

# **SANEI WORKING PAPER SERIES**

**No. 12 - 09**

## **EVALUATING GLOBAL COMMODITY PRICE FLUCTUATION AND ITS IMPLICATION FOR PAKISTAN AGRICULTURE: AN APPLICATION OF POLICY ANALYSIS MATRIX**

**USMAN MUSTAFA  
MUHAMMAD A QUDDUS**



**South Asia Network of Economic Research Institutes**

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**Usman Mustafa**

Pakistan Institute of Development Economics (PIDE), Pakistan  
[usman@pide.org.pk](mailto:usman@pide.org.pk)

**Muhammad A Quddus**

Punjab Economic Research Institute, Pakistan

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### **South Asia Network of Economic Research Institutes**

SANEI Secretariate, 1st Floor, Bangladesh Institute of Development Studies  
E-17 Agargaon, Sher-e-Bangla Nagar, GPO Box # 3854, Dhaka-1207, Bangladesh  
Telephone: +88-02-9118324, Fax: +88-02-8181237  
W: [www.saneinetwork.net](http://www.saneinetwork.net), E: [saneibd@gmail.com](mailto:saneibd@gmail.com)

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Samiul Ahsan

**Page layout**  
Samiul Ahsan

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# **EVALUATING GLOBAL COMMODITY PRICE FLUCTUATION AND ITS IMPLICATION FOR PAKISTAN AGRICULTURE: AN APPLICATION OF POLICY ANALYSIS MATRIX**

USMAN MUSTAFA  
MUHAMMAD A QUDDUS

## **SECTION 1 INTRODUCTION**

### **1.1 Agriculture in the Economy of Pakistan**

The agriculture sector is still one of the largest sectors of Pakistan's economy ahead of manufacturing, and accounts for 21 percent of GDP. It accounts for 45 percent of the total employed labour force, and is the largest source of foreign exchange earnings. It also contributes to growth by providing raw material as well as being a market for industrial products. Over the last one decade, i.e. 1990s agriculture grew at an annual average rate of 4.4 percent per annum and during 2000's 3.2 percent while it was as high as 5.4 percent during 1980's. Wheat, rice, cotton and sugarcane account for 91 percent of value added in major crops. Thus, the four major crops (wheat, rice, cotton and sugarcane), on average, contribute 31.7 percent to value added in overall agriculture (Government of Pakistan, 2010).

### **1.2 Problem Specification**

In most of the developing countries, social or economic profitability deviates from private profitability because of distortions in factor and output markets, externalities and government policy interventions that tend to distort relative prices. It is, therefore, necessary to assess the comparative advantage of the production of major crops in Pakistan. It may be emphasized that the analysis of this comparative advantage can help in deriving meaningful policy conclusions on how to transform the farming system towards more efficient crops activities under the Global price fluctuating situation.

The downward trend of real food prices for the past 25 years came to an end when world prices started to rise in 2006 and escalated into a surge of price inflation in 2007 and 2008. Prices of staple foods, such as rice and vegetable oil, doubled between January and May 2008 (Mulat et. al., 2009). At the beginning of 2008, real prices reached their highest level in nearly 30 years. Projections suggest that they are likely to remain relatively high in the next few years, although at a lower level. Much will depend on how global supply will respond and on whether demand will continue to grow as rapidly as in the recent past (FAO, 2008). All these have profound impact on developing countries including Pakistan under the international rules and regulations.

Pakistan, as a member of the WTO, is committed to the rules and regulations that the Uruguay Round (UR) applied to agriculture. The commitments cover a wide range of topics including those in the area of domestic support, market access and export subsidies in agriculture. The potential benefits of the UR Agreements for Pakistan would emerge from the trading regime in its present form and the potential trading opportunities for both import substitution and export promotion in Pakistan. However, eventually, whether or not a country can take advantage of the new trading opportunities would depend upon its comparative advantage, without subsidies or with limited subsidies that are permitted for all trading

partners by the rules governing the new trading environment. Therefore, an assessment of the comparative advantage of which crops to produce either for import substitution or export can be helpful in this regard. The principal objectives of this study were to a) determine comparative advantage and competitiveness of major crops (Wheat, Rice, Sugarcane, Cotton) in Pakistan under the Global price fluctuation, b) assess whether Pakistan qualifies for export of wheat, rice, sugarcane and cotton and/ or should produce wheat, rice, sugarcane and cotton as an import substituting strategy, c) measure the effect of policy incentives that might have favored or discriminated against crop production, and d) to analyze the impacts of Global commodity prices trends and their implications for Pakistan agriculture.

## SECTION 2

### REVIEW OF LITERATURE

A study entitled “Comparative Advantages of Selected Syrian Agro-food Commodity Chains: Implication for Policy Formulation” was carried out by the National Agricultural Policy Centre (NAPC) with the assistance of FAO of the United Nations (FAO, 2004). The comparative advantage of productive systems is measured through the Policy Analysis Matrix (PAM), three lines by three column table containing all the different accounting values and derived ratios needed for the analysis of the comparative advantage.

A study on “Economic Incentives and comparative advantage in Indonesian Food Crop Production” was conducted at IFPRI by Gonzales, et al. (1994). This study examined trend in government policies and production of five major food crops- rice, corn, soybean, sugar, and cassava; and analyzed the effect of government input- output pricing policies on domestic production, incentives for these crops; and assessed their relative comparative advantage under three trade regimes: import substitution, interregional trade and export promotion. The measures used to assess economic incentives include direct, indirect, and total nominal and effective protection rates. This study finds that Indonesian rice has comparative advantage as an import substitute but not as an export crop because of poor quality and a thin world rice market. Corn is the most efficient of the five crops as an import substitute. If corn productivity continues to improve, it could become competitive as an export crop. Soybean production despite rapid expansion is not efficient. Sugar is also economically inefficient.

Khan and Ashiq (2004) in their study on Comparative Advantage of Cotton Production in Pakistan” using Policy Analysis Matrix (PAM) concluded that there was a strong national comparative advantage in seed cotton production. The study further revealed that Sindh has regained its historical dominance over Punjab in the crop by making quantum jump in yield from 1997 onward. The Nominal Protection Coefficients indicated that seed cotton production in Pakistan is heavily taxed. The finding of the paper suggested that to exploit available potential in cotton cultivation to cater to local needs and earn foreign exchange, concerted efforts need to be made to improve performance of the production and processing sectors.

