A = Area under cotton crop
- β_0 = Intercept
- β_1 = Slope coefficient

- P = Support price
- ϵ = Error term

The Regression Model in Eq. 1 and 2 were estimated by using Ordinary Least Square Method.

RESULTS AND DISCUSSION

This study presents pattern of growth of production, area, yield, effect of support price on cotton production in Pakistan and explores the main factors causing variation in cotton production with policy measures for development of cotton industry in Pakistan.

Cotton (Production, area and yield): Production, area and yield of cotton in Pakistan are showed in Fig. 1 and 2, respectively. The production of cotton is provisionally estimated at 11819 thousand bales for the year, 2008-09 which is much lower than the 2005-2007 but little bit higher than 2007-08. The factors that responsible for the decline in cotton production are excessive rain at the time of sowing, high temperature at flowering stage, late wheat harvesting resulting in decline of area under the crop and pest attack in some cotton growing areas of Punjab and Sindh provinces.

Figure 1 and 2 show overall increasing trend of cotton in Pakistan during the period 1978-79 to 2007-08. But ups and downs occur due to water shortage, heavy rainfall at sowing time, high temperature at flowering stage, late harvesting and technological change in the data history. Since, the inception of data 2004-05-79, the maximum output level of production, area and yield of cotton in Pakistan were 14263 thousand bales, 3193 thousand ha and 760 kg ha⁻¹, respectively. It was the maximum level of output in data history during 1979-80 to 2008-09. The beginning of last decade in 1994-95 cotton industry of Pakistan remained under crises due to less contributing of cotton production by Sindh and Punjab and curves also shows a little downward turn and same curves were restoring their increasing position in end of last decade 1994-95 which is recorded drought period by the Government of Pakistan, under the shadow of support price due to predefined factors, i.e., water shortage, heavy rainfall at sowing time, high temperature at flowering stage of cotton crop, late harvesting and land deforestation of land during cotton growing season in 1995 last decade of data history (Bakhsh *et al.*, 2005).

To review closer relationship of cotton production, area and yield, we tested average Growth Rate Model for cotton production, area and yield for secondary collected time series data on cotton crop and found the results.

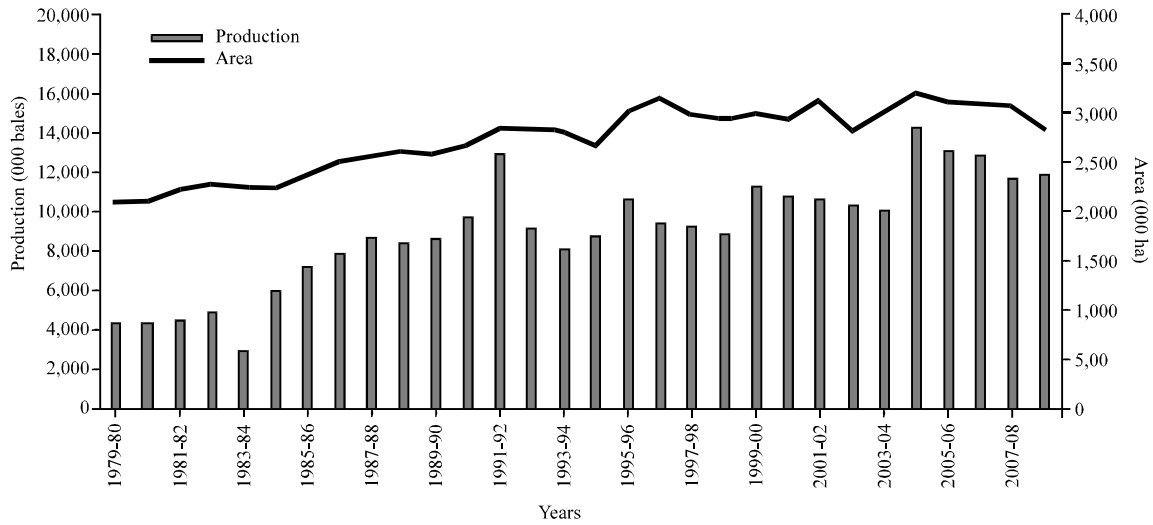


Fig. 1: Area and production of cotton crop in Pakistan during 1979-80 to 2008-09 (Government of Pakistan, 2008)

