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Economic Efficiency and Distortions to Incentives in Production of Cotton and Rice Crops in Punjab

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Abstract:

The study based on crop budgets, for 2010-12 crops, was, inter alia, designed to examine economic efficiency and distortions in incentives to production of cotton and basmati rice, long grain aromatic rice, crops in Punjab. The analysis has confirmed the competitiveness of their production in Punjab as farmers' gross revenues from these crops exceeded their total costs, enabling farmers make some profit. The competitiveness, nevertheless, is sensitive to changes in prices of the produce and those of the inputs. The analysis conducted at economic prices have indicated economic efficiency and comparative advantage of Punjab in producing both basmati rice and cotton. The domestic resource cost coefficients for basmati as well as cotton were consistently less than one, confirming Punjab's comparative advantage and economic efficiency in their farming. The estimation and analysis of nominal projection coefficients and effective protection coefficients for basmati and cotton crops have indicated implicit taxation as well as some protection to domestic producers. The results of economic efficiency and comparative advantage, of both basmati and cotton, are quite sensitive to the fluctuations and developments in world markets with spill over to the domestic market, impacting their competitiveness.

Keywords: Domestic Resource Cost, Effective Protection, Agriculture Policy Matrix

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1. INTRODUCTION

Cotton and rice are the most important export crops of Pakistan. Annually planted over an area covering three million hectares, cotton is the 2nd largest and principal cash crop of the country. Cotton farming is the main source of raw material and mainstay for the textile sector— the major source of employment in large scale manufacturing in Pakistan. With annual production of cotton averaging over 2 million tons and ranking 4th in world cotton production, Pakistan is an important player in cotton markets. An important by-product of cotton production is cotton seed, which is widely used in the domestic vegetable oil and ghee industry to produce cooking oil. Cotton seed cake, obtained as a by-product of processing cotton seed in vegetable oil industry, is a valuable feed for livestock and dairy farming. Exports of cotton and its made-ups account for over 60 percent of the foreign exchange earned from exports of merchandize goods. Rice, with annual area exceeding 2.5 million hectares, is the 2nd most important food grain and the 3rd largest crop of the country. Pakistan is famous the world over for its production and exports of long grain aromatic rice-basmati. Pakistan also exports substantial quantity of coarse rice with total rice exports averaging 2.5 million tons in recent past [GoP (2012)]. Pakistan with its share of 11 percent in world rice trade of about 30 million tons per year is an active player in rice markets, ranking at 4-5 on world rice trade map. A good harvest of cotton and rice is imperative not only for the performance of agriculture in Pakistan but also for the robust growth in manufacturing and healthy balance of trade.

In view of their economic importance, production and marketing, rice and cotton have been subjected to several policy interventions in Pakistan, ranging from restrictions on their cultivation in certain districts/areas to zoning, and monopoly procurements in domestic markets and exports. There were also restrictions on the movement of basmati rice, requiring a permit from the Punjab Food Department for its movement. In 1974, Rice Export Corporation of Pakistan (RECP) was set up in the public sector and it had monopoly in rice exports. It also acted as the government agency for implementing official price support for rice through procurement operations [UCGL (1989)]. Rice Mills

were nationalized in 1976 and denationalized in 1977. Similarly, cotton ginning was nationalized in 1976 and denationalized in 1977 [Hamid, Ijaz and Anjum (1990)]. Cotton Exports Corporation (CEC), established in the 1974 had the monopoly over cotton exports which lasted until 1986-87 [Salam (2008)]. When CEC was formed it worked at two levels: as the main agency for the purchase of cotton from the farmers and as the exporter to international traders at government regulated prices [Altaf (2008)]. Cotton and rice exports were also subjected to export duty and other taxes [Salam (2008) and Altaf (2008)]. All these interventions in domestic marketing and trade of cotton and rice created many distortions in the cotton and rice sectors, impacting the structures of incentives and investments in these important sub-sectors of economy. Under the economic reforms initiated under structural adjustment program in 1985, many of these restrictions on marketing and trade of rice and cotton along with the RECP and CEC have been phased out and private sector fully taken over the marketing and trade in cotton and rice.

With their extensive forward and backward linkages production, processing and marketing of cotton and rice crops play a crucial role not only in agriculture but also in industrial growth, employment generation and balance of trade. Thus, it is important to examine and analyze their economic efficiency and ascertain incentives in their domestic production. The subject is of critical importance and interest for policy planners and those interested in the development of agriculture. There are not many studies on the subject and some of these are dated. Dorosh and Salam (2009), and Salam (2010)] in their analysis of economic protection and taxation of agriculture and important crops in Pakistan had, inter alia, examined the distortions in incentives to cotton and rice production and so did Hamid, Ijaz and Nasim (1990). Appleyard (1987) in his assessment of the comparative advantage of important crops in the 1980s also addressed the issue of protection to cotton and rice crops in Pakistan. Other recent studies relating to the topic are those by Akhtar, *et al.* (2007), Chaudhry, *et al.* (2009) and Quddus and Mustafa (2011). The present study has been designed to ascertain the efficiency of cultivation of cotton and rice and estimating distortions to incentives, if any, in the course of their production in the Punjab -- the largest producer of these crops in the country. Punjab with 84 percent of the cotton area

contributes about 75 percent of its total production. Its contributions in case of rice are estimated at 67 and 55 percent in area and production, while cultivation of long grain aromatic basmati rice is confined to Punjab only [GoP (2013)].

