

## **PRICES OF FOOD GRAINS AND FARM INPUTS IN PAKISTAN: EMPIRICAL ANALYSIS OF FARMERS' INCENTIVES AND TERMS OF TRADE**

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**Abstract.** This study was designed to review the impact of economic reforms introduced in farm output and input markets on the incentives to production of food grains and estimate the terms of trade for food grains during 1995-2015. On the average, domestic prices of wheat have lagged behind the international prices by 16 percent per year, adversely distorting producer incentives. Basmati producers faced implicit taxation for most of the years during the study period, as NPC averaged at 0.84. The overall picture for IRRI farmers has been of implicit subsidy and protection @ 12 % per year. Import parity prices of maize have been generally higher than the corresponding domestic prices while export parity prices were by and large less than the domestic prices by varying degrees. Taken together, the weighted average of domestic prices of food grains has lagged behind the corresponding world prices by about 14 % a year. The prices of important tradable farm inputs: tractor rentals, urea and DAP fertilizers and labor wages during the study period, 1995-2015, as a

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group have increased at the @11.93 % per year as compared to 10.02 % a year for food grains. As a result, with the passage of time increasingly higher quantities of food grains have been required to buy a given quantity of farm inputs, reflecting decline in their purchasing power and a deterioration in terms of trade.

**Keywords:** Distortions, Incentives, Interventions, Markets, Subsidy, Implicit taxation

**JEL classification:** O31, Q13, H25,

## I. INTRODUCTION

Farm commodity markets in Pakistan in general and of food grains in particular have witnessed several interventions, over time, to stave off short time supply challenges and realize immediate and short time objectives. Many a time these interventions were not based on in depth analysis of the facts and relevant factors and without much consideration for long term consequences and implications of such interventions for farm incentives. In addition, measures impacting farm incentives have, inter alia, included varying customs duties, exchange rate management, monetary and fiscal policies. The most important manifestations of these government interventions are on prices of outputs received by farmers and of price paid by them in purchase of inputs. The relationship between domestic and international prices, reflecting opportunity cost of domestic production, have implications for farmers' incentives, farm production and productivity. Similarly, policies and interventions in farm inputs and outputs markets impact the domestic terms of exchange, trade, and purchasing power of farmers, their incomes and wellbeing. In the wake of structural adjustment programs launched in the mid-1980s economic reforms were initiated in several sectors including agriculture. These reforms have led to deregulation of input-output markets and phasing out of many policy interventions in agriculture, which has also been devolved to the provinces as a result of the 18th amendment enacted in 2011.

In view of the importance of agriculture and food grains for the economy and food security, many scholars have analyzed the commodity markets in general and wheat market in particular. Some of these studies were concerned with pricing and marketing of wheat (Cornelisse and

Naqvi 1987, Dorosh and Salam 2008, Salam and Mukhtar 2008, and Salam 2009), while others examined the domestic and international prices for various crops, estimating distortions to incentives (Hamid et.al. 1990, Orden, et.al., 2006, Dorosh and Salam 2009, Salam 2010 and Dorosh et.al., 2016). A few of these studies dealt with the terms of trade for agriculture; (Cheong and D'Silva 1984, Qureshi 1985, Salam 1992, Khan and Qazi 2005, Niazi, et.al 2010 and Salam, 2011). The studies by Hamid et.al., Orden, et.al., Salam, Dorosh et.al., have analyzed the domestic and international prices of many commodities including food grains and estimated distortions in producer incentives. Cornelisse and Naqvi, Dorosh and Salam, Salam and Mukhtar and Salam examined the role and functioning of wheat markets and wheat prices in the context of government pricing policy and policy options. Cheong and D'Silva Qureshi 1985, Niazi, *et.al* and Salam estimated and examined the pattern in terms of trade for agriculture sector for different time periods. But only a few of the studies have examined the food grains in total and none of these examined the distortions in pricing and terms of trade together. The results of quite a few of these studies have also become dated. Here, we examine the incentives in the production of food grains and their distortions, review domestic prices of important farm inputs and analyze the domestic terms of trade for food grains during the period of 1995 - 2015; the period which has seen a paradigm shift in policy framework increasingly relying on markets in determining prices of farm inputs and outputs.

Rest of the paper is organized as follows. The role of food grains in Pakistan's economy is explained in section II. The conceptual framework for estimation and analysis of incentives in farm production and terms of trade are detailed section III. A methodological note for estimating producer incentives and terms of trade is presented in section IV. The empirical estimates of producer incentives are detailed in section V. The current prices of important farm inputs are reviewed in section VI, followed by an estimation and discussion on terms of trade of food grains in section VII. Main findings of the study are summed up in section VIII, which also offers some policy options and suggestions for consideration of policy makers.

## **II. MAJOR FOOD GRAINS: ROLE IN ECONOMY, AND POLICY INTERVENTIONS**

### **FOOD GRAINS CULTIVATED IN PAKISTAN**

A number of food grains including, wheat, rice, maize, barley, oats, jowar, bajra, etc. are cultivated in Pakistan. Wheat, barley and oats are grown during winter, under irrigated and or rain fed conditions while maize, rice, jowar and bajra are cultivated in summer. Maize is also cultivated as a spring crop in irrigated regions. However, from the perspective of meeting food and caloric requirements of human population wheat, rice and maize are the most important food grains in Pakistan. Further discussion of food grains in this paper is thus limited to these cereals only.

### **MAJOR FOOD GRAINS AND THEIR ROLE IN PAKISTAN'S ECONOMY**

Wheat, the staple food and largest crop in Pakistan, is annually planted on about 9 million hectares, contributing 39 percent to total cropped area. Wheat accounts for about 67 percent of the area and 68 percent of production of food grains. The production of wheat, averaging over 25 million tons in the recent past, has contributed 39 percent of value added by major crops in the country (Pakistan, MOF 2016). Rice, the second staple food after wheat, annually planted over an area averaging 2.66 million hectares (2013–15) has accounted for 20 percent of the area under food grains, contributing 18 percent to their total output. With annual production of about 6.46 million tons, Pakistan ranks 12th globally among the rice producing countries. She is also the 5th largest exporter of rice, catering for 8–9 percent of the world exports hovering around 40–55 million tons. Area under maize in Pakistan, the 3rd most important food grain, has averaged around 1.12 million hectares and production at 4.69 million tons. The contribution of maize in annual production of food grains during 2013–15 is estimated at 12.76 percent and 8.60 percent of the value added by major crops (Pakistan, MOF 2016). Traditionally, maize has been raised as a summer crop from indigenous seed but hybrid maize planted in the spring with yields averaging at 8-9 tons per hectare has revolutionized maize production especially in the important irrigated regions. Maize area in the country is

estimated to have increased at the rate of 1.02 percent and its production at the rate of 6.68 percent per annum during 1990-2015, reviving the memories of Green Revolution, experienced in the country during the late 1960s and 1970s.

Approximately 60 percent of the area under wheat, 58 percent of rice and 75 percent of maize is reported to have been sown on farms operating less than 12.5 acres (Pakistan, Statistics Division 2013). The cultivation of wheat, rice and maize, is the principal means of meeting the food security challenges for the country's burgeoning population. The production of these crops provides raw material for wheat flour, rice milling, livestock and poultry feed, and starch industries. The production, processing and marketing of food grains, all in the private sector, have vast forward and backward linkages in the economy, providing employment to a large number of unskilled, semi-skilled and skilled laborers playing important role in the socio economic set up of Pakistan.

Rice is a major export while wheat has been an important import and a recent addition to exports and maize used for food and feeding livestock. Thus performance of food grain crops impacts not only the food security situation and health of the industrial sector but also the course of international trade and balance of trade and payment positions in the country.

