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DYNAMICS OF COMPARATIVE ADVANTAGE AND COMPETITIVENESS OF COTTON CROP IN PAKISTAN AND POLICY IMPLICATIONS

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This paper analyse the changing comparative advantage and competitiveness of cotton over time and its implications on the cotton sector and all the stakeholders in Pakistan, in an era of globalization. The data collected by the Agricultural Price Commission (APCom) on the cost of production of seed cotton for the period of 2002-2007 was used for the analysis. The financial and economic budgets were prepared separately to estimate profitability, value addition, comparative advantage and competitiveness of the cotton crop. The Policy Analysis Matrix (PAM) was the basic analytical framework. Policy distortions in the input and output market were also analysed through Nominal Protection Coefficient (NPC) and Effective Protection Coefficient (EPC). The Domestic Resource Cost (DRC) ratio was selected as a measuring tool for comparative advantage. The risk analysis was further carried out on the basis of risk prices of fertilszer (DAP and Potash) and cotton to assess the comparative advantage of the country in cotton production. The results show that Pakistan has a comparative advantage in the production of cotton at export parity price and can maintain competitiveness in the world cotton market. The textile industry of Pakistan can rely on cotton growers to supply sufficient amounts of raw material at competitive prices. In the free trade scenario, Pakistan is likely to maintain its competitiveness and gain more in the cotton market provided the developed countries follow the rules of the WTO. Ensuring quality improvement through efficient utilisation of all resources is essential to complete the value chain of the cotton sector and remain competative under different circumstances.

I. Introduction

Cotton as the silver fiber has a unique position in the world economy, in general, and for Pakistan in particular. Around the World, about 100 million rural households are involved in the production of cotton. In Pakistan 7 million (about 19 per cent)

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rural households are engaged in production of cotton and earn their livelihood from producing this crop. Cotton also contributes around 10 per cent to the agriculture GDP in the country. Data shows that the growth rate in the country's GDP and cotton production move in the same direction. Reduction of one million bales of cotton production narrows the GDP growth rate by one digit. A good cotton crop is therefore vital force to the economy.

Cotton is not only an important crop but an important source of raw material to the textile industry in Pakistan. Major investment in the form of over 1,000 ginning factories, 450 textile mills, and about 9 million spindles depend heavily upon a good cotton production level. In the 1990s, decline in cotton yields led shortage of cotton to close down 150 mills [Banuri (1998)]. Exports of finished textiles are now a major source (60 per cent) of foreign exchange.

In the past, cotton production and marketing were subjected to many public policy interventions that impacted on the welfare of growers. The cotton crop was under priced in all the years to provide an incentive to the domestic textile industry. Distortions were not only exercised in the form of low support price, but many direct or indirect taxes also affected the sector. The Cotton Export Corporation was phased out and the cotton economy was freed in the 1990s. The private sector was allowed to purchase cotton directly from the ginners. An export tax based on minimum export price and benchmark price of cotton was levied from 1988 to 1995, [Qureshi (1992), Hudson and Ethridge (1995)]. The export tax was intended to provide cheaper raw material to domestic spinning and textile industry. The domestic price of cotton was again suppressed compared to international market prices leading to various problems in the cotton trade. Higher grade cotton against the officially declared grade was exported for the sake of vested interests of exporters, [Salam (2008)]. Yarn was put in the market at lower prices resulting in anti-dumping duties on yarn export from Pakistan imposed by Japan and Turkey.

With the advent of trade liberalisation, state interventions in the sector declined. Free trade policy helped cotton growers to receive international price for 1994-95 crop providing them an incentive to produce more. Availability of domestic cotton at high prices necessitated the import of cotton to meet the shortfall in the demand for cotton by the domestic textile mills. Provisions for the import of yarn at a lower tariff rate led to a high inventory of domestic yarn (1994-95 and 1995-96) and slower yarn export from Pakistan. In addition to the forgoing issues in the output market, various marketing malpractices in input markets aggravated the situation over the period. Non-availability of inputs at the required time and of proper quality due to mixing and hoarding, coupled with escalating prices squeezed the growers. Market interventions distorted agriculture price incentives, resulting in an inefficient allocation of resources and the comparative advantage was not realised.

The global economic environment is undergoing change under the free trade regime, resulting in increased competition and relative competitiveness of different

countries. This warrants a significant change in the country's structure of economic incentives and major adjustments in the pattern of production, allocation of resources and trade flows involved. It is, therefore, crucial for every country to exploit its comparative advantage in the production and trade of agricultural commodities. Not only on-farm production, but analysis of the entire commodity chain needs to be considered in comparative advantage analysis, [Salinger (1997)]. A major criticism of comparative advantage is that it is a *static* partial equilibrium analysis and does not allow for *dynamic* feedback in the system. Further international prices of agricultural output and inputs are more volatile. To overcome this obstacle *price risk analysis* is essential to estimate the sensitivity and to ensure Pakistan's potential to compete in the current global market scenario. In the light of the above discussion the study estimated the comparative advantage and competitiveness of cotton crop in both scenarios.