The organization of remaining paper is as follows: The Policy Analysis Matrix (PAM), the main plank of the analytical frame work used here to evaluate the economic efficiency and distortions in incentives to production of cotton and rice is explained in section 2. The data requirements of PAM are also discussed in section 2. The empirical results emerging from PAM are described at length in section 3. The paper sums up main results and their policy implications in section 4.

2. POLICY ANALYSIS MATRIX: METHODOLOGY AND DATA

2.1. Methodology

Enterprise budgets, providing details of various inputs used, their prices, outputs and prices thereof form the building blocks of policy analysis aimed at estimating their efficiency and related measures. These data are nevertheless to be transformed into various summary measures and indicators of profitability and efficiency. In this context Policy Analysis Matrix (PAM), developed by Monk and Pearson (1989), comes handy. The way PAM, given in Table 1, has been designed and constructed provides a detailed analytical framework, outlining its requirements of data and their arrangement, to estimate various indicators of financial and economic viability of given enterprises. PAM is also helpful in estimating various measures of protection such as nominal and effective protection coefficients, manifesting the impact of various interventions in input-output markets, providing clue to the nature of distortions in incentives to the enterprises under examination.

The indicators of private and social profitability, used to ascertain the efficiency and profitability of basmati rice and cotton and other measures of their comparative advantage are explained below:

Table 1. Policy Analysis Matrix (PAM)

Item	Revenue	Costs		Profit
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Divergence	I	J	K	L

Source: Monke and Pearson (1989).

- **Private Profit,** D = A – (B+C), measures the private profitability and competitiveness of a given enterprise at market prices of inputs and output. A positive value of D is indicative of the enterprise's private profitability and its financial viability.
- **Output – Input Ratio** = Gross income / gross costs = A / (B+C). It is an overall measure and indicator of relative efficiency and profitability of the enterprises under reference.
- **Profitability Ratio.** In terms of the symbols used in Table 1, it is: C / (A-B), providing an estimate of cost of domestic factors per unit of value added at private prices. It is a useful measure for ranking private profitability and financial viability of different crops and other farm enterprises.
- **Social Profit** for a given enterprise is evaluated at social / economic prices of inputs and outputs. For economic viability of a given enterprise its social profit: as indicated by H = (E-F-G), in Table 1, must be positive.
- **Domestic Resource Cost:** It is the cost of domestic factors used in production of a commodity per unit of the foreign exchange earned from its increased exports or saved through its import substitution. DRC is the ratio between cost of domestic factors and value added at social prices, G / (E-F). In case DRC > 1 the country does not have comparative advantage in domestic production of the commodity and when DRC < 1 the country enjoys comparative advantage.
- **Nominal Protection Coefficient (NPC):** It is the simplest measure of protection. It is calculated by dividing the domestic market prices of a commodity by its international prices adjusted for domestic marketing costs, or P_{di} / P_{wi}, where P_{di} is the domestic price of the commodity and P_{wi} is the corresponding social (world) price. In

terms of the symbols used in Table 1, it is obtained by calculating the ratio between A and E, i.e., dividing total revenue estimated at actual market prices by the total revenue evaluated at social prices. When NPC > 1, domestic production enjoys protection and a value of NPC < 1 implies implicit taxation and discouragement to domestic producers.

- **Effective Protection Coefficient (EPC):** It measures the net effect of interventions in factor inputs and output markets. It is calculated by taking a ratio between the values added by an enterprise at private prices and at social prices, i.e., (A – B) / (E- F). The interpretation of EPC is similar to that of the NPC discussed earlier.

The formulae for estimating different coefficients as given above are based and adapted from the discussions in Scandizzo and Bruce (1980) and Monke and Pearson (1989).

2.2. Data for Constructing PAM

Data for filling in various cells of PAM, as outlined in Table 1, were adapted from the cost of production estimates of basmati rice and cotton crops reported in the respective Policy analysis reports of the Agriculture Policy Institute. These data were supplemented, where needed, from the analysis and information presented in the unpublished M. Phil thesis of Tufail (2014). Data on output prices were also supplemented with the information provided in the Statistical Appendix of Pakistan Journal of Agricultural Economics January 2012 issue and some of the economic prices were estimated by the authors from the data on international prices of cotton and rice reported in Pakistan Economic Survey. Based on these data, as explained above, PAM for basmati rice and cotton were constructed and are given at Annexes 1-3. Data used in the study relate to 2010-2012 crop years, which are characterized by considerable variation in input and output prices, the main reason for selecting period of study.