Nelson and Panggabean (1991) in their study on “The Cost of Indonesian Sugar Policy: A Policy Analysis Matrix Approach” found that the Indonesian sugar policy is a complex web of contradictory policies, including mandatory production, price supports, and fertilizer and credit subsidies. The policy analysis matrix (PAM) was developed by Monke and Pearson to provide a more complete perspective on social profitability and the divergence between and social costs than other commonly used social cost-benefit measures.

Shahabuddin and Dorosh (2002) conducted a study on comparative advantage in Bangladesh Crop Production and observed that the economic profitability analysis demonstrates that Bangladesh has a comparative advantage in domestic production of rice for import substitution. However, at the export parity price, economic profitability of rice is generally less than economic profitability of many non-rice crops, implying that Bangladesh has more profitable options other than production of rice for export.

Tweeten (1986) in his study on “Impact of Domestic Policy on Comparative Advantage of Agriculture in the South” concluded that the South and the United States have a comparative advantage in grains and soybeans. Judging by supply demand and by input and output prices under more normal circumstances but with open markets, the South does not have a comparative advantage in production of sugar, wool, and manufactured milk products. More of these commodities along with additional tobacco, cotton, fruits and vegetable would be



imported in the absence of price supports and trade restrictions. Red meat poultry eggs and milk for fluid consumptions have characteristics of non traded goods. In an open world market, the United States would export or import only modest amounts of these commodities.

A number of specific agro-food chains have been selected by the NAPC, the selected chains included cotton, wheat and olive for the group of strategic crops, tomato for vegetable, orange for fruit production and beef meat and milk production for livestock. The results concluded that all the system achieved a positive profit at private price, the highest profit per hectare being achieved by tomato, followed by orange and olive production. Field crops, cotton and wheat achieved a much lower return per hectare compared to the tomato and perennial production systems. However, cotton still generates a profit that is around four times the profit per hectare obtained by wheat based systems, whereas flour production gets the lowest profit per hectare. The group which achieved highest profit at private price, i.e. tomato, fresh orange and olive oil, while the field crops hard wheat flour and soft wheat maintain their profitability. In the livestock group only the production of packed milk is profitable at social price while meat production becomes unprofitable under live animal form or fresh meat form as well. Cotton production is also not profitable at social price.

## **2.1 Methodology for Measuring Economic Incentives**

This study assesses the impact of government intervention on the relative incentives and competitiveness of the four major crops under import substitution and export promotion trade regimes. As agriculture is a dominant sector of Pakistan, government policies that promote agricultural production in general or affect relative incentives within agriculture can have substantial economy- wide effects (Krueger, et al., 1988).

### **2.1.1 Measures of Economic Incentives:**

A wide range of government policies influence economic incentives in agricultural production. Price and subsidy policies, import and export policies, and more general macroeconomic policies such as exchange rate and interest rate policies may affect relative incentive in agriculture. These effects can be measured by using the nominal and effective protection rates as indicators (Gonzales, et al., 1994).

#### **2.1.1.1 Nominal Protection Rate:**

Border prices of commodities are used as reference prices in measuring the effects of government intervention policies. Without government intervention, the domestic producer prices are expected to be closely related to the border prices. The nominal protection rate (NPR) is then defined as the amount by which the domestic price of a tradable output deviates from its border price. It is stated as

$$\text{NPR} = (\text{Pod} / \text{Pob}) - 1$$

Where Pod is domestic producer price of a tradable agricultural product o, and Pob is the border price of o, evaluated at the official exchange rate, adjusted for quality, transport, storage, and other margins, measured under competitive condition, and expressed in local currency. A positive NPR implies price protection and positive incentive for the production of the commodity.

In calculating NPRs for agricultural tradable, the market point for comparison is of crucial importance. Since NPRs are indicators of output incentives or disincentives, there are two marketing points where comparisons can be made. One is at the production point to determine the incentives that farmers receive at the farm level. The other is at the wholesale

or consumption point to determine the effects of pricing policy over a broader spectrum of farm production-processing marketing activities.

### **2.1.1.2 Effective Protection Rates:**

The NPRs can separately measure the sectoral and economy-wide effects on both the outputs and inputs, but not their net effects on the total agricultural production system. It is the Effective Protection Rate (EPR) that measures these net effects through their effects on the value-added of the agricultural product. Formally, it is conventionally expressed as

$$EPR = (P_{od} - \sum_j a_{oj} P_{jd}) / (P_{ob} - \sum_j a_{oj} P_{jb}) - 1 = (V_{od} / V_{ob}) - 1,$$

Where

$P_{jd}$  = Domestic Price of Input  $j$

$P_{jb}$  = Border Price of Input  $j$  expressed in local currency

$V_{od}$  = Value added in domestic price

$V_{ob}$  = Value added in border prices expressed in local currency

The numerator is value added expressed in actual domestic market prices, whereas the denominator is value added expressed in border prices converted to local currency. Again, border prices are used as the reference prices that would prevail in the absence of interventions. In effect the ratio is a summary measure of the incentives or disincentives caused by government policies and market distortions in both the output and input markets. A positive EPR therefore, implies that a particular production activity is receiving a positive incentive through protection at the existing exchange rate and trade policies, while a negative EPR indicates a production disincentive.

## **2.2 Measures of Comparative Advantage:**

Comparative advantage in the production of a given food crop for a particular country or region is measured by comparing with its border price the social or economic opportunity costs of producing, processing, transporting, handling, and marketing an incremental unit of the food commodity. If the opportunity costs are less than the border price, then that country has a comparative advantage in the production of that particular food crop. In most developing countries, social or economic profitability deviates from private profitability because of distortion in the factor and output market, externalities, and government policy interventions that tend to distort relative prices. Comparative advantage or comparative efficiency in the Punjab's economy is estimated here using the Domestic Resource Cost (DRC).