The agriculture sector in Pakistan is characterised by scarce resources of fertile land for further expansion, irrigation water, fertiliser, skilled labour etc., that have to be allocated among various crops. Therefore, it becomes important to identify the priorities for resource allocation among competing crops.[1]

Cotton being a *kharif* crop works as a complementary crop to wheat as both can be grown in the same climate and soil one after the other, depending upon their production seasons. However, in many cotton growing areas sowing period of wheat is somewhat delayed due to late cotton picking. So, for this short duration (about 2-6 weeks) these two crops compete with each other. Rice is the major *kharif* crop that can potentially compete with the cotton crop but due to diverse requirements of factor inputs and agro-climatic conditions rice does not usually compete with cotton. Sugarcane is the sole and largest competing crop for cotton.

Appleyard (1987), in his analysis concluded that Pakistan has a comparative advantage in the production of cotton and Sindh has more comparative advantage than the Punjab. Ali (1992), showed that producers of cotton were heavily taxed (negative PSEs) during the period under analysis as the input assistance to farmers was phased out by the government. Up to 1991-92, strong comparative advantage prevailed in the production of cotton, [Longmire and Debord (1993)]. Khan and Ashiq (2002), showed that Pakistan possessed competitiveness in seed cotton production. It was further concluded that in terms of comparative advantage Sindh has an edge over the Punjab due to its natural and geographic comparative advantage.

[1] A detailed study was carried out by the authors for the four major crops (wheat, cotton, rice and sugarcane) of the country with the data over three harvesting periods (2001-2003). Results for each crop are published in various refereed journals which can be provided on request.

II. Methodology and Data

In Pakistan, cotton production is concentrated in provinces of Punjab and Sindh.[2] The time series data on cost of production (COP) of cotton for the six harvesting years (2001-02 to 2006-07) was obtained for both provinces. After individual analysis, national level data set was constructed by taking a weighted average for both provinces.

Agricultural Price Commission (APCom)[3] performed the function of estimation of COP for various crops based on the surveys conducted throughout the country. At the data analysis stage the survey respondents were grouped according to certain socio-economic characteristics. The farmers were grouped as large farmers, small farmers, average farmers, and progressive farmers, etc. This paper is confined to the analysis related to average farmers.

The study first estimated the comparative advantage and competitiveness of the cotton crop at market prices and then price risk analysis was undertaken. Methodologies adopted for Static and Risk analysis are outlined in the following sections.

1. Static Analysis

Various techniques have been used to measure the comparative advantage and competitiveness in producing and exporting different commodities. Two main techniques i.e., Domestic Resource Cost (DRC) and Benefit Cost Ratio (BCR) are extensively used, [Green et al. (1994), Kannapiran and Fleming (1999)]. DRC was selected as the best choice for analysis under the recommendations of Asian Development Bank, as being the most widely used measure of comparative advantage, used by developed and developing countries.

The Policy Analysis Matrix (PAM) was selected as the analytical framework. It was designed by incorporating revenues and costs taken from private and economic budgets for cotton. In addition to DRC, International Value Addition (IVA) was also calculated. The measurement of policy distortions in agriculture was developed through Nominal Protection Co-efficient (NPC) and Effective Protection Co-efficient (EPC).

2. Policy Analysis Matrix (PAM)

The Policy Analysis Matrix (PAM) framework was developed by Monke and Pearson (1989) and augmented by Masters and Nelson (1995) for measuring, input use efficiency in production, comparative advantage and the degree of government interventions [Nelson and Panggabean (1991)].

The basic format of the PAM is a matrix of two way *accounting identities*; one set defining profitability and the other defining the difference between private and economic values of a commodity system.

a) Private Profitability

The data entered in the first row of Table 1 provides a measure of private profitability; the difference between observed revenue and costs valued at market prices. The private profitability calculations show the *competitiveness* of the agricultural system given current technologies, output values, input costs, and policy transfers. The cost of capital that owners of the capital require to maintain their investment in the system is included in the domestic costs (C); hence profits (D) are excess profits above normal returns to the producers. If private profits are negative ($D < 0$), operators are earning a subnormal rate of return. Alternatively, positive private profits ($D > 0$) are an indication of supernormal returns showing a potential for future expansion of the system.

b) Economic Profitability

The second row (Table 1) of the matrix utilises economic prices. The economic profitability is the difference between revenue and costs of domestic factors and tradable inputs priced at their opportunity cost. Economic profit is the measure of *comparative advantage* and efficiency because outputs (E) and inputs (F + G)

Table 1

Policy Analysis Matrix (PAM)

Items	Revenues	Production Costs		Profit
		Tradable Inputs	Domestic Factors	
Private prices	A	B	C	D
Economic prices	E	F	G	H
Policy transfer	I	J	K	L

Source: Monke and Pearson (1989).