Farm inputs used in production of rice and cotton for use in constructing PAM are divided into tradable and non-tradable. The prices of inputs and outputs for use in policy analysis matrix were

categorized into market / private and social / economic prices as explained below:

- **Tradable Inputs:** They include all those inputs which were either purchased or can be traded in the international market. In our analysis these are seed, chemical fertilizers, pesticides, services of farm machinery, i.e., tractor, thresher, tube well, etc.
- **Non-Tradable Inputs/Domestic Factors:** They include land, labour, and farm yard manure and canal water.
- **Private Prices** are the market prices actually paid by the farmers for their purchases of inputs and received for their produce.
- **Social Prices of Inputs and Outputs:** These were worked back from the actual international prices of various inputs and outputs accounting for costs and margins entailed in their marketing and distribution.

3. RESULTS FROM POLICY ANALYSIS MATRIX

From the data in Annexes 1-3, indicators of private profitability, economic efficiency and comparative advantage and distortions to incentives, as detailed above, were estimated. These indicators are explained here under along with their implications for distortions in incentives in cotton and rice farming in Punjab.

3.1. Private Profitability and Competitiveness

The market prices reflect the underlying economic costs and valuation and the effects of all policies and market failures [Monke and Pearson (1989)]. The private profitability of rice and cotton crops in the Punjab is reflected by the positive values in the second column of Table 2, showing their competitiveness all along for the period under reference. As the gross revenues accruing to the producers from the sale proceeds of each crop were higher than the total costs entailed in the use of tradable and non- tradable factors producers received above normal returns to their investment in producing these crops.

In view of the varying use levels of farm inputs and differences in durations of growing periods of cotton and rice, resulting in a lot of

variation in their overall investment, absolute values of profits may not be appropriate for comparing their profitability. To overcome this limitation, we estimated the ratio of the domestic factors' costs to the value added at private prices in production of cotton and rice. The ratio between the costs of domestic factors and value added at private prices shows how much a given enterprise can afford to pay domestic factors and still remain competitive [Monke and Pearson (1989)]. Assuming cost minimization behavior of farmers, lower the ratio between cost of domestic factors and the value added, higher the profitability ranking of that crop / enterprise. The input-output coefficients may also change on account of technological development and result in changing use level of inputs and resulting output. But this is more likely to happen in the long run or in period of rapid technological changes. Thus, to account for the impact of varying levels of total investments on crop profitability we have estimated the ratios between total revenues and total costs, i.e., output–input ratio to estimate the relative efficiency and overall rate of return to the costs incurred in the process. To account for the impact of price fluctuations on profitability and relative positions output input ratios were calculated for three crop years. The results of these estimate-ions are also given in Table 2.

During 2009-10 crop year, cotton farming experienced higher ranking in terms of domestic factors' cost per unit of value added as compared to basmati rice. The analysis based on the ratio between total revenue and total costs also confirmed this ranking and indicated higher returns to investment in cotton farming as compared to those of basmati rice. During 2010-11, there was a dramatic improvement in the ranking of cotton as the ratio of domestic factors' cost to value added at domestic prices declined from 0.45 in 2009-10 to 0.21 in 2010-11. There was a marginal improvement for basmati rice as well. The output input ratio for cotton also increased from 1.57 in 2009-10 to 2.76 in 2010-11, while that of rice improved from 1.18 to 1.22. The situation in 2011-12 crop year witnessed a significant change in the economics of both cotton and rice, as the prices received by cotton growers fell sharply; from Rs.4,003 per 40 kg in 2010-11 to Rs.2,558 in 2011-12 while those of basmati paddy increased from Rs.1,320 per 40 kg to Rs.1,424. As the input prices of various inputs were on the rise profitability of both cotton and rice are

estimated to have declined during 2011-12 crop year. These results of profitability and competitive analyses suggest only the absolute values of profits accruing from these crops and their relative rankings being also quite sensitive to the fluctuations in output prices.

Table 2. Private Profitability and Competitiveness of Basmati and Cotton Crops: 2010 to 2012

Crop and Crop Year	Private Profit	Private - Cost Ratio	Output - Input Ratio
	Rs. / acre	C/(A-B)	A/(B+C)
2009-10:			
Basmati	3,981	0.75	1.18
Cotton	12,045	0.45	1.57
2010-11:			
Basmati	5,585	0.70	1.22
Cotton	43,774	0.21	2.76
2011-12:			
Basmati	768	0.96	1.02
Cotton	13,916	0.50	1.46

Note: (1) Private profit = Gross revenue at private prices minus total costs; (2) Private cost ratio is the ratio of non-tradable costs to the value added at private prices; and (3) Output - input ratio is the ratio between gross revenue and total costs, both estimated at private prices.