### **Domestic Resource Cost (DRC):**

The DRC of foreign exchange earned or saved from a particular production activity can be expressed as the ratio of domestic (nontaxable) factor costs in shadow prices per unit of output to the difference between the border price of output and foreign (tradable) costs (both expressed in foreign currency). In effect, the DRC is the "own exchange rate" of a particular production activity. Since the numerator is expressed in local currency whereas the denominator is in foreign currency. DRC can be used to determine the economic competitiveness of a production activity by comparing it with the shadow exchange rate (SER) of the currency. Thus an activity is economically competitive, or displays comparative advantage, if the opportunity cost of earning or saving an incremental unit of foreign exchange is less than the SER. The smaller the DRC relative to the SER, the greater the

activity's comparative advantage. Those activities with the smallest DRCs display the greatest relative comparative advantage.

### **2.3. Policy Analysis Matrix (PAM)**

Policy analysis is "determining which of various alternative policies will most achieve a given set of goals in light of the relations between the policies and the goals" (Nagal, 1998). Displaying the impacts of policy alternatives can be done using a policy analysis matrix (PAM). It provides a summary of the policy impacts for the various alternatives and examination of the matrix can reveal the tradeoffs associated with the different alternatives (Wikipedia, 2012). Several studies have used Policy Analysis Matrix (PAM) that relates with the comparative advantage and policy effect (Khan, 2001, Khan and Ashiq, 2004, Pearson et. al., 2003, Quddas and Mustafa, 2011, and Sabaouhi, 2011).

The assessment of the comparative advantages of a given productive system encompasses a broad range of conceptual works emanating from cost-benefit analysis and the theory of international trade. The basic concept is that an economic activity in a given country has a comparative advantage as far as it can compete with alternative source of supply through import without benefiting from any specific support from the rest of the economy under the form of transfer of resources. Using the Policy Analysis Matrix (PAM) framework developed by Monke and Pearson (1989), private profit (D) are equal to total revenue (A) less the cost of tradable inputs (B) and domestic resources such as land, labour and capital (C), all evaluated at private prices (Table 1). Similarly, social profit (H) are defined as total revenue (E) less the cost of tradable inputs (F) and domestic resources such as land, labour and capital (G), all evaluated at their social opportunity cost (social prices).

TABLE 1  
Policy Analysis Matrix (PAM)

	Revenue	Tradable Input	Domestic Factor	Profit
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Divergence	I	J	K	L

**Notes:**

Private Profit (D)	= A-B-C	<b>Ratio indicators for comparison of unlike outputs are:</b>
Social Profit (H)	= E-F-G	
Output Transfer (I)	= A-E	
Input Transfer (J)	= B-F	
Factor Transfer (K)	= C-G	
Net Transfer (L)	= D-H- I-J-K	
		Private Cost Ratio (PCR) = C/ (A-B)
		Domestic Resource Cost Ratio (DRC) = G/ (E-F)
		Nominal Protection Coefficient on Tradable output (NPC) = A/E
		Nominal Protection Coefficient on Tradable
		Input (NPC) = B/F

*Source: Monke and Pearson (1989)*

The profit generated by a selected system is measured by subtracting from the value of the total tradable output the value of the tradable inputs and the values of the domestic factors utilized to produce the output. Considering that the total output sale is the revenue of the system, this accounting identity is computed using two price systems. The first line of the PAM contains the value for the accounting identity measured at private prices (A,B,C,D), which are the prices actually used by the different agents to purchase their inputs and domestic factors and sell their outputs. The second row of the PAM gives the value of the same identity but measured at social prices. These prices are the prices that would prevail if the value of tradable inputs and outputs and domestic factors were not modified either by the economic policy in place (tax, subsidy, price intervention) or by output, input or factors market failure, which results in a distorted price system. The third row of the PAMs obtained by subtracting the social value from the private value indicates the magnitude of the divergence between the situation at private price and social price.

The PAM provides straightforwardly a range of indicators for assessing the efficiency and the comparative advantages of a system. If D is positive the system generates profit under the current policy and market conditions and is competitive. Similarly, if H is positive the system would be able to make profit even without benefiting from subsidy or constrained by taxes, and the system is said to be comparative advantage. If a system is benefiting from input use, or has to pay higher prices for labour, the system can be competitive i.e.  $D > 0$ , while having no comparative advantage i.e.  $H < 0$  (IFPRI, 2002).

- The Financial Cost Benefit ratio (FCB) is the value of the Domestic Factors against the difference between the Revenue minus the Tradable Input.  $FCB = C / (A - B)$ , If this ratio is above one, it means that the systems utilize more value of Domestic factors than the Value added, then the system is not profitable. If the  $FCB < 1$ , the system is profitable.
- The Domestic Resources Cost ratio (DRC) provides a measure of the level of comparative advantages achieved by the selected system,  $DRC = G / (E - F)$ . If the DRC is above one, the system has no comparative advantage, if it is below one, the system has a comparative advantage.

- The Nominal Protection Coefficient (NPC) measures the level of protection for the tradable output by looking at the ratio of the revenue at private price above the revenue at social price.  $NPC = A/E$ . If NPC is above one it indicates that the system benefits from a protection, a NPC below one indicates that the main output is undervalued at private price resulting in a transfer of wealth from the productive system to the economy.
- The Effective Protection Coefficient ratio (EPC) compares the added value at private price to added value at social price.  $EPC = (A-B) / (E-F)$ , which gives a combined index of the level of trade distortion on both tradable inputs and outputs; it provide a more accurate measure of the level of protection than the NPC. An EPC above one means that the selected system is protected while an EPC below it means that the system generates fewer added values at market price than it would at social prices.

### **Policy Analysis Matrix (PAM) Results**

Wheat is the leading food grain in Pakistan as well as in Punjab province; therefore, it gets the highest priority in the government's agricultural development strategy. Punjab is the main wheat producing province accounting for 76 percent in national production and 76 percent of the area (Govt. of Pakistan, 2010b). In view of its importance, it is imperative to examine its competitiveness from the farmer's as well as national perspective. In view of upcoming WTO regime domestic crop production in general and wheat in particular has become a challenging issue. To see that Pakistan has comparative advantage in producing wheat we have to estimate and examine the three commonly used economic efficiency parameters viz- a-viz, Nominal Protection Coefficient (NPC), Effective Protection Coefficient (EPC) and Domestic Resource Cost (DRC) in the context of wheat farming.