Private Profitability (D) = A – (B + C) Economic Profitability (H) = E – (F + G)
Output Transfers, (I) = A – E Input Transfers (J) = B – F
Factor transfer, (K) = C – G Net Policy Transfers (L) = D – H

[2] The Punjab province contributes about 80 per cent in area under cotton and the total country production of cotton, [GOP (2007)].

[3] Now, Agriculture Price Institute (API).

are valued in prices reflecting their scarcity values. A positive economic profit (H > 0) indicates efficient utilisation of scarce resources and *comparative advantage* in production. The negative economic profit (H < 0) indicates wastage of scarce resources suggesting other better alternative uses.

c) Divergences/Policy Transfers

The second identity of the accounting matrix, indicated by the third row of Table 1, is concerned with the differences between private and economic valuations of revenues, costs, and profits. Any divergence between the observed private price and the estimated economic price are explained by the effects of policy or by the existence of market failures. Distorting policies lead to an inefficient use of resources enhancing the stated divergence. Efficient policies offset the effects of market failures and create greater income and thus correct divergences by reducing difference between private and social valuations.

d) Nominal Protection Coefficient (NPC)

Nominal Protection Coefficient (NPC), is the ratio of the domestic price of cotton to its border parity price. The border parity price is defined as the price of any commodity in the international market converted into local currency through an exchange rate. The NPC is called gross nominal protection coefficient when discounted with the official exchange rate and net nominal protection coefficient if the shadow exchange rate is used as follows:

$$NPC = P_C^d / P_C^b \quad (1)$$

where:

P_C^d = Domestic price of cotton,

P_C^b = Border parity price of cotton.

The simple form of these ratios is:

i) Nominal Protection Coefficient of outputs (NPCO) = A/E (in PAM).
ii) Nominal Protection Coefficient of inputs (NPCI) = B/F (in PAM).

As an indicator of policy effects, NPC lower than one means that the production of a particular commodity is taxed either due to market failure or government intervention. Conversely NPC greater than unity indicates inefficiency of a country in producing that particular commodity and that the price is heavily influenced by government policies or other factors.

e) Effective Protection Coefficient (EPC)

$$EPC = A - B / E - F \quad \text{(in PAM)}$$

The Effective Protection Coefficient (EPC) is the ratio of distorted tradable value added at market price to its un-distorted value at border prices. The EPC combines the two NPC's to assess the overall effect of an implicit tax and subsidy through both outputs and inputs. Thus, it is an alternative indicator to NPC that captures the net effects of all policies on value added of agricultural production systems and not simply on input or output prices.

The formula for the EPC is the following:

$$EPC = (P_C^d - \Sigma F_t V_t^d) / (P_C^b - \Sigma F_t V_t^b) \quad (2)$$

where:

F_t = Units of tradable factors (inputs) per unit of output,

V_t^d = Domestic price of tradable inputs,

V_t^b = Border parity price of tradable inputs.

An EPC greater than unity, implies price protection and positive incentives to the domestic producer of that commodity. While the opposite is true if the EPC is less than unity. If the EPC is equal to one, the structure of protection is neutral. Producers are neither favoured nor discriminated against.

f) Domestic Resource Cost Ratio

$$DRC = G / (E - F) \quad \text{(in PAM)}$$

The Domestic Resource Cost (DRC) analysis is a further refinement towards development of a more practical measures of comparative advantage. The DRC was first developed independently by Michael Bruno in Israel and Anne Krueger in the United States, [Masters and Nelson (1995)]. This ratio can be used to compare different economic activities in terms of economic and social costs of domestic resources employed in earning or saving a unit of foreign exchange. The basic conceptual formula is:

$$DRC = \Sigma F_{nt} V_{nt} / (P_C^b - \Sigma F_t V_t^b) \quad (3)$$

where:

F_{nt} = Units of non tradable inputs,

V_{nt} = Shadow price of non-tradable inputs/domestic resources,

V_t^b = Border parity price of tradable inputs.

A country has a comparative advantage in the production of any commodity provided that the DRC ratio is less than unity. Conversely, a DRC ratio greater than unity indicates inefficiency in producing that particular commodity.

g) International Value Addition (IVA)

$$IVA = E\text{-}F/\text{Exchange Rate} \quad \text{(in PAM)}$$

This represents the gains or losses from the production and export of cotton in international currency utilised for the analysis. This expresses how much foreign exchange (US$) is earned or lost by producing and trading that particular commodity. The following formula is utilised to estimate the IVA:

$$IVA = \Sigma Y P_C^{Fb} - \Sigma F_i V_i^{Fb} \qquad (4)$$

where

Y = Per acre yield of cotton,

P_C^{Fb} = Border parity price of cotton in dollars,

V_i^{Fb} = Border parity price of tradable inputs in production and marketing in dollars.

The negative sign indicates that production and marketing of that particular commodity is causing a cost in terms of foreign exchange more than its value. In the same way a positive sign means that more of foreign exchange is earned and value is added by producing and trading of the commodity than its cost.