3.2. Economic efficiency and Social profitability

Social profits defined as social revenue less social costs, measure efficiency or comparative advantage of a production system or farm enterprise [Monke and Pearson (1989)]. Data relating to social profits from cotton and rice production and their domestic resource cost coefficients are set out in Table 3. The economic or social prices as used in the analysis presented in this paper are based on the actual respective export prices of basmati rice and cotton. In addition, as cotton has been imported in large quantities in the recent past, its economic prices were also calculated from its actual import prices. There is a substantial difference in the economic prices, as calculated from the export or import prices of cotton and both were used to ascertain the economic efficiency of cotton. The results of this analysis are presented in Table 3 and discussed in the following paras.

Table 3. Social Profits and Domestic Resource Costs of Basmati and Cotton : 2010 to 2012

Crop and Crop Year	Social Profit Rs. /acre	DRC
2009-10:		
Basmati – export price	9,197	0.64
Cotton – export price	1,294	0.92
Cotton – import price	18,923	0.43
2010-11:		
Basmati – export price	3,614	0.84
Cotton – export price	46,013	0.27
Cotton – import price	67,875	0.20
2011-12:		
Basmati – export price	(6,549)	1.38
Cotton – export price	(7,414)	1.44
Cotton – import price	23,696	0.51

Note: (1) Social profit = Gross revenue - total costs of tradable and non-tradable inputs, all estimated at social/economic prices; (2) Social prices of basmati and cotton export were estimated from their actual export prices; (3) As large quantity of cotton has been imported, its social prices also estimated from import prices and used here; (4) Data in cotton export and cotton import rows based on its export and import parity prices; and (5) The values in parentheses are in negative, indicating negative profitability.

The respective values of social profits, for both cotton and basmati rice, for the 2009-10 and 2010-11 crop years, were positive. Thus, cultivation of these crops was economical from the national perspective. In other words, Punjab enjoyed economic efficiency and had comparative advantage in cultivation of both cotton and rice during these two crop seasons. However, the absolute values of social profits of rice and cotton, as reported in Table 3, reflect vast differences. This is mainly on account of the varying intensity of factor inputs use and varying periods of crop duration, resulting in varying levels of farm investment values. To overcome this problem we have estimated domestic resource cost coefficients for both cotton and rice. The DRCs measure the country's international comparative advantage in production and foreign exchange generating capacity of specific production activities [FAO (1991)]. Appleyard (1987) noted since DRC coefficient shows the domestic resource costs incurred per unit of foreign exchange earned or

saved, when DRC for a given commodity is less than 1, (DRC < 1), the country has comparative advantage in its produc-tion and vice versa.

The DRCs estimated for both cotton and rice, for 2009-10 crop year, were less than one (<1), thus Punjab had a comparative advantage in their production. These results also indicated economic efficiency of Punjab in the cultivation of these export crops. However, there was wide difference in the DRC coefficients of the two crops, impacting their economic rankings. During the next crop season, 2010-11, the world prices of cotton witnessed a significant increase that translated into much higher economic prices in relation to the last season; (Rs. 4, 647 / 40 kg in 2010-11 as compared to 1,709 in 2009-10). However, export parity price of basmati paddy in 2010-11 declined, (from Rs. 1,511 per 40 kg in 2009-10 to Rs. 1, 480 in 2010-11) due to lower export prices of basmati rice obtaining in export markets (Table 4). Accordingly, economic position of cotton as reflected in its higher social profits in 2010-11 was strengthened over that of 2009-10 but that of basmati rice weakened. Nevertheless, rice continued to enjoy economic viability and social profitability as reflected by its positive values of social profit. In view of the contrasting changes in their economic prices during 2010-11, as explained above, comparative advantage of cotton as reflected in its declining domestic resource cost coefficient also improved over that of basmati rice. Although, DRCs for both cotton and rice in 2010-11crop year, estimated at 0.27 and 0.84, respectively, indicative of their comparative advantage in export markets their relative positions vis-a-vis each other had changed considerably due to the varying developments in international markets. In view of these DRC estimates, cotton had a much higher comparative advantage as it required 66 percent less domestic resources to earn one unit of foreign exchange as compared to that of rice.