## **INTERVENTIONS IN OUTPUT MARKETS**

Some of the most important policy interventions in food grains, primarily in wheat and rice, are listed below:

- Fixation of support prices
- Setting of production targets
- Large scale procurements and storage in public sector
- Restrictions on commodity movements
- Measures at the border; export taxes and import duties
- Public sector monopoly in trade
- Determination of issue prices for supply of food grains like wheat from govt. stores to millers

As a sequel of policy reforms aimed at reducing the role of public sector in economic activities, introduced in the mid-1980s, most of the interventions in food grains and other commodities and farm inputs markets have declined. But all the governments, have been committed to maintain autarky in food production for considerations of food security. An important policy instrument employed in this context has been support price, designed to assure minimum but guaranteed price to the growers during the harvest season, when market prices are under pressure (Salam, 2002). Increasing role of private sector in commodity markets in the aftermath of deregulation has provided a healthy competition. Farmers though appreciative of this policy shift have nevertheless often complained about rising input prices and inadequate output prices and difficulties in marketing their produce, adversely impacting farm incentives and terms of trade.

### **INTERVENTION IN INPUT MARKETS**

Interventions in input markets, not specific to any particular crop but applicable to all crops including food grains, are listed below.

- Input subsidies- fertilizers
- Levying of general sales tax (GST) on farm inputs
- Institutional credit- production and investment loans
- Agricultural packages- providing various subsidies and incentives in the recent past
- Investment in farm research, extension, education
- Investments in irrigation and rural infrastructure

### **III. CONCEPTUAL FRAMEWORK FOR ANALYSIS OF INCENTIVES AND TERMS OF TRADE**

#### **FARM INCENTIVES**

International prices of traded commodities representing opportunity cost of their domestic production provide a ready reference for ascertaining the kind of incentives, protection or taxation, obtaining to producers in the domestic markets. The international or border price is expressed in local prices by converting the price in international market

into local currency using an exchange rate (Tsakok 1990). Timmer (1986) underscores the importance of border prices by arguing welfare is maximized by using border prices to determine domestic prices. Thus, a comparison between the domestic and border prices will provide useful information. The ratio between the domestic and the border prices of a commodity is called nominal protection coefficient, NPC. The NPC provides a simple and straightforward method of knowing and measuring the level of incentives in domestic production of a given commodity or product.

$$\text{NPC} = \frac{P_i^d}{P_i^b}, \text{ where}$$

- $P_i^d$  is the domestic price of commodity  $i$ , and
- $P_i^b$  is the border price of commodity  $i$ , i.e. international price x exchange rate

When the domestic price of a commodity is higher than the border price,  $\text{NPC} > 1$ , it is indicative of positive protection and incentives to domestic production. On the other hand, when domestic price of a commodity is less than the corresponding border price,  $\text{NPC} < 1$ , it is a manifestation of negative protection, implicit taxation and disincentives for domestic producers of the commodity.

## **INPUTS-OUTPUTS PRICES AND TERMS OF TRADE FOR FOOD GRAINS**

Terms of trade indicate relationship between prices for any group of products (Tomek and Robinson, 1990). The terms of trade between any two commodities is the value of one in terms of the other. Terms of trade thus refer to the rate of exchange between two commodities or two sets of commodities (Tsakok ,1990). The ratios between the prices paid and received by farmers, respectively, for various farm inputs and outputs determine their terms of exchange or trade and, inter alia, influence the nature and direction of incentives in farm production. This ratio  $P_j^x/P_i^d$ ; where,  $P_j^x$  indicates price of input  $j$  in domestic market and,  $P_i^d$  indicates price of output  $i$  in the domestic market. The ratio between the prices of a specific input and a given output indicates the units of output needed to

purchase a given level of the input. This ratio also indicates purchasing power of a given output in terms of a specific input. The ratio between the input and output prices will change, overtime, depending upon the level and nature of changes in input and output prices. The changes in these ratios overtime, *ceteris paribus*, indicate the variation in purchasing power and relative profitability of various outputs. A downward movement in this ratio, indicating lower quantity of commodity to buy a given level of factor input will result in improvement in its purchasing power and terms of trade in the context of a specific input and vice a versa. An improvement in the terms of trade for farmers occurs whenever farm outputs prices rise relative to the prices of the items farmers buy. The terms of trade may deteriorate either because farm prices decline while prices of industrial products continue to rise or because farm prices fall more than prices of nonfarm goods or services (Tomek and Robinson, 1990).

#### **IV. EMPIRICAL ESTIMATES: A METHODOLOGICAL NOTE**

##### **PRODUCER INCENTIVES IN FOOD GRAINS PRODUCTION**

We review the domestic producer prices of wheat, rice and maize- the principal food grains and staple food crops and relate these to their corresponding world / border prices during the twenty-one years period spanning from 1995 to 2015. The study period is characterized by a number of shifts in policy interventions in domestic markets, developments in international markets and trading position of Pakistan. Before we do so, a few points regarding the world / border prices and estimations thereof are in order.

The empirical estimation of NPCs, providing for a simple ratio between the domestic and border prices of a commodity nevertheless involves several conceptual issues, and practical problems in marshalling the requisite data. These, *inter alia*, require data on domestic market prices of a given commodity, its international prices, i.e., CIF for imports and FOB for exports, selection of exchange rate and conversion of international prices into local currency, adjusting international prices for domestic marketing costs, etc. In addition, farm commodities are seldom traded in the form in which they are produced at farm, often involving

processing and value addition before their international trading, compounding the data requirements. There also arises a question of quality equivalence between the domestically produced and traded products. A detailed discussion on the subject is available in the OECD's the PSE Manual (OECD, 2016). We have addressed all these questions carefully, selecting the actual imports or exports prices, as per requirements, where available and accounted for the domestic marketing and processing costs. Where actual imports or exports prices data were not readily available, we have relied on the international quoted prices of the kind of produce closely matching the domestically produced farm output. In case of rice since Pakistan is a regular exporter we have estimated export parity prices to represent its international prices and the opportunity cost of its domestic production. In case of wheat and maize, given the long period of analysis involving a change from a situation of imports to exports and or simultaneous imports and exports, we have adopted the average of imports and export prices of the commodity to represent its international prices for the period 2005-2015, and import parity prices for the earlier years when exports were negligible. The requisite data relating to marketing, processing costs, etc., were adopted from the relevant policy reports of the Agricultural Prices Commission (APCOM) / Agriculture Policy Institute (API), located in the National Ministry of Food Security and Research.

### **TERMS OF TRADE**

In estimating domestic terms of trade for food grains we have included the following farm inputs: tractor ploughing, urea and DAP fertilizers, and farm labor. These inputs are estimated to account for a significant proportion, about 55%, of the cost of cultivation of food grains in Pakistan. These inputs are also the principal constituents of the out of pocket expenses entailed in their production, thus significantly impacting the gross margins, net farm incomes, and profitability in production of food grains and other crops. The data on prices of these inputs: rental rate for hiring tractors, prices of urea and DAP as paid by the farmers and ongoing market wage rate for farm labor were adopted from the pricing policy reports of the APCOM / API. As regards the prices of food grains market prices of wheat, basmati and IRRI paddy received by the growers during harvest season as reported in the APCOM / API policy reports have been used in our analysis. In case of maize

wholesale prices ruling in Lahore market, as reported in Agricultural Statistics of Pakistan for various years, are used in our calculations.