3. *Components of PAM and Data Requirement*

The Policy Analysis Matrix requires a comprehensive set of data. In the study, data on various variables outlined below were collected from different national and international sources.

a) Input/Output Technical Coefficients

These are the physical quantities of inputs and outputs. Compilation of data on physical output and inputs on a per unit basis were compiled.

b) Input and Output Domestic and World Prices

The farm gate prices and market prices of inputs and output were utilised and termed *private prices*. These prices were used to calculate the actual revenues and costs received or paid by farmers i.e., the private budget. Economic prices

were estimated on basis of the Export Parity Price (EPP) and Import Parity Price (IPP) depending upon the origin of the tradable commodity. World prices were collected from various sources like Food and Agriculture Organisation, and United Nations data. The State Bank of Pakistan (SBP), the Ministry of Agriculture and Livestock (MINFAL) and the International Cotton Advisory Committee (ICAC) were the main sources of data on official exchange rate, values of exports and imports and taxes on international trade and transactions.

c) Decomposition of Input Cost Items

The cost of production was separated into tradable and non-tradable components, thus every item was divided into two parts. Some items have greater proportion of tradable element than others. Labor and land were regarded as 100 per cent non-tradable. Material inputs such as machinery and fertilizers tend to have a significant proportion of tradable elements. For all other inputs (material and operations) the proportions of these two different components were estimated on ad hoc basis, by consulting relevant studies and field experts.

4. *Economic Valuation of Tradable Inputs and Outputs*

The calculation of economic prices of tradable outputs and inputs envisages the estimation of the shadow exchange rate and import and export parity prices of tradable outputs and inputs.

a) Shadow Exchange Rate

To value the prices of imports and exports an average official exchange rate was used. When the foreign exchange market is distorted, the official exchange rate may not fully reflect the real cost of foreign currency. A shadow exchange rate that reflects the opportunity cost of the foreign currency was used instead. Shadow Exchange Rate (SER) was estimated from the Official Exchange Rate (OER) using a Social Conversion Factor (SCF) as by Appleyard (1987), as follows:

$$SER = OER / SCF$$

$$SCF = (M+X) / [M(1+T_M)+X(1-T_X)] \qquad (5)$$

where:

M = CIF value of imports,

X = FOB value of exports,

T_M = Average tax rate on imports,

T_X = Average tax rate on exports.

b) Import and Export Parity Prices of Tradable Outputs and Inputs

At the border the import and export parity prices are the cost, insurance and freight (CIF) and free on board (FOB) prices. In domestic currency these are called border parity prices. When the shadow exchange rate is used instead of nominal exchange rate they become the economic border parity prices. The market import and export parity prices were derived from the border parity price by allowing for social costs associated with moving the traded commodity from border to the market. To correctly compare two different prices, two required conditions have to be fulfilled: the commodities are exactly comparable in physical terms and at the same location. To fulfill the second condition a precise accounting of transport, handling and marketing costs was made.

The following equation was used for the calculation of the Export Parity Price (EPP) of cotton.

$$\text{Export Parity Price} = (\text{FOB}^* \text{ SER}) - (HC_B) - (TC_{BM} + MC_{BM}) \qquad (6)$$

where:

FOB = Free on board price at border,
SER = Shadow exchange rate,
HC_B = Handling costs at border,
TC_{BM} = Transport costs from border to market,
MC_{BM} = Marketing cost from border to market.

In the calculation of the Export Parity Price of cotton, the cotton seed must also be treated as if imported or exported. But following Appleyard (1987), its parity price was not included. Instead the domestic marketing price was used to arrive at the market price of seed cotton through the Export Parity Price of cotton lint.

The following equation was used for the calculation of the Import Parity Price (IPP) of DAP and potash fertilisers:

$$\text{Import Parity Price} = (\text{CIF}^*\text{SER}) + (HC_B) + (TC_{BM} + MC_{BM}) \qquad (7)$$

where:

FOB = Free on board price at border,
SER = Shadow exchange rate,
HC_B = Handling costs at border,
TC_B = Transport costs from border to market,
MC_{BM} = Marketing cost from border to market.

Inputs which were tradable (for which respective parity prices were not calculated) were weighted by a premium (ratio of SER to OER).

5. *Economic Valuation of Non-Tradable Inputs*

Shadow wage of labour, social interest rate for capital and opportunity cost of water and land were calculated for the nontradeable inputs..

a) Shadow Wage of Labour

For all the activities during crop production, marketing or transporting for which labour was hired, actual wage rate was considered as the private price. If family labour was employed, the prevailing wage rate was considered the opportunity cost of family labour. The minimum wage rate for labour is not available in the rural areas of Pakistan. To overcome this problem, following Ahmad and Martitni (2000) the opportunity cost of labour was taken as 30 per cent higher than current market price for the corresponding year. Family labour was treated in the same way as hired labour.

b) Shadow Interest Rate

The opportunity cost of capital and the discount rate announced by the State Bank of Pakistan was used as the shadow interest rate.

c) Shadow Price of Land

In the event there exists land or rental market, the land rent reflects the marginal productivity of the land which is regarded as the opportunity cost of land. The prevailing land rent in the area for the same quality of land was used as the shadow price of land.

d) Shadow Price of Seed

The cotton seed (Banola) is considered non tradable and therefore the market price of Banola valued with premium (reciprocal of conversion factor calculated in the shadow exchange rate) was used as the shadow price of seed.

e) Irrigation

In the cost of production estimates APcom considered three categories of irrigation water i.e. canal, tube well and mixed. Canal irrigation is subsidised and considered as 100 per cent non-tradable. For tubewell irrigation, the prevailing market price in the adjoining area was considered as the shadow price of water. Canal

irrigation was also valued at the given (subsidised) price as shadow water rate. The assumption behind this is that canal irrigation water has the best next alternative use as irrigation water for other competing crops.