For the 2011-12 crop, the economic position of both cotton and rice, deteriorated sharply as their international prices precipitated and translated into much lower economic prices in relation to the last year (cotton Rs.2,416 and basmati paddy at Rs.1,392 per 40 kg). The social profitability of both cotton and rice when evaluated at export parity prices was negative as the gross revenue at social prices was less than the total costs expended by the society in their farming. The DRC

coefficients of cotton and rice, as estimated from their respective export parity prices, during 2011-12 were 1.44 and 1.38; exceeding one (DRC >1) by a substantial margin and reflecting comparative disadvantage in world trade/markets. This dramatic turnaround in the economic fortunes of two of the most important cash and export commodities of Pakistan was primarily triggered by the sharp fall in their export prices.

Table 4. Prices of Output and Important Inputs

Item	2009-10	2010-11	2011-12
Seed Cotton: (Rs / 40 kg):			
Market price	1,916	4,003	2,558
Import parity price	2,746	5,933	4,264
Export parity price	1,709	4,647	2,416
Basmati paddy:(Rs /40 kg):			
Market price	1,097	1,320	1,424
Export parity price	1,511	1,480	1,392
Input Prices:			
Labour wage rate: Rs./ day	220	250	300
Urea : Rs./ bag	784	878	1,182
DAP: Rs./ bag	1,896	2,629	4,067
Ploughing: Rs./ acre	300	400	500

Note and data sources: (1) Market prices of seed cotton and paddy adopted from API's Policy reports and Pakistan Journal of Agricultural Economics issue of January 2012; (2) Export parity price of paddy for 2009-10 and 2010-11 from Pakistan Journal of Agricultural Economics issue of January 2012 and that for 2011-12 estimated by the authors from the exports data. Prices rounded off to whole numbers; (3) Export and import parity prices of seed cotton estimated by the authors from the actual exports and import prices of cotton; and (4) Input prices from the crop budgets as reported in API Policy reports.

As Pakistan in the recent past has inter alia imported large quantities of cotton we have also estimated its import parity prices, besides export parity, from the actual import prices to reflect the opportunity cost of its domestic production. It may be pointed here that in such a situation, export parity price is always less than its import parity price and thus use of import parity prices in the economic analysis, when so warranted, will improve the economic position of the commodity under reference.

The results of comparative analysis, as discussed above, are sensitive to the changes in international commodity prices. The comparative advantage and economic efficiency of Punjab in production of basmati rice and cotton, though well established and robust for 2009-10 and 2010-11, was threatened during 2011-12 when export prices fell

sharply. Thus, here is a lesson for all those concerned with agricultural development in general and cotton and rice in particular. The lesson is to keep a continuous watch on the developments in international markets and monitor and analyze the commodity prices and advise the concerned quarters of the emerging policy challenges facing the country in world markets.

The results of empirical analysis presented here are in line with those published by Appleyard, based on crop budgets of the 1980s [Appleyard (1987)]. The comparative advantage of both rice basmati and cotton in Punjab-Pakistan was ascertained on the basis of their social prices, estimated as export parity prices from their corresponding export prices. Thus, increasing production and exports of cotton and basmati rice in the province is an economic proposition and in the country's interest. These results are similar to those reported by Chaudry, *et al.* (2009) in their study of cotton in Punjab.

3.3. Distortions to incentives

To examine the situation of incentives to domestic production of cotton and rice and distortions thereof, their nominal and effective protection coefficients were estimated. These coefficients are presented in Table 5. The nominal protection coefficient for seed cotton for 2009-10 crop was greater than one, (>1). Thus, domestic market prices of seed cotton as received by growers were higher than the corresponding world prices. The producer prices of seed cotton in domestic market, on the average, exceeded export parity prices by about 12 percent. The effective protection coefficients for cotton, which reflect the net effect of v interventions in factor inputs and output markets, also endorsed the contention of protection and incentive to cotton producers. It needs to be mentioned here that there is a vast domestic market for cotton feeding the domestic textile industry and competing with exports for quality cotton, offering attractive prices for the produce. Nevertheless, producer prices of seed cotton were considerably less than its corresponding economic prices worked back from the actual import prices of lint. The NPC and EPC for seed cotton based on its import parity prices worked

back from its actual import prices were respectively 0.70 and 0.66, indicating implicit taxation of domestic production.

The NPC for basmati rice during 2002-10 crop year, estimated at 0.74 was less than one, (<1), indicating 26 percent implicit taxation of domestic production. Taxation of basmati as estimated from its EPC increased to 36 percent, reflecting the net outcome of government interventions in farm input and output markets. The implicit taxation of basmati rice and resource transfers from basmati farmers have also been reported by the earlier studies on the subject; Appleyard (1987), GoP (1988) Hamid, Ijaz and Nasim (1990), Akhtar, *et al.* (2007), Chaudhry, *et al.* (2009), Dorosh and Salam (2009), Salam (2009 and 2010), and Qudus and Mustafa (2011).