The estimation of NPC, EPC and DRC is based on the detailed data of average farmers and import/export prices of wheat. The efficiency parameters have been calculated for the period from 2001-02 to 2008-09 crop years. Data on private and social profitability for these years are given at Annex-A.

### **Nominal and Effective Protection Coefficient for Wheat Crop (NPC and EPC)**

Empirical estimates of NPCs and EPCs in respect of wheat crop in Punjab are given in Table-2. The NPCs estimated by dividing domestic output prices by social prices i.e. import/export parity prices, measures the impact of output pricing policies without any consideration about intervention/distortion in input markets. The examination of the Nominal Protection Coefficients (NPCs) given in the Table reveals that during 2001-02 to 2008-09 producer prices range from 55 to 09 percent less than their export parity levels implying implicit taxation of its producers as producer prices were less than the border prices. Overtime it reveals that wheat in Pakistan has not received any protection during the period i.e. 2001-02 to 2008-09, as the coefficients are less than one.

TABLE 2  
Nominal and Effective Protection Coefficient for Wheat Crop in Punjab

Year	NPCs = A/E	EPCs = (A-B)/(E-F)
2001-02	0.70	0.43
2002-03	0.68	0.41
2003-04	0.81	0.55
2004-05	0.76	0.53
2005-06	0.80	0.61
2006-07	0.63	0.42
2007-08	0.45	0.34
2008-09	0.91	0.89
<b>Average</b>	<b>0.72</b>	<b>0.52</b>

The EPC is the ratio of the difference between the revenue and tradable inputs costs in private prices to that in social prices. From the Table 2 it is revealed that EPC in wheat decreased from 0.43 in 2001-02 to 0.41 in 2002-03. However, during 2003-04 and 2005-06, increased domestic prices of wheat and simultaneously increased input prices lead to increase in EPC to 0.55 and 0.61, implying a reduction in implicit tax. It also shows that value added at domestic price was around 34 percent to 89 percent of value added at international prices during 2001-02 to 2008-09.

#### Domestic Resource Cost (DRC) Analysis for Wheat Crop

Table-3 presents the results of DRC analysis of wheat crop for the period 2001-02 to 2008-09. The DRCs coefficients declined from 0.52 in 2001-02 to 0.47 in 2004-05. The average DRC coefficient of 0.44 reflects that we earn/save one rupee of foreign exchange by employing our domestic resources of Rs. 0.44 in wheat production. It also implies that wheat has comparative advantage, as the product can generate foreign exchange at a lower resource cost than can direct purchase of the foreign exchange.

TABLE 3  
Domestic Resource Costs (DRC) Coefficients of Wheat Crop

Year	DRCs = G/(E-F)
2001-02	0.52
2002-03	0.48
2003-04	0.52
2004-05	0.47
2005-06	0.61
2006-07	0.41
2007-08	0.16
2008-09	0.38
<b>Average</b>	<b>0.44</b>

### Import/Export Parity Prices of Wheat

Pakistan was the regular importer of wheat up to 1999-00. During the year 2002-03, country ported about 1.7 million tons of wheat. But in the year 2003-04 Pakistan imported 1.5 million tons of wheat. Estimating of import parity prices of a commodity is helpful in determining the opportunity cost of resources used in its domestic production while export parity prices are helpful in ascertaining its competitiveness in international market. Both the import and export parity prices have been calculated on the basis of f.o.b. (Pacific) quoted price of US Western White Wheat. The calculation of import/export parity prices are based on economic analysis.

The computational details of estimated import / export parity prices and nominal protection coefficient of wheat for the study period are given in Table-4 (A&B). The estimates presented in this Table indicate that the wheat producers have not received any protection. The prices received by the growers have been substantially below the corresponding import parity prices. The results show that Pakistan (Punjab) has comparative advantage in wheat production for food self sufficiency.

TABLE 4A  
NPC for Wheat under Import Parity Price Scenario (Rs. /40 KG)

Year	CIF Price of Wheat	Transportation and Handling Charges	Transportation From Karachi to Lahore	Procurement Centre to Lahore	Import Parity price at Procurement Centre	Market Price	NPC
2001-02	374.2	55	40	6.7	462.5	292	0.63
2002-03	417.9	55	40	6.7	506.2	305	0.60
2003-04	467.6	55	40	6.7	556.0	388	0.69
2004-05	466.8	55	40	6.7	555.1	471	0.85
2006-09	1294.8	65	88	6.7	1445.1	676	0.47
2008-09	1095.6	84	88	6.7	1239.1	939	0.76

TABLE 4B  
NPC for Wheat under Export Parity Price Scenario (Rs. / 40 KG)

Year	FOB Price of Wheat Karachi	Incidental Charges (Multan)	Export Parity Price at Procurement Centre	Procurement Centre to Lahore	Market Price	NPC
2001-02	259.5	73.6	185.9	6.7	292	1.57
2002-03	303.0	73.6	229.4	6.7	305	1.39
2003-04	350.4	74.8	275.6	6.7	388	1.43
2004-05	346.0	74.7	271.3	6.7	471	1.63
2006-09	929.6	121.2	808.4	6.7	676	0.84
2008-09	939.6	121.6	818.0	6.7	939	1.15

### Nominal Protection Coefficient (NPC) for Wheat under Export Parity Price Scenario

The NPCs estimated under exporting situation have ranged from 1.15 to 1.63 except during 2006-09 which is less than 1, indicating that mostly the prices received by the growers have been higher than the export parity/economic prices. This is also an indication that wheat cultivation for export purpose at the current input-output and price relationship is not feasible as the current export of wheat is subsidizing consumers of importing country from the tax payers' money of Pakistan (Table-4B). On the whole the results show that Pakistan (Punjab) does have comparative advantage in wheat production for self sufficiency but not for export purpose at the current input-output and price structure.