6. Private and Economic Budgets

With the calculation of private values of revenues and costs, private budgets were constructed. Economic budgets were calculated as economic values of revenues and costs, decomposed into tradable and non-tradable.

7. Risk Analysis

According to the United States Department of Agriculture (1996) survey, the producers of major field crops are generally more concerned about *price* and *yield* variability than any other factor. In this study the major focus is on price risk analysis where the cotton prices were changed along with fertiliser prices. The effect of changing the output price is equivalent to changing yields and thereby quantity by the same proportion, since revenue is the product of price and quantity, [Kannapiran and Flemming (1999)].

The risk analysis was carried out, utilising two softwares i.e., the "Best Fit" and "@ Risk 4.5.3". The world price of cotton has shown a fluctuating trend over the past three decades. The risk price of cotton was estimated on the basis of world price over the period of 1981 to 2000-01. Normal distribution of world price of cotton was plotted and the coefficient of variation (C.V.) was estimated. On the basis of estimated C.V. world prices (CIF[4] price) for the year 2001-02 to 2006-07 were converted into risk prices. The C.V. was added and subtracted in CIF price of cotton lint to obtain the potential maximum and minimum range of world price, respectively. In the same manner risk, prices of DAP and potash fertiliser were estimated on the basis of their respective world prices from 1989 to 2001.The only exception was that for fertiliser, only maximum potential prices were estimated on the assumption that inputs showed increasing price trend over time.

III. Empirical Estimates of Static Analysis

Table 2 highlights the results of the static analysis. Results show that cotton farmers earned a positive profit throughout the period under analysis that ensured their continuous survival in the production process. In the same way international value added for one dollar investment was enough to keep the farmers in business. It also showed earning by a country and its competitiveness in producing the cotton

[4] cost, insurance and freight

TABLE 2

Indicators of Profitability, Competitiveness and Comparative Advantage of Cotton for the years 2001-02 to 2006-07 Across Provinces

	Private Proftability			IVA			DRC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	384.63	1514.10	961.78	122.06	121.31	121.73	1.06	0.86	0.96
2002-03	555.61	1156.14	863.86	207.07	99.25	147.10	0.88	0.89	0.88
2003-04	5975.14	7062.90	6554.62	262.69	253.00	254.43	0.95	0.94	0.96
2004-05	574.52	533.14	597.54	190.14	157.00	170.20	0.85	0.85	0.87
2005-06	1529.05	3257.62	2444.97	177.75	211.36	190.14	0.91	0.74	0.83
2006-07	1727.83	2426.91	2146.90	178.59	207.81	189.87	0.85	0.80	0.84

Source: Authors' estimation.

crop. The domestic resource cost ratios also indicated efficiency in cotton production. The values of DRC fluctuated throughout the period but remained less than one, indicating that Pakistan maintained a comparative advantage in the production of the cotton crop. It is further concluded from the results that value of almost all DRC were less for Sindh than the Punjab, due to proximity to the port. Sindh being close to the port and due to many other production factors, showed a higher comparative advantage in cotton production.

During the study period, the Nominal Protection Coefficient ratios for inputs (NPI) were less than one showing non-protection of inputs (Table 3). The NPI further indicated that domestic prices of tradable inputs were slightly lower than world prices. The NPC was also less than unity except for the year 2001-02, indicating that cotton was not protected by any subsidy/support. The cotton market is almost liberalised in the country. The price gap showed marketing inefficiency, high transportation charges, and low infrastructure development in processing and marketing channels.