Table 5. Nominal and Effective Protection Coefficients in Rice and Cotton Production:
2010 to 2012

Crop and Crop Year	NPC	EPC
2009-10:		
Basmati paddy	0.74	0.64
Seed cotton 1	1.12	1.42
Seed cotton 2	0.70	0.66
2010-11:		
Basmati paddy	0.90	0.84
Seed cotton 1	0.86	0.88
Seed cotton 2	0.68	0.65
2011-12:		
Basmati paddy	1.02	1.05
Seed cotton 1	1.06	1.66
Seed cotton 2	0.61	0.58

Note: Coefficients of basmati paddy based on economic prices estimated from export prices of long grain aromatic rice.
Seed cotton 1 coefficients are based on export parity prices of cotton as estimated from its export prices.
Seed cotton 2 coefficients are based on import parity prices of cotton as worked base from its actual import prices.

The NPCs and EPCs calculated from the PAM for cotton for the 2010-11 crop year, based on its import parity prices, like the ones discussed for the previous crop, indicate continued implicit taxation of domestic production. As the international prices of cotton scaled new heights, its export parity prices experienced a quantum jump. The domestic prices of seed cotton also rose in tandem with the world prices

but were considerably less than the corresponding export parity prices. Thus NPC of seed cotton was estimated at 0.86 while its EPC was 0.88. As these estimates of NPC and EPC, both based on export and import parity prices, were less than one, domestic production of cotton during 2010-11 crop year was subjected to implicit taxation, ranging from 12 to 35 percent. The, NPC and EPC for basmati paddy estimated at 0.90 and 0. 84 respectively, being less than one, (< 1), indicated continued taxation of basmati producers during 2010-11. However, incidence of implicit taxation of rice basmati, as reflected by the higher values of its NPC and EPC in relation to previous crop year, declined to 10-16 percent as compared to 26-36 percent in 2009-10 crop year.

The situation of incentives for basmati crop during 2011-12 season as reflected by its NPC and EPC estimates of 1.02 and 1.05 reflected marginal protection to domestic producers as the prices received by them were somewhat higher than the corresponding economic price as worked back from export prices. Thus there was a qualitative change from previous years of its high implicit taxation. For cotton crop with NPC and EPC estimates of 0.61 and 0.58, calculated from the import parity prices, the implicit taxation as observed in previous years continued. Nevertheless, the situation of implicit taxation of domestic cotton production changed into protection when economic prices of domestic cotton were worked back from its actual export price as the NPC and EPC calculated at 1.06 and 1.66, respectively, from the 2011-12 crop data were greater than one. These results are similar to those reported by Qudus and Mustafa (2011) for cotton in their study of comparative advantage of major crops in Punjab.

Both cotton and rice are important export crops of Pakistan. There is also an active domestic market for both cotton and rice as substantial proportion of the domestic production of cotton is processed into various products in domestic textile industry. Similarly, a considerable proportion of domestic production of long grain aromatic basmati rice is consumed domestically. Accordingly, there is active trading of these commodities in domestic market, and competition between domestic and export markets for cotton and rice aligning the trends in domestic market prices with the developments in world markets. This is amply borne out by the wide fluctuations in the values

of protection coefficients estimated from the annual data. These fluctuations in prices add to the risk and uncertainty, hallmark of agriculture and crop production and underline the need for adopting such measures as to minimize the adverse effects on domestic production emanating from the price fluctuations in world markets.

The results of PAM as reported in this paper depend not only on the technical efficiency of farmers but also on the structure and functioning of inputs and output markets. The construction of PAM is also quite demanding in terms of its data, requiring a good understanding of the technical details of the enterprises under examination and conceptual issues entailed in classification of various inputs and estimation of economic prices. The results are also sensitive to the trade orientation of a given commodity, whether imported or exported as it impacts on the level of resulting opportunity cost of the domestic produce which is also influenced by the supporting infrastructures in the domestic markets. The results, as highlighted by the changes in the annual estimates of different indicators, are quite sensitive to the developments in international and domestic markets, thus need to be interpreted with care, keeping in view the organization of domestic markets and their linkages with the commodity markets at large.

4. CONCLUSION

Analysis of crop budgets for basmati rice and cotton, 2010 to 2012 crops, has confirmed competitiveness of their production in Punjab. The degree of competitiveness however remains sensitive to fluctuations in input and output prices. Farmers' total revenue exceeded their gross costs incurred in the production of cotton and rice. The surplus revenue however fluctuated from year to year, impacting the extent of competitiveness. The domestic resource cost coefficients, for both the crops, though varying from year to year, were consistently less than one. Thus, results of economic analysis confirm their comparative advantage and economically efficient production in Punjab.

The estimation and analysis of NPCs and EPCs for basmati and cotton crops have indicated implicit taxation as well as some protection to domestic producers. Nevertheless the extent of taxation and protect-

ion, as manifested by varying size of the NPC and EPCs, keeps on changing with the developments in world commodity markets and their spill over to domestic market. The comparison of domestic prices of seed cotton with corresponding world prices, worked back from export prices of lint has indicated some protection to cotton production during some of the crop years but implicit taxation when comparison is based on economic prices estimated from actual import prices of cotton.