### Economic Efficiency of Resource Use in Rice Production in Punjab

The estimation of NPC, EPC and DRC is based on the detailed data of average farmers and export prices of rice. The efficiency parameters have been calculated for the period from 2001-02 to 2008-09 crop years. Data on private and social profitability for these years used in the analysis are given in Annex-B.

### Nominal and Effective Protection Coefficient for Basmati and IRRI (Paddy) Crop (NPC and EPC)

Empirical estimates of NPCs and EPCs in respect of Basmati and IRRI (Paddy) in Punjab are given in Table 5. The NPCs estimated by dividing domestic output prices by social prices i.e. import/export parity prices, measures the impact of output pricing policies without any consideration about intervention/distortion in input markets. The examination of the Nominal Protection Coefficients (NPCs) estimated for Basmati and IRRI paddy during 2001-02 to 2008-09 reveals that producers prices for Basmati ranges from 1 percent less during 2002-03 and 2004-05 to 29 percent less in the year 2008-09, than the export parity prices implying that producers prices were less than the corresponding border prices. It is also indicated that NPC overtime for Basmati prices did not receive any protection during the years 2001-02 to 2008-09. The examination of EPC also indicated that extent of implicit taxation of the domestic producers of Basmati has been higher during the period from 2001-02 to 2008-09. In case of IRRI rice, both the NPC and EPCs for the Punjab province are generally higher than one, implying protection in its production.

TABLE 5  
Nominal and Effective Protection Coefficient for Basmati and IRRI (Paddy) Crop in Punjab

Year	NPCs = A/E		EPCs = (A-B)/(E-F)	
	Basmati	IRRI	Basmati	IRRI
2001-02	0.89	1.43	0.43	1.67
2002-03	0.99	1.37	0.41	1.54
2003-04	0.97	0.95	0.55	0.78
2004-05	0.99	0.97	0.95	0.90
2005-06	<b>0.73</b>	<b>0.92</b>	<b>0.59</b>	<b>0.81</b>
2006-07	<b>0.76</b>	<b>0.89</b>	<b>0.61</b>	<b>0.74</b>
2007-08	<b>0.73</b>	<b>0.61</b>	<b>0.68</b>	<b>0.51</b>
2008-09	<b>0.71</b>	<b>0.93</b>	<b>0.64</b>	<b>0.92</b>
<b>Average</b>	<b>0.85</b>	<b>1.01</b>	<b>0.61</b>	<b>0.98</b>



### Domestic Resource Cost for Basmati and IRRI (Paddy) Crop (DRC)

Domestic Resource Cost (DRC) indicates the opportunity cost of domestic resources used per unit of the value added in the production of a commodity. If the DRC is, less than one, it indicates a commodity system having a comparative advantage, and if it is greater than one a disadvantage situation. Results in the table show that the DRCs for Basmati have been less than one during the years 2001-02 to 2008-09 implying that Pakistan (Punjab) has a comparative advantage in Basmati production. The value of DRCs -ranges from 0.31 during 2007-08 to 0.72 during 2003-04. It also means that domestic resources involved in earning one US dollar through Basmati rice exports have been consistently less than the corresponding exchange rate. Therefore, increasing Basmati production for exports is an economic proposition.

The DRCs for the IRRI have been greater than one from year 2001-02 to 2006-07 except for the years 2007-08 and 2008-09. It indicates that at given input-output relationship and price relationship in the export market, Pakistan does not have comparative advantage in producing IRRI for exports.

TABLE 6  
Domestic Resource Cost Coefficients for Rice Crop

Year	DRCs = G/(E-F)	
	Basmati	IRRI
2001-02	0.70	2.22
2002-03	0.71	2.22
2003-04	0.72	1.08
2004-05	0.65	1.12
2005-06	0.61	1.01
2006-07	<b>0.65</b>	1.08
2007-08	<b>0.31</b>	0.48
2008-09	<b>0.42</b>	0.72
<b>Average</b>	<b>0.60</b>	1.24

Rice, an important food and cash crop, is the third largest crop of Pakistan in terms of area after wheat and cotton. Punjab province accounts for 69 percent of area under rice crop as a whole and 58 percent of the total production.

### Export Parity Prices of Rice (Paddy)

Pakistan is exporter of both fine and coarse varieties of rice. The export of rice about 2-3 million tones constituting 11 percent of the world rice trade. The export parity prices have been calculated on the basis of actual export prices and Thai white quoted prices (for course varieties) and economic parity prices have been worked out. Details are given in the Table-7-A and 7-B.

The NPCs for Basmati and IRRI (Paddy) estimated under exporting situation have ranged from 0.75 to 0.92 and 1.03 to 1.21, indicating that the prices received by the growers for basmati have been lower while for IRRI the prices received by growers were higher than the

export parity / economic prices, indicating that Basmati prices in Punjab have not received any protection, while IRRI have protection to its production. Tables 7-B revealed that during the year 2008-09 rice (basmati) as well as rice (irri) the NPCs are less than 1, indicates that prices received by the growers for both the rice (basmati & irri) were lower than the export parity / economic prices.

**TABLE 7A**  
**NPC for Rice (Paddy) Under Export Parity Price Scenario (Rs. /40 kg)**  
(2002-03 to 2004-05)

Items	Basmati	IRRI	Basmati	IRRI	Basmati	IRRI	Basmati	IRRI
Ave. fob (Karachi) Price	1153.20	410.9	1176.32	411.72	1184.74	461.50	1241.25	540.09
Expenses from Sheller	186.00	48.00	186.00	48.00	186.00	48.00	186.00	48.00
Product Recoveries per 100 kgs of paddy	45 kg	48.60	45	48.60	45.00	48.60	45kg	48.60
Value of Rice	435.24	176.37	445.64	176.77	449.43	200.96	474.86	239.15
Total Value of Products	526.93	239.11	561.51	236.87	565.26	268.88	600.00	318.46
Processing Charges	50.80	40.00	50.80	40.00	50.80	40.00	50.80	40.00
Export Parity Price of Paddy	476.13	199.11	510.71	196.87	514.46	228.88	549.20	278.46
Market price	356	205	468	218	473	257	451	338
<b>NPC</b>	<b>0.75</b>	<b>1.03</b>	<b>0.92</b>	<b>1.11</b>	<b>0.92</b>	<b>1.12</b>	<b>0.82</b>	<b>1.21</b>