The Effective Protection Coefficient, a better indicator than NPC, measures

TABLE 3

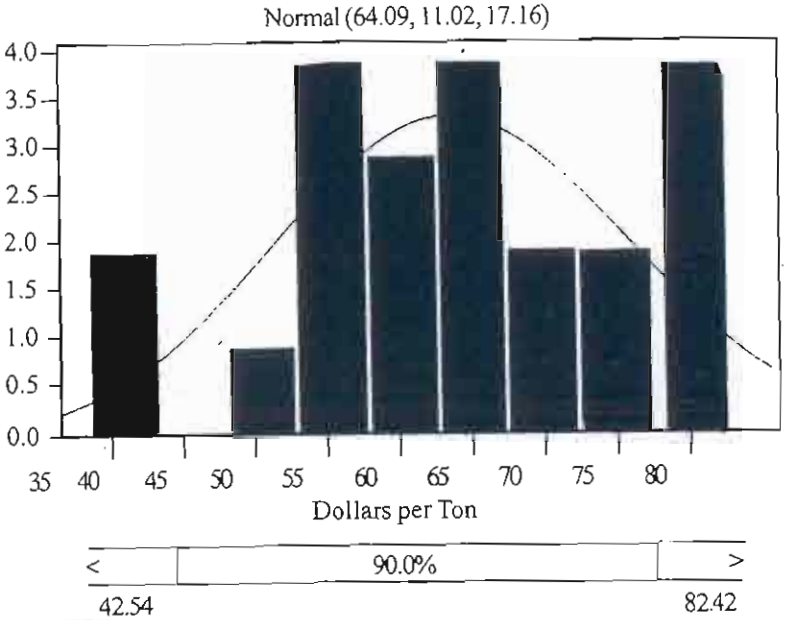
Estimation of Various Indicators of Protection for Cotton for the years 2001-02 to 2006-07 Across Provinces

	NPI			NPC			EPC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	0.94	0.93	0.93	1.04	1.01	1.02	1.04	1.01	1.02
2002-03	0.86	0.84	0.85	0.77	0.99	0.88	0.77	0.99	0.88
2003-04	0.82	0.79	0.81	0.91	0.89	0.91	0.91	0.89	0.91
2004-05	0.89	0.89	0.89	0.87	0.87	0.88	0.87	0.87	0.88
2005-06	0.85	0.89	0.87	0.96	0.96	0.97	1.01	0.99	1.01
2006-07	0.86	0.85	0.85	0.93	0.93	0.95	0.99	0.98	0.99

the total effects of policy distortion introduced by government interventions. Almost all EPC values were less than one with few slightly greater than one. The EPC values less than unity implied that cotton production was receiving a negative incentive. Cotton as a fiber has never received any concession from the Government. The only subsidy provided to this sector is on cotton seed as a food oil crop.[5]

IV. Empirical Estimates of Risk Analysis

In the risk analysis, the Export Parity Price (EPP) of seed cotton was estimated based on the risk price of cotton in the international market. The risk price of cotton was estimated by normal distribution of time series data on world price of cotton from 1990 to 2000 (Figure 1). This risk function had a mean value was US$ 64.09 per pound and standard deviation of 11.02 with a coefficient of variation 17.16. The two ranges of risk prices for cotton were estimated by adjusting the cif



Source: Authors' estimation.

Figure 1

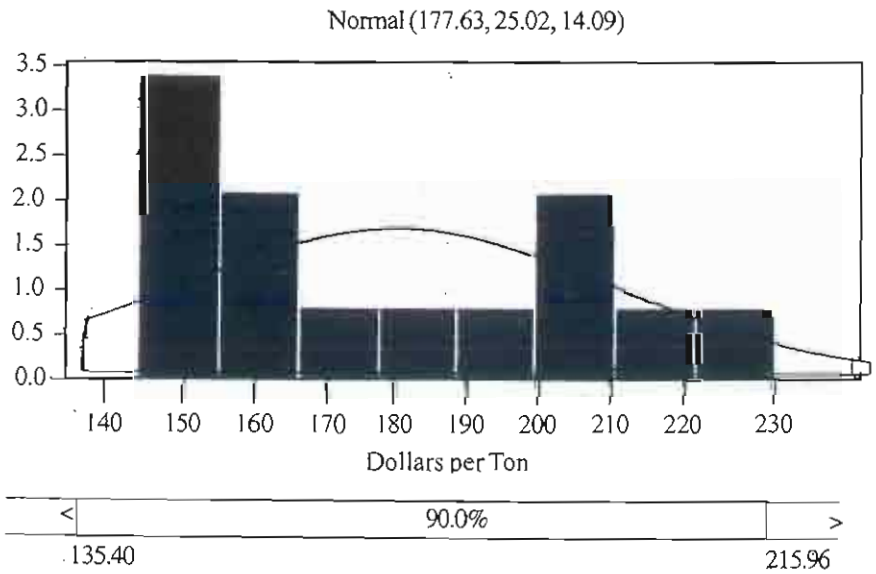
Normal Distribution of Time Series World Price of Seed Cotton from 1980-81 to 2000-01

[5] In the last fifty years, cotton has been considered a "strategic" crop and government intervention has taken place at every level, from production to marketing and exports, and prices paid to farmers and the price for exports were both set by the State. The farm gate prices were less than the border equivalent price. However, during the last few years the government has allowed free pricing

price of cotton over the period of 2001-02 to 2006-07. The cif price was allowed to fluctuate between two maximum and minimum values. The individual risk analysis was carried out for both minimum and maximum risk prices of cotton through the policy matrix approach.

The import parity price of DAP and potash was also estimated based on their respective risk price estimates. The risk prices of both were generated through normal distribution of time series world prices for DAP and potash, respectively, (Figure 2 and Figure 3). The PAM results based on maximum range of risk prices of cotton, DAP and potash are presented in Tables 4 and 5.