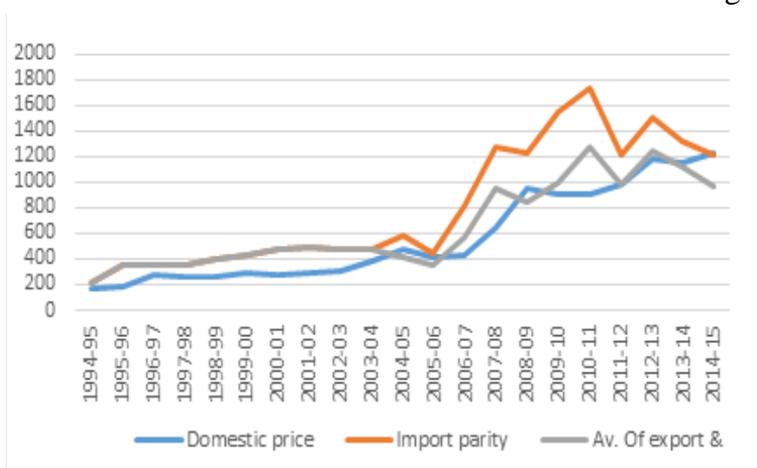
## **V. EMPIRICAL ESTIMATES OF PRODUCER INCENTIVES AND ANALYSIS THEREOF**

### **INCENTIVES IN WHEAT PRODUCTION**

Data on domestic prices of wheat along with corresponding international prices, import parity prices from 1995 to 2004 and export parity prices from 2005 to 2015, are presented in Table 1. Import parity prices are estimated from the actual import prices while export parity prices have been estimated from the quoted prices of US soft red winter wheat no 2 and relate to the period when Pakistan has exported worthwhile quantity of wheat.

A perusal of the data in Table 1 indicates domestic wheat prices have generally lagged behind their corresponding international prices as reflected by the import parity prices. As per these results, wheat farmers have been implicitly taxed as the prices received by them were less than the opportunity cost of resources used in domestic production. However, for the years when Pakistan exported wheat, i.e. 2005 to 2015, domestic wheat prices were higher as compared to the corresponding export parity prices. Accordingly, domestic production was implicitly subsidized, receiving protection and encouragement during this period. Pakistan has been exporting as well as importing wheat during 2005-2015, and comparison of domestic prices with import and export parity prices in this period yielded conflicting results. To resolve this issue, we have employed the average of import and export parity prices of wheat to represent its international price during this period. The comparison of domestic and international prices during this period yields some interesting results. For five of the years during this span of eleven years' period, domestic prices exceeded the international prices and for the remaining years, border prices, representing the opportunity cost of domestic resources used in domestic production, were higher than the domestic prices.

FIGURE 1  
Domestic and International Prices of Wheat Rs. / 40kg



An important conclusion and policy option, emerging from the foregoing discussion of empirical results, which needs to be recognized and appreciated: increasing domestic production for import substitution makes economic sense but producing wheat for exports requires improving efficiency in its production and marketing. As long as Pakistan was importing wheat, relevant world prices were import parity and derived from the import prices comprising costs, insurance and freight. But when we enter export markets the relevant world price, i.e. export parity is derived from the export prices, i.e. FOB. Moreover, estimating import parity prices involves adding up the port charges and domestic marketing cost to the CIF costs. The resulting international prices are higher than the corresponding export parity prices as the latter are estimated by subtracting domestic marketing cost and port charges from the FOB prices. The position is reflected in Figure. 1, depicting the domestic and international prices of wheat; line representing import parity prices is lying above the export parity prices line. Domestic wheat prices have been all along lower than the import parity prices but higher as compared to the corresponding export parity prices. These results imply country's comparative advantage in increasing wheat production to the extent of import substitution but betrays a position of comparative disadvantage in export markets.

For fifteen of the twenty-one years' period under reference here, the NPCs for wheat were less than one as domestic prices lagged behind the international prices. On the average, domestic prices have lagged behind the international prices by 16 percent. Thus, resources were transferred from wheat producers to consumers, averaging at @ Rs. 2,052 per metric ton during the period under reference. Nevertheless, implicit taxation of domestic production averaging 31% per year during 1st half of the study period, 1995-2004, has fallen to only 2% a year in the 2nd half of the study period, spanning from 2005 to 2015.

TABLE 1

## Domestic and International Prices of Wheat in Pakistan: 1995–2015

Year	Domestic price	Import parity price	Export parity price	Av. Of export & import parity	NPC: with respect to av. Of export. & import parity
	.....Rs / 40kg.....				
1994-95	176	215	Not applicable	215	0.82
1995-96	185	348	Not applicable	348	0.53
1996-97	273	346	Not applicable	346	0.79
1997-98	259	352	Not applicable	352	0.74
1998-99	261	393	Not applicable	393	0.66
1999-00	297	433	Not applicable	433	0.69
2000-01	275	477	Not applicable	477	0.58
2001-02	292	497	Not applicable	497	0.59
2002-03	305	474	Not applicable	474	0.64
2003-04	388	472	Not applicable	472	0.82
2004-05	471	585	233	409	1.15
2005-06	420	449	246	347	1.21
2006-07	432	817	311	564	0.77
2007-08	651	1,277	638	958	0.68
2008-09	950	1,234	446	840	1.13
2009-10	902	1,557	450	1,004	0.90
2010-11	905	1,734	804	1,269	0.71
2011-12	984	1,218	740	979	1.00
2012-13	1183	1,505	970	1,238	0.96
2013-14	1150	1,316	921	1,119	1.03
2014-15	1223	1,218	727	972	1.26

Note: Domestic prices represent the average of harvest season prices from the main producer area markets. Import parity estimated from the actual import prices; export parity estimated from the FOB prices of US Soft Red Winter Wheat No 2 as reported in FAO Food Outlook 2015.

## INCENTIVES IN RICE PRODUCTION

Pakistan has been an active player in world rice markets, ranked 5th largest exporter after Thailand, India, Vietnam and USA. Rice exports of

both long grain aromatic basmati rice and of course IRRI varieties have fetched over US\$ two billion in the recent past. Based on the actual export prices of basmati and coarse rice, as reported in Statistical Supplement of Pakistan Economic Survey, various issues, the export parity prices of basmati and IRRI paddy, representing their respective border prices and opportunity costs of domestic production, have been estimated. The same are detailed in Table 2, in juxtaposition to the corresponding paddy prices received by the growers in domestic markets during the harvest season.

### **Basmati Paddy**

A perusal of data presented in Table 2 indicates current prices of basmati paddy have witnessed annual fluctuations but trended upward. This was also true for export parity prices of basmati paddy. The annual growth rate in domestic prices was estimated at 11.37 % per year as compared to 12.03% in its export parity prices. The basmati paddy prices obtaining in the domestic markets not only experienced a slower average growth rate but also fell short of the corresponding export parity prices. Accordingly, the NPCs – showing the ratio between domestic and international prices were less than one for 18 out of the 21 years under study. Thus, for most of the years, basmati producers faced implicit taxation, averaging at 16% per year, as NPC averaged 0.84. The prices data plotted in Figure. 2 also corroborates the implicit taxation of basmati farmers as the line representing export parity prices of basmati lies above the line depicting the domestic market prices. Accordingly, there has been a huge transfer of resources from the growers, during the study period, averaging at Rs. 165 per 40 kg of paddy i.e., at Rs. 4,121 per metric ton per year. As per the information available from the empirical analysis, the average rate of implicit taxation which had averaged at 13% during the first half, 1995–2004, of the study period is estimated to have increased to 18% per year during the 2nd half of study period.

FIGURE 2

Domestic and World Prices of Basmati Paddy Rs. / 40kg



### IRRI Paddy

Data relating to nominal prices of IRRI paddy in domestic market, presented in Table 2, though trending upward depict a lot of fluctuations. This is also true for its export parity prices. From the comparison of domestic and export parity prices of IRRI paddy a mixed pattern is discernible. From 1995 to 2007, the period during which the system of announcement of support prices of paddy was in vogue, prices received by the farmers in domestic market were significantly higher than the export parity prices. The ratio between the domestic and export parity prices during these years was greater than one, averaging at 1.29. During the subsequent period of study, spanning from 2008 to 2015, when support price program for rice has been practically abandoned, domestic prices have generally fallen behind the export parity prices. The NPC during this period, ranging from 0.64 to 1.02 has averaged at 0.84.