**TABLE 7B**  
**NPC for Rice (Paddy) Under Export Parity Price Scenario (Rs. /40 kg)**  
(2008-09)

Items	Basmati	IRRI
Ave. fob (Karachi) Price	<b>4015</b>	<b>1887</b>
Expenses from Sheller		
Product Recoveries per 100 kgs of paddy	<b>200</b>	<b>200</b>
Value of Rice	<b>45kg</b>	
Total Value of Products	<b>2135</b>	
Processing Charges	<b>78.08</b>	<b>78.08</b>
Export Parity Price of Paddy	<b>2089</b>	<b>788</b>
Market price	<b>1183</b>	<b>585</b>
<b>NPC</b>	<b>0.57</b>	<b>0.74</b>

### Economic Efficiency in Sugarcane Production:

The economic efficiency in sugarcane production has been evaluated by estimation of NPC, EPC and DRC through constructing Policy Analysis Matrix (PAM). These parameters have been estimated under situation of both imports and exports of sugar. The efficiency parameters have been calculated for the period from 2000-01 to 2009-10 crop years. Data on private and social profitability for these years are given in Annex-C.

### Nominal and Effective Protection Coefficient for Sugarcane Crop (NPC and EPC)

Empirical estimates of NPCs and EPCs in respect of sugarcane crop in Punjab are given in Table-8. The NPCs estimated by dividing domestic output prices by social prices i.e. import/export parity prices, measure the impact of output pricing policies without any consideration about intervention/distortion in input markets. The examination of the Nominal Protection Coefficients (NPCs) given in the Table reveals that during 2001-02 to 2009-10, producer prices ranged from 1 to 12 percent less than their import parity levels implying implicit taxation of its producers as producer prices were less than the border prices. Overtime it reveals that sugarcane in Pakistan has not received any protection during the period i.e. 1999-00 to 2004-05, as the coefficients are less than one. The NPCs using export parity prices revealed that the cane growers have received higher prices than the export parity prices implying that sugarcane cultivation is uneconomical proposition for exporting sugar.

TABLE 8  
Nominal and Effective Protection Coefficient for Sugarcane Crop in Punjab

Year	NPCs = A/E		EPCs = (A-B)/(E-F)	
	Import Parity Prices	Export Parity Prices	Import Parity Prices	Export Parity Prices
2001-02	0.93		0.86	
2002-03	0.90	1.38	0.81	1.32
2003-04	0.90	1.33	0.80	1.28
2004-05	0.93	1.99	0.85	2.08
2005-06	1.15	1.35	1.12	1.35
2006-07	1.01	1.70	0.97	1.76
2007-08	0.93	1.73	0.87	1.93
2008-09	0.72		0.66	
<b>Average</b>	<b>0.80</b>		<b>0.76</b>	

The EPC is the ratio of the difference between the revenue and tradable inputs costs in private prices to that in social prices. From the Table 8, it is revealed that EPC in sugarcane decreased from 0.97 in 2001-02 to 0.85 in 2009-10. Table also reveals that cane growers were implicitly taxed ranging from 3 to 20 percent during the study period under importing country scenario. The EPCs estimated using export parity prices of sugarcane in output pricing reveal positive support to sugarcane ranging from 28 to 93 percent.

### Domestic Resource Cost (DRC) Analysis for Sugarcane Crop

Table-9 presents the results of DRC analysis of wheat crop for the period 2001-02 to 2009-10. The DRCs coefficients increased from 0.66 in 2001-02 to 0.71 in 2002-03 and 0.81 in 2003-04 while it decreases to 0.66 in year 2006-07. The average DRC coefficient of 0.67 reflects that we earn/save one rupee of foreign exchange by employing our domestic resources of Rs. 0.67 in cane production. It also implies that sugarcane has comparative advantage, as the product can generate foreign exchange at a lower resource cost than can direct purchase of the foreign exchange. Using export parity prices the DRCs for sugarcane production in Punjab on the average is more than one. It suggests that sugar export is not a viable proposition at the prevailing input-output relationships and the prices.

TABLE 9  
Domestic Resource Costs (DRC) Coefficients of Sugarcane

Year	DRCs = G/(E-F)	
	Import Parity Prices	Export Parity Prices
	0.66	1.00
2001-02	0.71	1.08
2002-03	0.81	1.57
2003-04	0.72	1.02
2004-05	0.61	0.96
2005-06	0.65	1.28
2006-07	0.62	
2007-08	0.27	

### Economic Efficiency in Seed Cotton Production:

The economic efficiency in sugarcane production has been evaluated by estimation of NPC, EPC and DRC through constructing Policy Analysis Matrix (PAM). These parameters have been estimated under situation of both imports and exports of cotton. The efficiency parameters have been calculated for the period from 2002-03 to 2008-09 crop years. Data on private and social profitability for these years are given in Annex-D.

### Nominal and Effective Protection Coefficient for Cotton Crop (NPC and EPC)

Empirical estimates of NPCs and EPCs in respect of Seed Cotton crop in Punjab are given in Table-10. The NPCs estimated by dividing domestic output prices by social prices i.e. import/export parity prices, measure the impact of output pricing policies without any consideration about intervention/distortion in input markets. The NPCs under export scenario were either close to one or greater than one, whereas under importing situation these were less than one. It reveals that expansion in cotton production to meet the increasing raw material requirements as the imports have been more expensive than the domestic production. EPC takes into account the impact of policy intervention in the input markets, which reveals the same inferences as drawn from NPCs.