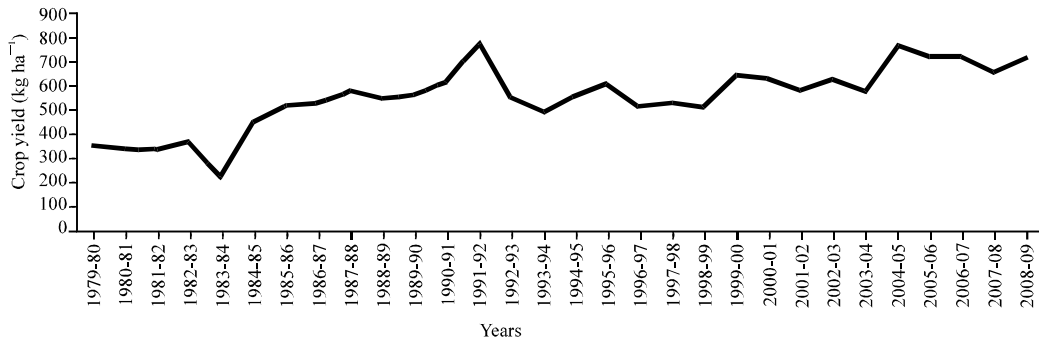


Fig. 2: Yield of cotton crop recorded in Pakistan since 1979-80 to 2008-09 (Government of Pakistan, 2008)

Table 1: Growth rate of production, area and yield of cotton during 1979-80 to 2008-09

| Years | Annual growth rate (%) | | |
|--------------------|------------------------|---------------|------------|
| | Production (000 bales) | Area (000 ha) | Yield (kg) |
| 1979-80 to 1988-89 | 7.8 | 2.1 | 4.5 |
| 1989-90 to 1998-99 | 2.2 | 1.3 | 0.9 |
| 1999-00 to 2008-09 | 3.4 | 0.7 | 2.4 |
| 1979-80 to 2008-09 | 5.2 | 1.9 | 3.2 |

The average growth rate (Table 1) of production, area and yield for Pakistan during last three decades is 7.8, 2.1 and 4.5% in 1988-89, 2.2, 1.3 and 0.9% during 1999 and 3.4, 0.7 and 2.4% in 2009, respectively. The overall growth rate of cotton production, area and yield in Pakistan during 1979-80 to 2008-09 was 5.2, 1.9 and 3.2%.

Support price effect on cotton crop: Support price is the price of a commodity that announced by the government before swing the crop, aimed to encourage farmers (Motiee and Sadrolashrafi, 1998). However, it to be noted that there are fluctuations in cotton production and yield in the years 1983, 1992, 1999 and onward up to 2008-09

Table 2: Regression results for cotton yield; dependent variable yield and independent variable t (year index)

| Independent variables | Estimated Coefficient | SD | t-statistics | Prob. | R ² |
|-----------------------|-----------------------|--------|--------------|-------|----------------|
| Constant | a ₀ | -56.20 | 9.1400 | -6.15 | 0.000 |
| t (year index) | a ₁ | 0.03 | 0.0045 | 6.82 | 0.000 |

Model 1: $In\ yield = a_0 + a_1 \times t$

due to rainfall at sowing time, high temperature at flowering stage, late harvesting and lack of management practices in cotton crop. Support price has positive effect on cotton production and yield in the data history of cotton crop as support price increases per year farmers grow more acres of cotton crop so, support price effect exclusively whole of cotton crop production and area in Pakistan during selected time series data period from 1979-80 to 2008-09. Table 2 show that yield of cotton crop in relation to time index is increasing with proportionate change of 0.03% annum⁻¹ since 1979-80 to 2008-09, depending upon maximum area sown under cotton crop. If other variables are kept constant for 30 years, the decision making variable will be the area because this model verifies that production of cotton crop

Table 3: Regression results for area and support price; dependent variable area and independent variable support price

| Independent variable | Estimated | | | | | |
|----------------------|-------------|-------------|------|--------------|-------|----------------|
| | Coefficient | coefficient | SD | t-statistics | Prob. | R ² |
| Constant | β_0 | 6.5 | 0.16 | 41.49 | 0.000 | 0.72 |
| Support price | β_1 | 0.2 | 0.02 | 8.29 | 0.000 | - |

Model 2: In area = $\beta_0 + \beta_1 \times$ in support price

with respect to area is increasing by 3% annum⁻¹, so for next 30 years, the area under cotton cultivation will end and may be production will increase by putting other variables or due to technological change. The area of the country is fixed, we could not purchase it from other country but instead of it, we can improve the technology and other factors as recommended by researcher and experts as per required time period.