As per the results of empirical analysis IRRI production enjoyed substantial protection and implicit subsidy, averaging 29%, during 1995 to 2007. This period was characterized with the announcement of support price of paddy. However, during the years of 2008 to 2015, the NPC of IRRI paddy has averaged at 0.84, indicating implicit taxation of its domestic producers. The chart in Figure.3 showing the movements in prices of IRRI paddy also supports these conclusions as the line depicting

domestic prices lies above the line of export parity prices during 1995 to 2007 but below the latter afterwards. The overall picture for entire period of the study is of implicit subsidy and protection for IRRI production, averaging 12% per year. In nominal terms it translates into Rs. 27 per 40 kg or Rs. 675 per metric ton of IRRI paddy. However, in the recent past 2005–15, IRRI production has been marginally taxed averaging 4 percent per year which is in sharp contrast to the 1st half of the study period when IRRI production had enjoyed an average protection of 29% a year.

TABLE 2

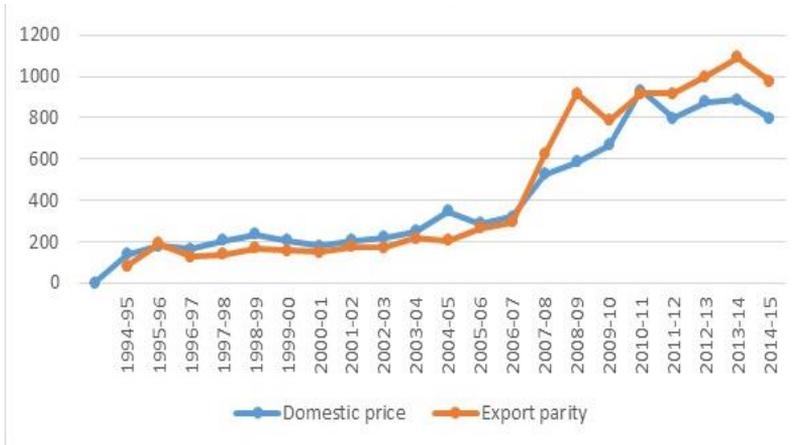
Domestic and International Prices of Basmati and IRRI  
Paddy in Pakistan: 1995–2015

Year	Basmati Paddy		IRRI Paddy		Basmati	IRRI
	Domestic price	Export parity price	Domestic price	Export parity price	NPC	NPC
	.....Rs / 40kg.....					
1994-95	192	198	137	81	0.97	1.69
1995-96	231	215	181	190	1.07	0.95
1996-97	296	315	164	126	0.94	1.30
1997-98	297	355	205	137	0.84	1.50
1998-99	362	395	234	169	0.92	1.39
1999-00	358	481	206	158	0.74	1.31
2000-01	302	477	179	150	0.63	1.19
2001-02	361	512	205	178	0.71	1.15
2002-03	471	509	221	170	0.93	1.30
2003-04	473	515	252	217	0.92	1.16
2004-05	453	565	346	206	0.80	1.68
2005-06	427	615	289	264	0.69	1.09
2006-07	451	680	320	294	0.66	1.09
2007-08	1,289	1,152	525	623	1.12	0.84
2008-09	1,181	1,764	585	915	0.67	0.64
2009-10	1,097	1,392	666	788	0.79	0.85
2010-11	1,320	1,396	931	916	0.95	1.02
2011-12	1,424	1,553	798	918	0.92	0.87
2012-13	1,653	1,960	875	1,000	0.84	0.87
2013-14	2,284	2,301	887	1,093	0.99	0.81
2014-15	1,385	2,419	797	978	0.57	0.82

Note: Domestic prices represent the average harvest season price in the important producer area markets. Export parity prices worked back from the actual export prices of basmati and coarse rice as reported in Pakistan Economic Survey (Statistical Supplement) various issues

FIGURE 3

Domestic and International Prices of IRRI Paddy in Pakistan Rs. / 40kg



### DOMESTIC AND INTERNATIONAL PRICES OF MAIZE

Data on domestic and international prices of maize are set out in Table 3. A perusal of these data indicates that international prices of maize, represented by its import parity prices, have been generally higher than the corresponding domestic prices. However, export parity prices were, by and large, less than the domestic prices by varying degrees. This situation is quite similar to the one observed and explained in case of wheat earlier. This is not surprising as a high degree of correlation has been noted between the prices of maize and wheat.

The NPC1, ratio between the domestic prices of maize and corresponding import parity price, for the study period averages at 0.85, implying 15 percent implicit taxation of maize, if we use the import parity to represent opportunity cost of domestic production. However, when we take into account the situation of maize exports which has characterized the maize sector during the last eight years of the study period then domestic producers have enjoyed protection and subsidy as NPCs have been greater than 1, averaging at 1.07 during 2005 to 2015. Thus, the overall picture of incentives for maize production during the last ten years of the study period, based on the relationship of domestic maize prices and the international prices is one of protection, @ 7 percent per year. From the foregoing, it appears that Pakistan will need to

improve its efficiency in production and marketing if she has to successfully compete in exporting maize.

TABLE 3

## Domestic and International Prices of Maize in Pakistan: 1995–2015

Year	Domestic price	Import parity price	Export parity price	NPC 1	NPC 2
	..... Rs / 40 Kg .....				
1994-95	204	198	Not applicable	1.03	
1995-96	257	259	Not applicable	0.99	
1996-97	276	360	Not applicable	0.77	
1997-98	312	328	Not applicable	0.95	
1998-99	316	319	Not applicable	0.99	
1999-00	308	322	Not applicable	0.96	
2000-01	310	349	Not applicable	0.89	
2001-02	321	372	Not applicable	0.86	
2002-03	354	379	Not applicable	0.93	
2003-04	355	446	Not applicable	0.80	
2004-05	386	476	135		1.26
2005-06	381	447	164		1.25
2006-07	460	591	248		1.10
2007-08	510	754	361		0.91
2008-09	751	894	405		1.16
2009-10	652	866	367		1.06
2010-11	1,116	1,216	684		1.17
2011-12	877	1,356	819		0.81
2012-13	1,044	1,618	974		0.81
2013-14	1,150	1,255	720		1.16
2014-15	1150	1,242	532		1.30

NPC1 is the ratio between the domestic and import parity prices while NPC2 represents the ratio between the domestic and average of the import and export parity prices.

## SUMMARY OF FARM INCENTIVES IN FOOD GRAINS AS A GROUP

After a detailed examination of the estimates of incentives in individual food grains production, we try to sum up the discussion for the food grains as a group. In this context we estimated a weighted average, each, of the domestic and world prices of food grains and the same are presented in Table 4. In the last column of the table, overall NPC for food grains is also calculated. It has been estimated that domestic food grains prices, as a group, increased @ 10.14 % per year during the study period

against the 8.40% increase experienced in the corresponding border prices used in our analysis here.

As per the estimates of aggregated NPC for the food grains as a group (table 4), its values have ranged from 0.63 to 1.11, averaging at 0.86 for the study period. The minimum value was estimated for 2000-01 while the maximum was observed in 2014-15. In 17 out of the 21 years NPC for the food grains as a group was less than one, indicating implicit taxation of domestic production as the producer prices were less than the opportunity cost of production. Only during four years of the entire study period, domestic producer prices were really higher than the corresponding world prices. The implicit taxation rate for the study period averages 14 %.