As per results of the analysis presented in this paper, basmati rice and cotton have been generally subjected to implicit taxation, intensity varying from year to year due to changes in domestic and world prices. The earlier studies by Appleyard (1987), Hamid, Nabi and Nasim (1990), GoP (1988), Dorosh and Salam (2009), Salam (2009), Chaudhry, *et al.* (2009), Qudus and Mustafa (2011), had also reported significant implicit taxation of basmati and cotton crops. Much water has since passed under the bridge. Economic reforms and policy initiatives resulting into dwindling role of the public sector and increasing role of private sector in farm output and input markets have been undertake. Nevertheless, domestic producers of basmati and cotton continue to be implicitly taxed, resulting in large resource transfers, adversely impacting producer incentives, farm investments and efforts aimed at alleviating rural poverty.

Punjab has a comparative advantage in production of both basmati rice and cotton, important export crops. Their producers and production need all the encouragement through research and development efforts. Implicit taxation of domestic production and resource transfers from farmers need to be arrested.

Under the 18th Amendment, in 2011, agriculture as a subject has been devolved to the provinces [GoP (2011)]. Since basmati rice and cotton are the two most important export crops of the Punjab, the provincial Department of Agriculture should make all-out efforts to ensure competition in the markets, improve marketing infrastructure and market intelligence to help farmers get better prices for their produce. Efforts also need to be directed to improve the processing of paddy and ginning of seed cotton so as to fetch higher prices in the world markets. Since basmati rice and cotton are two most important exports, their domestic prices are bound to reflect the developments in world markets.

Excessive fluctuations in market prices, however, would have adverse implications for resource use and productivity, farm incomes and household welfare. Ways and means ought to be found and steps taken to insulate domestic producers from excessive fluctuations in market prices. However, this is predicated on the availability and development of institutional capacity to continuously monitor and analyze the developments in the domestic and world markets.

ANNEXES

Annex 1: Policy Analysis Matrix for Basmati Paddy: 2010-12

Crop Year	Gross Revenue	Tradable Inputs Cost	Domestic Factors' Cost	Profit
		Rs./Acre		
Private Prices	25,634.00	9,392.00	12,261.00	3,981.00
Social Prices	34,742.00	9,374.00	16,171.00	9,197.00
Transfers	(9,108.00)	18.00	(3,910.00)	(5,216.00)
2010-11:				
Private Prices	30,840.00	12,295.00	12,960.00	5,585.00
Social Prices	34,360.00	12,385.00	18,361.00	3,614.00
Transfers	(3,520.00)	(90.00)	(5,401.00)	1,971.00
2011-12:				
Private Prices	33,828.00	15,635.00	17,425.00	768.00
Social Prices	33,124.00	15,756.00	23,917.00	(6,549.00)
Transfers	704.00	(121.00)	(6,492.00)	7,317.00

Note: Basic data used in these calculations are adopted from the crop budgets as reported in API's Policy reports, prices data supplemented with other sources as indicated in the text.

Annex 2: Policy Analysis Matrix for Seed Cotton Based on Its Export Parity Prices: 2010-12

Crop Year	Gross Revenue	Tradable Inputs' Cost	Domestic Factors' Cost	Profit
		Rs./Acre		
2009-10:				
Private Prices	33,032.00	11,121.00	9,866.00	12,045.00
Social Prices	29,513.00	14,056.00	14,163.00	1,294.00
Transfers	3,519.00	(2,935.00)	(4,297.00)	10,751.00
2010-11:				
Private Prices	68,626.00	13,179.00	11,673.00	43,774.00
Social Prices	79,574.00	16,733.00	16,828.00	46,013.00
Transfers	(10,948.00)	(3,554.00)	(5,155.00)	(2,239.00)
2011-12:				
Private Prices	44,186.00	16,136.00	14,134.00	13,916.00
Social Prices	41,772.00	24,855.00	24,331.00	(7,414.00)
Transfers	2,414.00	(8,719.00)	(10,197.00)	21,330.00

Note: Basic data used in these calculations are adopted from the crop budgets as reported in API's Policy reports, prices data supplemented with other sources as indicated in the text.