Fertiliser is a major component in the cost of production i.e., about 12-15 per cent, out of which urea contributes more than 50 per cent, pesticides showed a larger share in total production cost of cotton per unit of area. The maximum cost relate to rental charges of the land (various APCom cotton budgets). The private profitability of cotton growers depends upon market prices of output and inputs. The reason being that the private profitability is not affected by increased price of inputs and outputs until both are shifted to domestic markets. If CIF price of cotton had increased (as presumed with the removal of subsidy by the USA to its cotton growers) along with increase in fertiliser prices, Pakistan would have earned more value over one dollar as compared with figures in Table 2. The increase in world



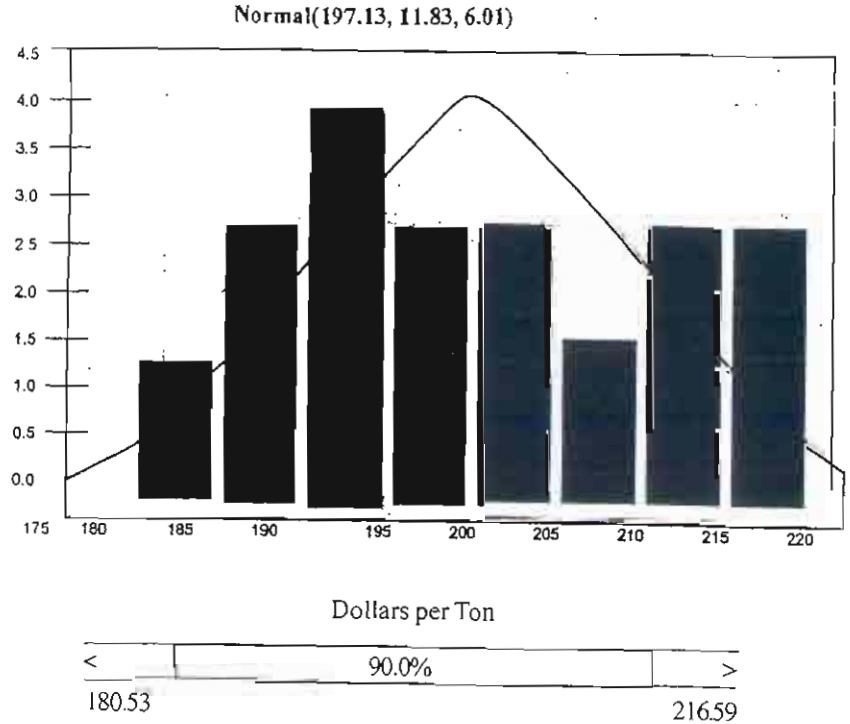
Source: Authors' estimation.

Figure 2

Normal Distribution of World Price of DAP from 1989-90 to 2000-01

price had improved the comparative advantage in cotton production of Pakistan through-out the period (2001-02 to 2006-07). This shows good opportunity for profitability for Pakistan and its cotton growers provided the subsidy extended to farmers from USA and other countries is removed. Pakistan can benefit from free trade if all the developed countries follow the rules and regulations set by WTO.

The NPI was almost the same for the Punjab and Sindh as at the national level. This showed that in the free trade regime where prices of fertilisers were increased, the gap between domestic and world market prices would increase. At the given prices of fertilisers in the domestic market, the NPC was 0.67 showing lower price of cotton in the domestic market. This led to the conclusion that if domestic prices of cotton had not followed the international higher prices of cotton; implicit taxation and dis-protection to the growers would have resulted. The value of EPC (0.58) for the year 2001-02 was the lowest and an increasing trend was seen for the next few years. Cotton growers therefore had a disincentive through implicit taxation. This showed a resource transfer to other sectors of the country.



Source: Authors' estimation.

Figure 3

Normal Distribution of Time Series World Price of

TABLE 4

Indicators of Profitability, Competitiveness and Comparative Advantage with Maximum Range of Risk Prices of Cotton Lint Across Provinces

	Private Profitability			IVA			DRC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	384.63	1514.10	961.78	234.91	225.22	230.12	0.64	0.55	0.54
2002-03	555.61	1156.14	863.86	207.77	130.65	164.02	0.68	0.75	0.73
2003-04	5975.14	7062.90	6554.62	215.02	208.45	208.29	0.77	0.62	0.71
2004-05	574.52	533.14	597.54	219.73	152.48	181.68	0.69	0.81	0.76
2005-06	1529.05	3257.62	2444.97	183.57	254.50	214.57	0.86	0.59	0.72
2006-07	1727.83	2426.91	2146.90	232.29	262.91	220.09	0.68	0.66	0.73

Source: Authors' estimation.