TABLE 4

Food Grains Prices in Domestic and World Markets:1995–2015  
(Rs. / 40kg)

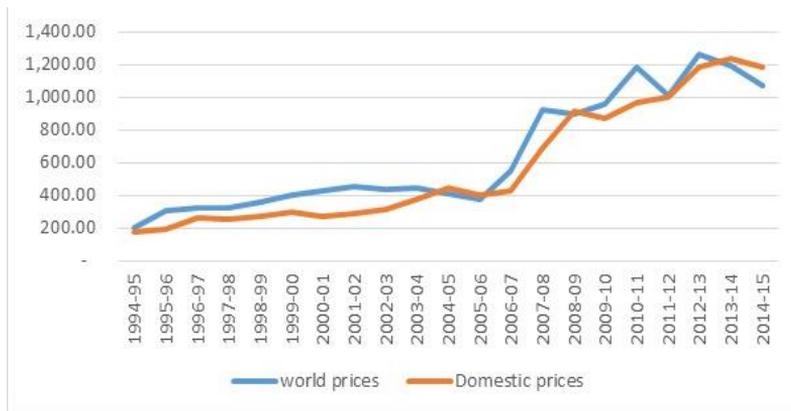
Year	weighted average of		NPC
	world prices	Domestic prices	
1994-95	198.48	176.50	0.89
1995-96	310.27	196.40	0.63
1996-97	322.55	264.70	0.80
1997-98	328.02	262.70	0.77
1998-99	363.26	273.90	0.75
1999-00	399.02	295.10	0.74
2000-01	431.56	271.60	0.63
2001-02	453.75	293.10	0.65
2002-03	437.47	318.10	0.73
2003-04	448.19	379.60	0.85
2004-05	410.76	448.20	1.09
2005-06	375.82	403.70	1.07
2006-07	551.66	425.50	0.77
2007-08	923.43	688.10	0.75
2008-09	896.16	916.70	1.02
2009-10	957.35	872.88	0.91
2010-11	1,188.00	970.20	0.82
2011-12	1,014.47	998.74	0.98
2012-13	1,259.86	1,185.28	0.94
2013-14	1,194.35	1,237.10	1.04
2014-15	1,073.66	1,189.30	1.11

Note: Food grains include wheat, basmati and IRRI rice, and maize with weights of 70, 10, 10 and 10 percent, respectively. Weights based on production data from 2001 to 2010 in Pakistan Economic Survey

No doubt Pakistan has enjoyed comparative advantage in exporting rice, especially basmati but its domestic production has been implicitly taxed. In case of wheat whose domestic production has been implicitly taxed as well Pakistan, given the recent experience and available technologies and the historical pattern of world prices, will need to improve its production and marketing efficiencies to successfully compete in world markets. The same may be true for maize as well. But the hemorrhage of resources bleeding the food grains sector must stop so as to provide farming community with much needed resources for investment in new technologies to raise crop productivity and farm incomes.

FIGURE 4

Chart Showing Average of Domestic and World Prices of Food Grains  
Rs. / 40kg



## VI. PRICE OF FARM INPUTS

Data relating to current prices of selected farm inputs: custom hiring rate of tractors for cultivation, wage rate for farm labor and prices of important fertilizers, DAP and urea, from 1995 to 2015 are set out in Table 5. A perusal of these data indicates prices of all these inputs trending up; albeit, at varying rates across the inputs as well as across time.

The custom rate of hiring tractors for cultivation, a kind of composite input reflecting the cost of tractor, operator's wages, prices of diesel, etc., has experienced the largest increase of all the inputs i.e. from Rs. 60 for

ploughing per acre in 1995 to Rs. 700 per acre in 2015, an overall rise of 10.67 times or 1067 percent. The average rate of increase in tractor rental for the study period works out to 11.95 % per year. The Diammonium Phosphate (DAP), a compound fertilizer supplying nitrogen and phosphorus nutrients to plants, and the second most commonly used fertilizer in the country, after urea, costing farmers Rs. 380 per 50 kg bag in 1995 was sold for Rs. 3,587 in 2015, reflecting an overall increase of 844 percent. The average rate of increase in DAP is calculated at 12% a year. The prices of urea- the most widely used fertilizer in the country, reported at Rs. 235 per 50kg in 1995 were estimated at Rs. 1,824 in 2015, showing a cumulative increase of 676 percent. This calculates to average annual increase of 9.4%. The nominal wage rates of farm labor; reported at Rs. 58 per day in 1995 and Rs. 350 in 2015 are estimated to have experienced an increase of 503 percent; the lowest increase of all the inputs included in this study. The wage rate is estimated to have increase @9.12 percent per year.

TABLE 5

## Prices of Selected Farm Inputs: 1995–2015

Year	Plowing Rs/op/acre	Wage rate Rs/day	DAP Rs / bag	Urea
1994-95	60	58	380	235
1995-96	65	60	450	250
1996-97	90	70	570	345
1997-98	100	80	570	345
1998-99	110	85	610	350
1999-00	120	85	710	340
2000-01	120	90	550	320
2001-02	130	90	650	390
2002-03	140	95	740	411
2003-04	150	100	829	414
2004-05	155	100	1,050	475
2005-06	200	120	1,037	490
2006-07	220	125	1,076	521
2007-08	225	130	1,206	525
2008-09	300	200	3,067	695
2009-10	400	250	1,949	758
2010-11	400	250	2,575	800
2011-12	500	300	3,170	1,053
2012-13	600	300	3,882	1,718
2013-14	650	300	3,917	1,829
2014-15	700	350	3,587	1,824

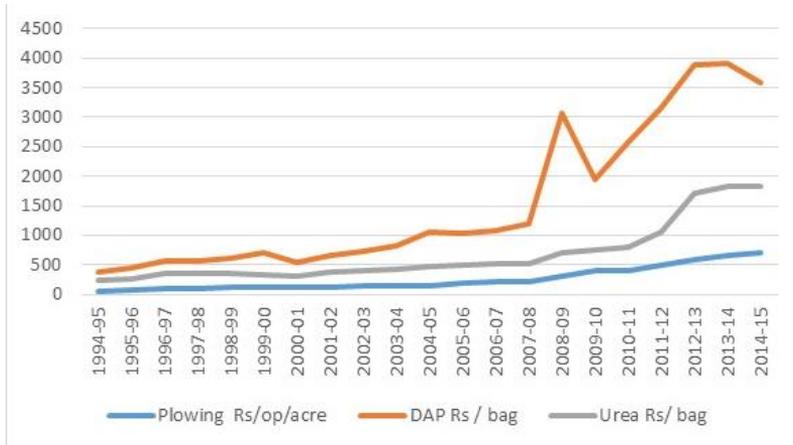
Source: APCOM /API policy reports for relevant years

A careful perusal of the data Table 5, reflects that prices of inputs in the country have increased irregularly. The first half of the period under examination *i.e.*, from 1995 to 2004, was characterized by slower increase in inputs' prices while the latter half, spanning from 2005 to 2015 experienced a much higher rise. This is true for all the inputs included in the study. For example, rate of tractor for ploughing one acre witnessed an increase of 158 percent during the first ten years in comparison to 352 percent increase during the latter eleven years. Similarly, the prices of DAP and urea rose much faster during the latter half, by 242 and 284 percent as compared to 176 and 102 percent during the first half. The wage rates of farm labor which rose by 72 percent during 1995-2005 are estimated to have shot up by 250 percent during 2005 to 2015. The charts showing prices of farm inputs in Figure 5 also reflect these varying increases, the graphs rising slowly in the first ten years but rising quite sharply during the latter half of the study period.

## **VII. TERMS OF TRADE FOR FOOD GRAINS EMPIRICAL ESTIMATES**

As discussed earlier, nominal prices of various food grains: wheat, rice paddy and maize, during the period under examination, have witnessed varying increases. To ascertain their relative positions *viz.* a *viz.* selected farm inputs, and changes in their purchasing power we have estimated the ratios between the nominal prices of inputs and of various food grains. These ratios, commonly known in the literature as terms of trade (Tsakok 1990 p.277), indicate the quantity of respective food grains required to buy a certain quantity of the given inputs. The data are set out in Tables 6 to 13. In view of the long period of the study and varying developments in input-output markets the period was, *inter alia*, divided into various sub-period to examine the input-output price relationships for different sub periods. We explain these empirical estimates of the terms of trade for each of the food grain in the context of our selected farm inputs described above.