TABLE 10  
Nominal and Effective Protection Coefficient for Cotton Crop in Punjab

Year	NPCs = A/E		EPCs = (A-B)/(E-F)	
	Import Parity Prices	Export Parity Prices	Import Parity Prices	Export Parity Prices
2002-03	0.75	0.98	0.61	0.88
2003-04	0.92	1.22	0.83	1.21
2004-05	0.74	<b>0.96</b>	0.57	0.83
2005-06	0.83	<b>0.90</b>	0.72	<b>0.80</b>
2006-07	<b>0.90</b>	<b>0.97</b>	<b>0.81</b>	<b>0.92</b>
2007-08	<b>0.92</b>	<b>0.97</b>	<b>0.86</b>	<b>0.94</b>
2008-09	<b>0.72</b>	<b>1.10</b>	<b>0.59</b>	<b>1.17</b>
<b>Average</b>	<b>0.83</b>	<b>1.01</b>	<b>0.71</b>	<b>0.96</b>

#### Domestic Resource Cost (DRC) Analysis for Seed Cotton Crop

The results of the analysis (Table-11) indicated that DRC have been less than one during the study period under both importing and exporting situations. Thus Punjab (Pakistan) enjoys the comparative advantage in cotton production. The DRCs coefficients range from 0.52 to 1.03, while the average DRC is 0.70, implying that cost of domestic resources involved in earning one US \$ through cotton export is 30 to 48 percent less than the current exchange rate. Therefore, increasing cotton production is an economic proposition for export. Under importing scenario DRCs coefficients are lower than the corresponding coefficients estimated under exporting situation, implying that cost of domestic factors involved in saving one unit of foreign exchange through increased cotton production is only 35 to 47 percent of its market price. Thus expansion in cotton production for import substitution is highly cost effective.

TABLE 11  
Domestic Resource Costs (DRC) Coefficients of Cotton

Year	DRCs = G/(E-F)	
	Import Parity Prices	Export Parity Prices
2002-03	0.43	0.62
2003-04	0.36	0.52
2004-05	0.46	0.68
2005-06	0.56	0.62
2006-07	0.65	0.74
2007-08	0.65	0.71
2008-09	0.52	1.03
<b>Average</b>	<b>0.52</b>	<b>0.70</b>

## Annex-A

**Economic Efficiency of Resource Use in Wheat Policy Analysis Matrix (PAM)  
For Average Farmers (Based on Import Parity Prices) Rs. / Acre**

	Revenue	Trade Cost	Domestic Factors Cost	Profit
<b>2001-02</b>				
Private Prices	7931	4917	3931	-917
Social Prices	11361	4357	3627	3377
Transfers	-3430	559	304	-4294
<b>2002-03</b>				
Private Prices	8384	5266	4005	-888
Social Prices	12330	4676	3711	3943
Transfers	-3946	590	294	-4831
<b>2003-04</b>				
Private Prices	10274	5769	4268	237
Social Prices	12617	5010	3961	3646
Transfers	-2344	759	307	-3409
<b>2004-05</b>				
Private Prices	11332	6443	4712	178
Social Prices	14961	5670	4365	4926
Transfers	-3629	773	347	-4749
<b>2005-06</b>				
Private Prices	12219	7206	5248	-236
Social Prices	14948	6745	4991	3212
Transfers	-2729	461	258	-3447
<b>2006-07</b>				
Private Prices	12923	7754	5313	-145
Social Prices	19629	7408	5048	7173
Transfers	-6707	347	265	-7318
<b>2007-08</b>				
Private Prices	19810	8500	5469	5841
Social Prices	41531	8727	5157	27647
Transfers	-21721	-227	312	-21806
<b>2008-09</b>				
Private Prices	27623	10445	7728	9449
Social Prices	29282	9895	7329	12059
Transfers	-1659	550	400	-2609

*Source: Support Price Policy for Wheat, 2001-09 Crop, APCoM, Government of Pakistan, Islamabad.*

Annex-B

**Economic Efficiency of Resource Use in Basmati and IRRI (Paddy) Average Farmers**  
Rs. / Acre

	Revenues		Traded Cost		Domestic Factors Cost		Profit	
	Basmati	IRRI	Basmati	IRRI	Basmati	IRRI	Basmati	IRRI
<b>2001-02</b>								
Private Prices	10027	7927	4559	3872	4743	4331	-725	-276
Social Prices	11210	5546	3803	3112	5220	5392	2187	-2957
Transfers	-1183	2380	756	760	-478	-1062	-1462	2681
<b>2002-03</b>								
Private Prices	11483	7910	4660	3995	5083	4521	1740	-606
Social Prices	11639	5764	3853	3214	5561	5650	2225	-3100
Transfers	-156	2146	807	781	-479	-1129	-485	2494
<b>2003-04</b>								
Private Prices	11722	8647	5220	4377	5491	4708	1011	-438
Social Prices	12035	9116	4331	3645	5947	5910	1757	-439
Transfers	-313	-469	888	732	-456	-1203	-745	1
<b>2004-05</b>								
Private Prices	12760	9199	5665	4732	5728	4808	1367	-340
Social Prices	12939	9468	4832	4006	6230	6108	1876	-647
Transfers	-179	-268	832	725	-502	-1300	-509	307
<b>2005-06</b>								
Private Prices	12408	9493	6070	5269	6278	5429	60	-1206
Social Prices	16583	10264	5802	5038	6608	5744	4172	-519
Transfers	-4175	-771	268	231	-330	-315	-4113	-687
<b>2006-07</b>								
Private Prices	13351	10054	6917	5881	6531	5597	-97	-1424
Social Prices	17169	11227	6612	5623	6885	6041	3673	-437
Transfers	-3818	-1173	306	258	-354	-444	-3770	-987
<b>2007-08</b>								
Private Prices	29520	16507	7180	6119	10169	9422	12171	966
Social Prices	40102	26598	7084	6167	10397	9900	22621	10531
Transfers	-10582	-10091	96	-48	-228	-478	-10450	-9565
<b>2008-09</b>								
Private Prices	27622	22930	9022	8485	11924	10797	6675	3647
Social Prices	38251	24506	9053	8721	12186	11356	17011	4429
Transfers	-10629	-1576	-31	-236	-262	-559	-10336	-781

Source: Support Price Policy for Rice (Paddy), 2001-09 Crop, APCoM, Government of Pakistan, Islamabad.