TABLE 5

Various Indicators of Protection for Cotton with Maximum Range of Risk Prices of Cotton Lint

Plus	NPI			NPC			EPC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	0.94	0.93	0.94	0.67	0.66	0.67	0.58	0.57	0.58
2002-03	0.87	0.85	0.86	0.77	0.87	0.83	0.72	0.88	0.81
2003-04	0.81	0.78	0.80	0.73	0.71	0.73	0.67	0.68	0.69
2004-05	0.89	0.88	0.88	0.82	0.91	0.87	0.78	0.92	0.86
2005-06	0.92	1.01	0.96	0.96	0.86	0.92	0.98	0.81	0.90
2006-07	0.89	0.90	0.90	0.81	0.81	0.88	0.76	0.78	0.87

Source: Authors' estimation.

Cotton prices that were supposed to increase under the free trade scenario, actually decreased in 1998-99 and almost remained constant in other years. In the risk analysis these CIF prices were further deflated by subtracting the C.V. from them. However, prices of fertilisers were not deflated, for the reason that prices of inputs do not tend to decrease.

The whole PAM model was separately estimated with minimum range of risk prices of cotton and the results are presented in Tables 6 and 7. The private profitability which dependents upon local market prices was not affected in this scenario. With the decrease of world price of cotton lint, Pakistan is likely to reduce its value addition capacity but still remain in the positive range showing profits. The main point to concentrate on is the value of DRC greater than one. This indicates that if the cost of production is not managed through the efficient utilisation of resources, a lower cotton lint price in the international market will result in a comparative disadvantage. If this happens Pakistan may altogether lose its position of competitiveness.

In case the effects of change in the international market prices of cotton and fertilisers are not transferred to local markets, the inputs and output markets may show a certain amount of protection for the cotton growers in Pakistan.

TABLE 6

Indicators of Profitability, Competitiveness and Comparative Advantage of Cotton with Minimum range of Risk Prices of Cotton Lint

	Private Profitability			IVA			DRC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	384.63	1514.10	961.78	152.13	149.51	150.77	1.01	0.85	0.85
2002-03	555.61	1156.14	863.86	95.81	62.62	74.89	1.44	1.48	1.53
2003-04	5975.14	7062.90	6554.62	133.92	135.60	131.11	1.17	0.90	1.15
2004-05	574.52	533.14	597.54	141.94	163.32	151.05	1.16	0.82	0.99
2005-06	1529.05	3257.62	2444.97	187.07	166.84	172.62	0.86	0.92	0.91
2006-07	1727.83	2426.91	2146.90	139.98	170.09	175.91	1.15	1.05	0.94

Source: Authors' estimation.

TABLE 7

Various Indicators of Protection for Cotton with Minimum Range of Risk Prices of Cotton

Plus	NPI			NPC			EPC		
	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan	Punjab	Sindh	Pakistan
2001-02	0.88	0.88	0.88	0.92	0.90	0.91	0.94	0.91	0.93
2002-03	0.75	0.74	0.74	1.18	1.16	1.19	1.63	1.96	1.86
2003-04	0.71	0.67	0.69	0.97	0.95	0.97	1.19	1.15	1.21
2004-05	0.89	0.88	0.89	1.12	0.91	1.01	1.28	0.92	1.10
2005-06	0.92	1.01	0.96	0.96	1.17	1.07	0.98	1.25	1.14
2006-07	0.89	0.90	0.90	1.10	1.10	1.02	1.30	1.22	1.11

Source: Authors' estimation.

V. Conclusions and Recommendations

The study is aimed at analysing the changing agricultural comparative advantage over time and its implications for development of trade in the country. Both static and risk analysis were carried out with the Policy Analysis Matrix (PAM) as an analytical framework.

The results showed that tradable inputs were not subsidised for cotton cultivation and farmers paid close to world prices for the inputs and only nominal protection was provided in the form of indirect subsidy on irrigation water. The cotton market was almost liberalised during the study period. Pakistan has a comparative advantage in the production of cotton in all its regions, at the Export Parity Price.

In the Risk analysis the Export Parity Price of cotton was estimated based on the mean risk price of cotton. Pakistan can earn more from the cotton and textile sector if the rules and regulations set under WTO are strictly followed by all developed countries. Pakistan has opened all its markets and also followed the AOA by reducing its market support and by lowering subsidies and tariffs.

For improvement in competitiveness and maintaining a comparative advantage in the sector two grey areas have to be worked out. First, the cost of production requires reduction through efficient utilisation of factors of production for which an efficient input delivery system is imperative; therefore black marketing, under weighing, sale of adulterated chemicals and substandard fertilisers require strict monitor-

ing. Special emphasis is required for ensuring the provision of good quality type seeds to the farmers. Second, the value of output needs to be enhanced through quality checks in total value chain encompassing production, processing and marketing practises. Therefore, "clean picking" and "better ginning" may be opted for improved quality of the produce. Market imperfections must be removed through marketing efficiency and institutionalisation of market intelligence. Further, the powerful syndicates of cotton may be regulated through anti-monopoly authority and commercial courts. The private sector should develop research capabilities and support advance research to develop high yielding, disease free and heat resistant varieties. To remain well informed the market actors and all the stakeholders should be provided training in the production, processing and the marketing of cotton products.

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