FIGURE 5  
Prices of Selected Farm Inputs



## TERMS OF TRADE BETWEEN FOOD GRAINS AND TRACTOR RENTALS

A perusal of the data in Table 6 indicates that quantity of wheat required to pay for hiring a tractor for ploughing has risen over time. During the first five years of the period, under investigation here, 15 kg of wheat sufficed to hire tractor for ploughing one acre. This quantity, however, increased significantly during the period of 2010 to 2015, averaging at 20 kg. The quantity of Basmati paddy required to pay tractor rental to plough one acre has all along has averaged at 14 kg, showing not much change in its barter terms of trade viz. a viz. tractor rentals. However, IRRI paddy seems to have suffered substantial erosion in its purchasing power, viz. a viz. tractor rental, over time. The quantity of IRRI paddy to hire tractor for ploughing one acre, ranging from 14 to 35 kg during the entire period under review, had averaged at 18 kg during 1995–99, and rose to 26 kg for the period of 2010–15. Maize required to pay for the rental services of tractors, having ranged between 10 and 25 kg during the entire period under reference, had averaged at 12 kg during 1995–99, increasing to 16 kg for 2000–04 and to 18 kg for the years 2005–09. For the period of 2010–15 quantity of maize required to pay for tractor services for cultivation jumped to 22 kg.

TABLE 6

Ratio Between Tractor Rental and Food Grains Prices  
Indicating Quantity of Different Food Grains Required to  
Hire Tractor to Plough One Acre

Crop year	Wheat	Basmati paddy	IRRI paddy	Maize
	... kgs / Plowing/ acre ...			
1994-95	14	13	18	12
1995-96	14	11	14	10
1996-97	13	12	22	13
1997-98	15	13	20	13
1998-99	17	12	19	14
1999-00	16	13	23	16
2000-01	17	16	27	15
2001-02	18	14	25	16
2002-03	18	12	25	16
2003-04	15	13	24	17
2004-05	13	14	18	16
2005-06	19	19	28	21
2006-07	20	20	28	19
2007-08	14	7	17	18
2008-09	13	10	21	16
2009-10	18	15	24	25
2010-11	18	12	17	14
2011-12	20	14	25	23
2012-13	20	15	27	23
2013-14	23	11	29	23
2014-15	23	20	35	24

Source: calculations by the author; based on prices of inputs and of outputs as discussed in this study

The results of analysis, as discussed above, suggest considerable deterioration in purchasing power of all food grains, other than basmati, in relation to tractor rentals. Maize has experienced the worst deterioration in its terms of trade as its quantity to pay for tractor rental, 22 kg, during 2010-15 was 83% higher as compared to the corresponding level during 1995–99. IRRI paddy and wheat, in that order, are estimated to have experienced 44 and 25 percent fall in their purchasing power in relation to tractor rentals during the above mentioned periods.

TABLE 7

Quantity of Food Grains Required to Pay for Tractor Rental  
to Plough One Acre Kg

Years	Wheat	Basmati	IRRI	Maize
1995-99	15	12	18	12
2000-04	17	14	25	16
2005-09	16	14	22	18
2010-15	20	14	26	22
1995-04	16	14	22	14
2005-15	18	14	24	20

Source: Calculations by the author

### **TERMS OF TRADE OF FOOD GRAINS VERSUS FERTILIZERS**

The use of chemical fertilizers, like Urea, Ammonium Nitrate, Nitrophos, Diammonium Phosphate, Triple Superphosphate, etc., have played important role in increasing farm production and productivity. Their application is facilitated by the provision of adequate and regular supplies and also motivated by favorable price relationships with farm outputs. We examine the relationship between the prices of urea and DAP, two of the most important and widely used fertilizers in Pakistan, and prices of major food grains – wheat, rice and maize. This ratio indicates the quantity of various food grains that will buy a certain level of fertilizers.

#### **Urea**

As per the data in Table 8, quantity of wheat to buy a bag of urea during 1995 to 2015 has fluctuated between 29 and 60 kg, averaging at 46 kg.

TABLE 8

Ratios Between Prices of Urea Fertilizer and Prices of Important Food Grains Indicating Quantity of Food Grains Needed to Buy One Bag of Urea

Years	Wheat	Basmati paddy	IRRI paddy	Maize
	... Kg / 50 kg bag of Urea ...			
1994-95	53	49	69	46
1995-96	54	43	55	39
1996-97	51	47	84	50
1997-98	53	48	67	44
1998-99	54	39	60	44
1999-00	46	38	66	44
2000-01	47	42	72	41
2001-02	53	43	76	49
2002-03	54	35	74	46
2003-04	43	35	66	47
2004-05	40	42	55	49
2005-06	47	46	68	51
2006-07	48	46	65	45
2007-08	32	16	40	41
2008-09	29	24	48	37
2009-10	34	28	46	47
2010-11	35	24	34	29
2011-12	43	30	53	48
2012-13	58	42	79	66
2013-14	64	32	82	63
2014-15	60	53	92	63

Source: Calculations by the author; based on prices of inputs and of outputs as discussed in this study

For most of the five-year sub periods of the period under review, 1995–2015, the quantity of wheat to buy a 50 kg bag of urea was greater than the overall average of 46 kg. However, during 2005 to 2009, on the average, revenue generated from selling 39 kg wheat was sufficient to purchase a bag of urea. As a result of varying developments in fertilizer and wheat markets during the 1995 to 2004 and 2005 to 2015 sub periods, quantity of wheat to buy one bag of urea declined from 51 kg to 45, thus improving purchasing power of wheat by about 12% in the latter half of the study period.

TABLE 9

Quantity of Food Grains Required to Buy Urea: Kg / Bag

Years	Wheat	Basmati	IRRI	Maize
1995-99	53	45	67	45
2000-04	48	39	71	45
2005-09	39	35	55	45
2010-15	49	35	64	53
1995-04	51	42	69	45
2005-15	45	35	60	49
1995-2015	46	38	63	47

Source: Calculations by the author

The situation of basmati paddy in terms of its purchasing power viz. a viz., urea is also similar to that one of wheat described above. Barter terms of trade, between urea and basmati paddy, requiring 40 kg paddy on the average to purchase one urea bag during the entire study period seem to have improved towards the latter half of the study period i.e. 2005 to 2015. During this period revenue from 35 kg of paddy could suffice to purchase one bag of urea whereas during the earlier half 42 kg of basmati paddy could generate the required amount of revenue, reflecting 17 percent improvement in basmati's purchasing power of urea.

The perusal of data relating to IRRI paddy also indicates some improvement in its purchasing power towards the latter half of the study period. For the overall study period: 1995-2015, quantity of IRRI paddy to buy one bag of urea averaged at 63 Kgs. The last five years of the study period have been characterized by a much wider dispersion in the quantity of IRRI paddy needed to buy a bag of fertilizer, varying from 34 to 92 kg, and reflecting high variability in price of the produce and farmers' income. On the average 64 kg of paddy could buy a bag of urea in this period as compared to overall average of 63 kg per urea bag.