Annex 3: Policy Analysis Matrix for Seed Cotton Based on Its Import Parity Prices: 2010-12

Crop Year	Gross Revenue	Tradable Inputs' Cost	Domestic Factors' Cost RS/Acre	Profit
2009-10:				
Private prices	33,032.00	11,121.00	9,866.00	12,045.00
Social prices	47,142.00	14,056.00	14,163.00	18,923.00
Transfers	(14,110.00)	(2,935.00)	(4,297.00)	(6,878.00)
2010-11:				
Private prices	68,626.00	13,179.00	11,673.00	43,774.00
Social prices	101,436.00	16,733.00	16,828.00	67,875.00
Transfers	(32,810.00)	(3,554.00)	(5,155.00)	(24,101.00)
2011-12;				
Private Prices	44,186.00	16,136.00	14,134.00	13,916.00
Social prices	72,882.00	24,855.00	24,331.00	23,696.00
Transfers	(28,696.00)	(8,719.00)	(10,197.00)	(9,780.00)

Note: Basic data used in these calculations are adopted from the crop budgets as reported in API's Policy reports, prices data supplemented with other sources as indicated in the text.

REFERENCES

API (2010) Rice Paddy Policy Analysis for 2009-10 Crop. Agriculture Policy Institute, Islamabad.

API (2010a) Rice Paddy Policy Analysis for 2009-10 Crop. Agriculture Policy Institute, Islamabad.

API (2011) Cotton Policy Analysis for 2011-12 Crop. Agriculture Policy Institute, Islamabad.

API (2011a) Rice Paddy Policy Analysis for 2011-120 Crop. Agriculture Policy Institute, Islamabad.

Akhtar,W., M. Sharif, and N. Akmal (2007) Analysis of Economic Efficiency and Competitiveness of the Rice Production Systems of Pakistan's Punjab. *The Lahore Journal of Economics, 12:1, 141-153.*

Altaf, Z. (2008) Challenges in the Pakistan Cotton, Yarn, Textile and Apparel Sectors". In "Cotton-Textile-Apparel Sectors of Pakistan. *Situations and Challenges* Faced. Cororaton, B. Caesar,

et al. (eds.) IFPRI Markets, Trade and Institutions Division. Discussion Paper 00800, 52-98, September 2008.

Amin, M. (2012) Statistical Appendix. *Pakistan Journal of Agricultural Economics*, 63:3, 627-638.

Appleyard, D. (1987) Comparative Advantage of Agricultural Production Systems and Its Policy Implications in Pakistan. FAO Economic and Social Development Paper No. 68, Rome.

Chaudry, I. S., M. B. Khan, and M. H. Akhtar (2009) Economic Analysis of Competing Crops with Special Reference to Cotton Production in Pakistan: The Case of Multan and Bahawalpur Regions. *Pakistan Journal of Social Sciences*, 29:1, 51-63.

Food and Agriculture Organization (1991) Economic Analysis of Agricultural Policies: A Basic Training Manual with Special Reference to Price Analysis. Training Materials for Agricultural Planning No. 30, Rome.

GoP (1988) Report of the National Commission on Agriculture. Government of Pakistan.

GoP (2011) Notification No. 4-9/2011—Min I. Cabinet Division, Government of Pakistan, June 29.

GoP (2012) Pakistan Economic Survey (Statistical Supplement): 2011-12. Ministry of Finance, Government of Pakistan, Islamabad

GoP (2013) Agricultural Statistics of Pakistan 2011-12. Government of Pakistan.

Hamid, N., I. Nabi, and A. Nasim (1990) Trade, Exchange Rate and Agricultural Pricing Policies in Pakistan (The Political Economy of Agricultural Pricing Policy). Washington, D.C.: The World Bank.

Monke, E. A. and S. R. Pearson (1989) The Policy Analysis Matrix for Agricultural Development. Ithaca and London: Cornell University Press.

Quddus, M. A. and U. Mustafa (2011) Comparative Advantage of Major Crops Production in Punjab: An Application of Policy Analysis Matrix. *The Lahore Journal of Economics*, 16: 1, 63-94.

Salam, A. (2008) Production, Prices and emerging Challenges in the Pakistan Cotton Sector. In Cotton-Textile-Apparel Sectors of Pakistan. *Situations and Challenges* Faced. Cororaton, B. Caesar,

et al. (eds.) IFPRI Markets, Trade and Institutions Division. Discussion Paper 00800, 52-98, September 2008.

Salam, A. (2009) Distortions in Incentives to Production of Major Crops in Pakistan: 1991-2008. *Journal of International Agricultural Trade and Development,* 5:2, 185-208.

Salam, A. (2010) Distortions in Prices of Food grains in Pakistan: 1996-2006. *Pakistan Journal of Applied Economics,* 1:2, 13-28.

Scandizzo, P. L. and C. Bruce (1980) Methodologies for Measuring Agricultural Price Intervention Effects. *World Bank Staff* Working Paper No. 394. Washington, D.C.: The World Bank.

Tufail, S. (2014) Comparative Advantage of Major Crops in Punjab, Pakistan: An Application of Policy Analysis Matrix. M.Phil. Thesis submitted to Federal Urdu University of Arts, Science and Technology, Islamabad.