Table 3 shows that area of cotton crop with respect to support prices increasing with the rate of 0.2% annum⁻¹ since, 1979-80 to 2008-09 depending upon maximum area sown under cotton crop. If production is equals to area times yield and area is increasing by 0.2 and yield is increasing by 0.03% in 1 year, so we estimated the function as:

$$\begin{aligned} \text{Production} &= \text{Area} \times \text{yield} \\ Y &= A \times y \end{aligned}$$

If production of cotton crop increase by 1% in a year, area increases by 0.2% in a year and yield increases by 3% in a year then:

$$\begin{aligned} Y(1 + g_p) &= A(1 + 0.002) \times y(1 + 0.03) \\ &= A \times y(1 + 0.002)(1 + 0.03) \\ &= Y(1 + g_p) = Y(1 + 0.002)(1 + 0.03) \\ g_p &= (1 + 0.002)(1 + 0.03) - 1 \\ g_p &\approx 0.002 + 0.03 = 0.032 \end{aligned}$$

The production is increasing with the rate of 0.032% in a year. Support price has positive effect on total production of cotton crop as support price increases, farmers sow more acres of cotton crop and they also improve the input use for achieving higher cotton yield. Estimation of the effect of support price and other variable on cotton production will be useful for forecasting the cotton production and future planning for achieving the government targets.

The results of support price reveal that production of cotton crop with respect to its area increasing with the rate of 3% annum⁻¹ depending upon maximum area sown under cotton crop. If we calculate the same for next 30 years, the area under cotton cultivation will end and may be production will increase by putting other variables

or due to the technological change in future. Similarly, Ali concluded that a sound policy designed to obtain the desired level and composition of output rests on a thorough understanding of how policy determinants affect farmers' choice of crop and the way the decision to produce a crop affects the production levels of other commodities.

Further results indicate that it would be hazardous to formulate a price policy on the basis of a single crop's cost of production and any change in the variables of one crop could have adverse repercussions on the prices of others. We identify that production of cotton crop with respect to support price increasing with the rate of 2% annum⁻¹, since 1979-80 to 2008-09 depending up on maximum area sown under cotton crop. Support price has positive effect on total production of cotton crop as it increases farmers sow more acres of cotton crop and they also improve the input use for achieving higher cotton yield which cannot only support country's cotton industry but will insures its sustainable development (El-Bahnasawi and El-Kheshen, 1997). Estimation of the effects of support price and other variable on cotton production will be useful for forecasting the cotton production and future planning for achieving the government targets. In this regard, Bruntrup investigated that high and stable prices can induce farmers to increase production by using mineral fertilizers and thereby improve the farm nutrient balance and reduce soil mining. This has been achieved through combination of price and non-price factors in a vertically integrated cotton sub-sector structure providing technology, inputs, credits, extension and commercialization. Some preconditions for the successful implementation of such a policy are also discussed.

The results discussed by key informant interviews transparently indicate that the cause of variation in production, area and yield as well as support price on cotton have increased over the time. Normally, the proportionate increase in these factors build growers confidence to grow more cotton crop. Because technological change and change in variable inputs efficiencies abundant environmental factors cause variation in cotton production. Support price also has positive effect on cotton production which is directly proportionate to yield. The other reason of mishaps can be the difference in ecological system and natural calamities. This study was generally overviewed by secondary data and few key informant interviews and limited in Pakistan.

CONCLUSION

From the research study, it is concluded that support price has substantial influence on cotton production since, 1979-80 to 2008-09 which seemed as the result of

protective measures by the government to build confidence among farmers, to grow more area under the crop to generate cash and have a choice to use more inputs to gain for bumper yield and increase sizeable per acre net income.

By increasing area under cotton cultivation, the production will increase and growers earn surplus income from cotton crop which will increase and this will support in country's cotton industry its sustainable development (El-Bahnasawi and El-Kheshen, 1997).

RECOMMENDATIONS

Some policy measures for the development of cotton industry in the country, it is important that future research should be added as resource conservation and environment friendly objective to all ongoing and agricultural research projects. Research is needed to analyze and guide for the long-term sustainability of agro-ecosystem. New research and information should be provided to assist the farmers so that they should be able to make decision on alternative management practices which include the useful management practices. The information should be provided through various methods of mass and electronic media and its impact on the natural system and possibility of increase in profits. Government has to assure the availability of major inputs, affordable treatment and canal water and provide technical assistance to control pesticides, fungicides and other harmful insects at cheaper rates.

Research is needed to develop new training material to save the environment based on new scientific analysis design and approach for sustainable development of cotton industry. Good quality and high yielding varieties of seed should be supplied before sowing of cotton crop in Pakistan. Cotton spinning and ginning factories made bound to provide technical assistance to farmers for qualitative and quantities measures for maintaining cotton and fiber as per international standard. Quick and cheap transport and communication facilities should be provided to farmers at farm level. Department of Agriculture Extension and Agriculture Research should disseminate free technical information to farmers at their doorstep and country level. Central Bank of Pakistan needed to assure availability of agricultural credit to growers of cotton crop at lower markup rate and quick procession in needed so that farmers can grow more area of cotton crop.

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