The quantity of maize to be sold and generate enough revenue to buy a bag of urea before 2005 generally moved in a narrow range, 39 to 50 kg. However, since 2005 the range has become much wider, from 37 to 62 kg. For the entire period of study 47 kg of maize, on the average, was required to pay for one bag of urea. Towards the latter half period of the

analysis this quantity increased to 49 kg, thus its purchasing power and barter terms of trade, in the context of urea fertilizer, suffered some deterioration. During the period of 2010-15, on the average 53 kg of maize, the highest quantity in the study period and 13% above the overall mean value, could pay for one bag of urea

## **DAP**

DAP – a compound fertilizer used to replenish phosphorus and nitrogen nutrients in the soil, is the 2nd most widely used fertilizer in Pakistan. Its prices were also decontrolled in the wake of economic reforms unleashed in the wake of structural adjustment programs. To ascertain changes in purchasing power of various food grains viz. a viz. DAP we have estimated the ratios between the annual prices of DAP and the corresponding prices of wheat, basmati paddy, IRRI paddy and maize. These data indicating the quantity of these food grains to buy one 50 kg bag are presented in Table 10. As per these data, quantity of wheat to buy a 50 kg DAP bag, ranging from 74 to 136 kg, averaged at 90 kg during the study period. During the first half of the study period, 1995-2004, the relationship between DAP and wheat prices was quite stable and on the average 90 kg wheat could pay for one DAP bag. However, during the 2nd half of the study period, spanning 2005–15, wheat required to buy a bag of DAP increased to 110 kg, showing an increase of over 22%. During 2010–15, 119 Kg of wheat was required to pay for one DAP bag, the highest quantity in the study period, exceeding the overall average of study period by 29%. These results suggest that prices of DAP have increased much faster as compared to wheat, resulting in a sharp decline in its purchasing power, especially during the last five years of the study period.

On the average 79 kg of basmati paddy was required to buy one DAP bag during 1995–2015. During the first half of the study period, 1995–2004, 74 kg of basmati paddy was sufficient to generate revenue to buy a bag of DAP. This quantity rose to 85 kg during 2005–15, reflecting substantial decline, 15% in the purchasing power of basmati paddy. If we take the data for 2010–15 the purchasing power of basmati paddy had declined by 6% as compared to the overall average for the entire study period.

**TABLE 10**  
**Ratios Between Prices of DAP Fertilizer and Prices of**  
**Important Food Grains Indicating Quantity of**  
**Food Grains Needed to Buy One Bag of DAP**

Year	Wheat	Basmati paddy	IRRI paddy	Maize
	Kgs / 50 kg bag of DAP			
1994-95	86	79	111	75
1995-96	97	78	99	70
1996-97	84	77	139	83
1997-98	88	77	111	73
1998-99	93	67	104	77
1999-00	96	79	138	92
2000-01	80	73	123	71
2001-02	89	72	127	81
2002-03	97	63	134	84
2003-04	85	70	132	93
2004-05	89	93	121	109
2005-06	99	97	144	109
2006-07	100	95	135	94
2007-08	74	37	92	95
2008-09	129	104	210	163
2009-10	86	71	117	120
2010-11	114	78	111	92
2011-12	129	89	159	145
2012-13	131	94	177	149
2013-14	136	69	177	136
2014-15	117	104	180	125

Source: calculations by the author; based on prices of inputs and of outputs as discussed in this study

The quantity of maize required to buy one bag of DAP during 1995–2015 varied between 70 and 149 Kg, reflecting a great deal of variation in the nominal and real prices of DAP and maize. The quantity of maize to buy one bag of DAP averaged at 102 kg for the entire period of study and was 80 kg during 1995–04 which rose to 128 kg during 2010–15. Obviously, purchasing power of maize in the context of DAP has experienced sharp decline since 2005 and more so during 2010–15, as the quantity of maize during the latter period was higher by 26 kg, *i.e.*

25% as compared to the overall average of 102 Kg. These data suggest significant decline in the purchasing power of maize and sharp decline in its terms of trade with respect to fertilizers.

TABLE 11

Quantity of Different Food Grains Needed to Buy DAP: Kg / Bag

Years	Wheat	Basmati	IRRI	Maize
1995-99	90	76	113	75
2000-04	89	71	131	84
2005-09	98	85	140	114
2010-15	119	84	153	128
1995-04	90	74	122	80
2005-15	110	85	147	121
1995-2015	92	79	127	102

Source: Calculations by the author

## REAL WAGE RATES IN TERMS OF FOOD GRAINS

In the wake of increasing commercialization and modernization of farming role of hired labor in agriculture has increased. Similarly, with progressive use of tractors and mechanization demand for hired labor on piece meal and or otherwise for performing certain operations like sowing, planting, harvesting, threshing etc., has been on the rise. At the same time, capitalist mode of farming, in which many part time and or full time farmers relying on markets for the supply of different factor inputs including labor, have assumed greater importance. Accordingly, we have compiled data on nominal wages of farm labor from the crop budgets, reported by APCom and API in their policy reports. These data on nominal wages were transformed into real wages, in terms of important food grains, by dividing the wage rate by the producer prices of food grains and the same are presented in Table 12. The salient features of these real wage rates and changes therein overtime, 1995–2015, are explained below along with their likely implications for farmers' and labors' incomes and welfare.

The annual real wage rate in terms of wheat, as given in Table 12, has witnessed large variations- ranging from 8 to 13 kg. The first half period of our analysis, extending from 1995 to 2004, was characterized

by relatively higher wage rate; 10 to 13 kg, averaging at 12 kg per day. The corresponding wage rate declined to 10 kg for the latter half of study period, i.e., 2005–2015, showing a decline of 20 percent in the real wage rate of farm labor. The overall average wage rate for the entire study period works out to 11 kg wheat. The period since 2005 has been marked by lower wages, hovering around 10 Kg of wheat per day.

TABLE 12

## Wage Rate in Terms of Different Food Grains: 1995–2015

Year	Wheat	Basmati paddy	IRRI paddy	Maize
	... Kgs/ labor day ...			
1994-95	13	12	17	11
1995-96	13	10	13	9
1996-97	10	9	17	10
1997-98	12	12	16	10
1998-99	13	9	15	11
1999-00	11	9	17	11
2000-01	13	12	20	12
2001-02	12	10	18	11
2002-03	12	8	17	11
2003-04	10	8	16	11
2004-05	8	9	12	10
2005-06	11	11	17	13
2006-07	12	11	16	11
2007-08	8	4	10	10
2008-09	8	7	14	11
2009-10	11	9	15	15
2010-11	11	8	11	9
2011-12	12	8	15	14
2012-13	10	7	14	11
2013-14	10	5	14	10
2014-15	11	10	18	12

Source: calculations by the author; based on prices of inputs and of outputs as discussed in this study

Real wages of farm labor expressed in terms of basmati paddy exhibit a pattern similar to that explained above in the context of wheat. The average wage rate in terms of basmati paddy, for the study period, is estimated at 9 Kg; it was 10 Kg for the first half of the study period and declined to 8 Kg for the second half. In fact, the period since 2005 has been characterized by considerably lower wages though showing a lot of annual variation. The declining real wages in terms of the most important food grains, i.e., wheat and basmati paddy have had a favorable impact

on farmers' incomes and welfare but adverse implications for incomes and welfare of farm labor and other non-farm households in the country side relying on farm employment to earn their livings.

The real wage rate of farm labor in terms of IRRI paddy has ranged from 10 to 20 kg per day during the study period, 1995–2015, averaging at 15 kg. Here also the first half of the study period, 1995–2004 had a much higher average wage of 16 kg as compared to 14 kg during the latter half of 2005 to 2015. These results also speak of a declining trend in real wages of farm labor; having favorable implications for farmers' income and welfare but adverse consequences for the farm labor.

TABLE 13

## Real Wage Rates in Terms of Food Grains: Kg / Day

Years	Wheat	Basmati paddy	IRRI paddy	Maize
1995-99	12	10	15	10
2000-04	12	10	17	11
2005-09	10	8	13	11
2010-15	11	8	14	12
1995-04	12	10	16	11
2005-15	10	8	14	12
1995-2015	11	9	15	11

Source: Calculations by the author

Real wage rate in terms of maize during the study period, ranging from 9 to 16 kg averaged at 11 kg per day. However, unlike the other food grains discussed above, real wages of farm labor in terms of maize seem to have improved over time. During the first half of the study period, 1995–2004, wage rate averaging 11 kg maize improved to 12 kg during the second half extending from 2005–15 as the sub period of 2005–2009 had the highest average wage rate of 13 kg of maize per day. The behavior of real wages in terms of maize has been unlike of wages in terms other food grains as its nominal prices as a consequence of large expansion in its area and increasing production have shown a tendency to fall in the last ten years of our study period while those of other food grains have risen.