## Annex-C

**Economic Efficiency of Resource Use in Sugarcane Production Policy Analysis Matrix  
(PAM) Based on Import Parity Prices (Rs. / Acre)**

	Revenue	Trade Cost	Domestic Factors Cost	Profit
<b>2001-02</b>				
Private Prices	20239	5946	11337	2956
Social Prices	21885	5339	11019	5528
Transfers	-1646	608	318	-2572
<b>2002-03</b>				
Private Prices	19474	6060	12233	1180
Social Prices	21929	5437	11848	4644
Transfers	-2455	623	385	-3464
<b>2003-04</b>				
Private Prices	19048	6604	12945	-501
Social Prices	21725	5892	12522	3312
Transfers	-2677	712	423	-3812
<b>2004-05</b>				
Private Prices	22436	7004	13645	1787
Social Prices	26454	6259	13058	7137
Transfers	-4018	745	596	-5359
<b>2005-06</b>				
Private Prices	34016	7539	14642	11836
Social Prices	29908	6759	14525	8624
Transfers	4109	780	117	3212
<b>2006-07</b>				
Private Prices	34042	9556	16622	7864
Social Prices	33724	8495	16385	8844
Transfers	318	1061	237	-980
<b>2007-08</b>				
Private Prices	35000	11467	17511	6021
Social Prices	37481	10501	16819	10162
Transfers	-2481	966	693	-4140
<b>2008-09</b>				
Private Prices	60991	14772	19894	26325
Social Prices	82891	13354	18856	50680
Transfers	-21900	1418	1038	-24355
<b>2009-10</b>				
Private Prices	93552	16105	26766	50680
Social Prices	115960	14587	25165	76209
Transfers	-22409	1519	1601	-25528

*Source: Price Policy for Sugarcane 2001-10 Crop, API's Series No. 223, Government of Pakistan, Islamabad.*



Annex-D

**Economic Efficiency of Resource Use in Sugarcane Production Policy Analysis Matrix (PAM) Based on Export Parity Prices (Rs. / Acre).**

	Revenue	Trade Cost	Domestic Factors Cost	Profit
<b>2001-02</b>				
Private Prices	20239	5946	10772	3521
Social Prices	11115	4354	10467	-3706
Transfers	9125	1593	305	7227
<b>2002-03</b>				
Private Prices	19474	6060	11662	1751
Social Prices	11236	4474	11295	-4532
Transfers	8237	1586	367	6284
<b>2003-04</b>				
Private Prices	22436	6626	12307	3506
Social Prices	14616	5057	11943	-2384
Transfers	7823	1569	364	5890
<b>2004-05</b>				
Private Prices	22436	7004	13645	1787
Social Prices	22360	5897	13004	3458
Transfers	77	1107	641	-1671
<b>2005-06</b>				
Private Prices	34016	7539	14512	11966
Social Prices	26737	6338	14461	5938
Transfers	7279	1201	51	6028
<b>2006-07</b>				
Private Prices	34296	9556	16480	8261
Social Prices	25639	8058	14808	2773
Transfers	8657	1498	1672	5487

**Source:** Price Policy for Sugarcane 2007-08 Crop, API's Series No. 223, Government of Pakistan, Islamabad.

## Annex-E

**Economic Efficiency of Resource Use in Seed Cotton Production in Punjab Policy  
Analysis Matrix (PAM) (Rs. / Acre)**

	Revenue	Trade Cost	Domestic Factors Cost	Profit
	Based on Export Parity Prices			
<b>2002-03</b>				
Private Prices	15043	5780	7089	2174
Social Prices	15278	4766	6529	3983
Transfers	-235	1014	560	-1809
<b>2003-04</b>				
Private Prices	21751	6383	7223	8146
Social Prices	17861	5192	6646	6022
Transfers	3891	1190	577	2123
<b>2004-05</b>				
Private Prices	15549	6974	7548	1027
Social Prices	16141	5770	7016	3354
Transfers	-592	1204	532	-2327
<b>2005-06</b>				
Private Prices	18070	7341	7818	2910
Social Prices	20079	6727	8329	5023
Transfers	-2009	614	-511	-2113
<b>2006-07</b>				
Private Prices	19912	8311	8711	2891
Social Prices	20479	7934	9283	3262
Transfers	-567	377	-573	-371
<b>2007-08</b>				
Private Prices	25721	8413	12638	4673
Social Prices	26389	8032	13004	5353
Transfers	-668	381	-368	-680
<b>2008-09</b>				
Private Prices	26967	11383	13346	2237
Social Prices	24461	11118	13766	-423
Transfers	2506	266	-420	2660

*Source: Support Price Policy for Cotton various issue, APCOM, Government of Pakistan, Islamabad*

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## Biography



Usman Mustafa is working as Chief, Project Evaluation and Training Division of Pakistan Institute of Development Economics (PIDE) and also serving as Director of newly established “Centre of Excellence” i.e. Economics of Conflict, Security, and Development Centre, PIDE. A prestigious leading economic research, policy and teaching institute. He has more than 30 years of meritorious research, teaching and development services record, in different International Organizations, Programs/projects including in different capacities. He got his Ph.D. and. M.S. degrees in Economics from the University of Philippines at Los Banos (UPLB) during 1991 and 1987, respectively. He also possessed MBA (Mkt.) degree from Pakistan. He got his B.Sc. (Hons.) and M.Sc. (Hons.) degrees in Agric. Economics from the University of Agriculture, Faisalabad, Punjab during 1976 and 1991, correspondingly. Dr. Mustafa has the expertise in research, policy analysis, training, teaching, monitoring and evaluation, HRM, environment, resource and agricultural economics, planning, co-ordination and collaboration, team building, management, development, formal and informal diagnostic survey. He has also been an active member of different international/national social and academic organizations. He is an author of more than 75 research articles, technical/consultancies reports, workshops/conferences papers and chapter in edited books.

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### **South Asia Network of Economic Research Institutes**

SANEI Secretariate, 1st Floor, Bangladesh Institute of Development Studies  
E-17 Agargaon, Sher-e-Bangla Nagar, GPO Box # 3854, Dhaka-1207, Bangladesh  
Telephone: +88-02-9118324, Fax: +88-02-8181237  
W: [www.saneinetwork.net](http://www.saneinetwork.net), E: [saneibd@gmail.com](mailto:saneibd@gmail.com)