**OVERALL TERMS OF TRADE FOR FOOD GRAINS**

. Having discussed terms of trade for individual food grains in the context of important farm inputs, we now turn to their terms of trade as a

group. These were estimated as the ratio between the geometric means of farm inputs prices and the geometric mean of the food grains prices. We also calculated the index of the resultant ratio between the inputs and food grains prices. These data are set out in Table 14.

TABLE 14  
Overall Terms of Trade Between Farm Inputs and  
Food Grains: 1995–2015

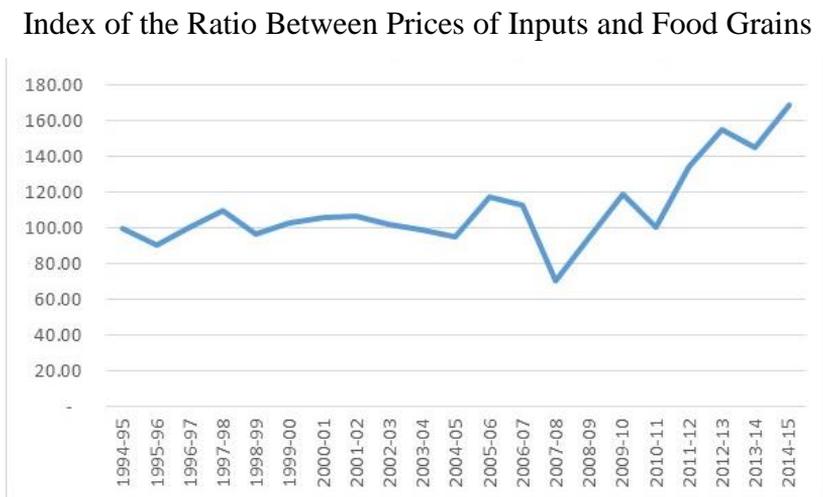
Year	Geometric mean of food grains prices	Geometric mean of inputs prices	Ratio between inputs and food grains prices	Index of the ratio
1994-95	175.30	132.77	0.76	100.00
1995-96	211.15	144.73	0.69	90.50
1996-97	245.92	187.61	0.76	100.73
1997-98	264.84	199.16	0.75	98.68
1998-99	289.11	211.37	0.73	96.53
1999-00	286.59	222.76	0.78	102.63
2000-01	260.55	208.80	0.80	105.81
2001-02	288.59	233.37	0.81	106.77
2002-03	325.60	252.19	0.77	102.27
2003-04	357.96	267.86	0.75	98.80
2004-05	410.86	296.52	0.72	95.29
2005-06	374.87	332.31	0.89	117.05
2006-07	411.52	352.37	0.86	113.05
2007-08	688.48	368.90	0.54	70.75
2008-09	837.90	598.02	0.71	94.23
2009-10	809.62	727.40	0.90	118.62
2010-11	1,055.50	801.17	0.76	100.22
2011-12	995.12	1,013.35	1.02	134.45
2012-13	1,156.09	1,361.62	1.18	155.51
2013-14	1,279.39	1,408.07	1.10	145.31
2014-15	1,116.24	1,429.59	1.28	169.10

Source: Calculations by the author from inputs - outputs prices data presented in this paper

The prices of food grains are estimated to have increased @ 10.02% per year against the 11.93% annual increase in prices of farm inputs. The overall ratio between the inputs and food grains prices, indicate the collective purchasing power of food grains in terms of a composite input, has shown wide fluctuations: varying between 0.54 and 1.28. The index of this ratio has ranged between 70.75 and 169.10. It bears reminding that the ratio between prices of inputs and food grains inversely reflects the purchasing power of food grains, i.e. when this ratio declines purchasing power of food grains rises, requiring lesser quantity of good grains to buy

a given level of inputs and vice versa. The lowest ratio in our estimates coincides with the extraordinary hike observed in international prices of cereals during 2007-08, with spillover effects in domestic market. As per the data in Table 14, in five out of the twenty-one years under review the terms of trade for food grains showed improvement, in ten years they suffered deterioration and in the remaining six years there was not much of a change in purchasing power of food grains. The movement in the ratio between prices of farm inputs and of food grains is also depicted in Figure.6. Trending up of the ratio during the last few years of the study period reflects a significant deterioration in the terms of trade for food grains, requiring higher than the average to buy specific inputs.

FIGURE 6



## VIII. CONCLUDING REMARKS AND POLICY CHALLENGES

The analysis of domestic and world prices of food grains during 1995–2015 provides an interesting but a mixed picture of incentives for domestic producers of wheat, basmati, IRRI and maize crops. Main findings of the analysis are summarized below.

Domestic wheat prices throughout the study period have been lower than the import parity prices but higher as compared to the corresponding export parity prices. These results imply country's comparative advantage in increasing wheat production to the extent of import

substitution but betrays a position of comparative disadvantage in export markets. On the average, domestic prices have lagged behind the international prices by 16 percent per year, adversely distorting producer incentives. Resources were transferred from producers to consumers, averaging at @ Rs. 2,052 per metric ton during the study period. Nevertheless, implicit taxation of domestic production averaging 31% per year during 1<sup>st</sup> half of the study period, 1995–2004, has fallen to only 2% a year in the 2<sup>nd</sup> half of the study period, spanning from 2005 to 2015.

Basmati producers faced implicit taxation for most of the years in the study period, averaging at 16 percent per year, as NPC averaged at 0.83. Accordingly, there has been transfer of resources from basmati farmers and regions growing this crop during the study period, averaging at Rs. 170 per 40 kg of paddy *i.e.*, @ Rs. 4,250 per metric ton per year. The rate of implicit taxation averaging @ 13 % during the first half of study period, 1995–2004, is estimated to have increased to 18% per year during the second half.

The overall picture for IRRI farmers has been of implicit subsidy and protection at 12% per year. In nominal terms it translates into Rs. 27 per 40 Kg or Rs. 675 per metric ton of IRRI paddy. However, during 2<sup>nd</sup> half of the study period, 2005-15, IRRI rice production has been marginally taxed, averaging 4 percent per year which is in sharp contrast to protection at 29% a year during 1<sup>st</sup> half of the study period.

The NPC, based on the import parity price for the entire period of study averages at 0.85, implying 15 percent implicit taxation of maize, However, when we take into account the situation of maize exports which has characterized the maize sector during the last eight years of the study period then domestic producers have enjoyed protection and subsidy as NPCs have been greater than 1, averaging at 1.07 during 2005 to 2015. Thus, the overall picture of incentives for maize production during the last ten years of the study period, based on the relationship of domestic maize prices and the international prices is one of protection, at 7 percent per year.

These results suggest that notwithstanding the deregulation of food grains markets, prices received by the farmers have generally lagged behind their opportunity costs as reflected by the corresponding border prices. The continuing resource transfers does not bode well for

development of agriculture and farm investments. To adequately address food security concerns of the burgeoning population, it is imperative to increase food production, primarily by raising productivity of land and other resources which is predicated on farm investment. In this context, farmers' perceptions of incentives and availability of resources can play important role. Another point which is of critical importance for policy planners is the need to appreciate and recognize the difference in import substitution and exports of wheat and maize. Exporting wheat and maize will require not only improving efficiency in production but also in marketing arrangements as marketing costs at present constitute a large proportion of the fob costs.

An examination and analysis of data relating to prices of important tradable farm inputs and food grains for the period 1995-2004 has indicated that inputs prices as a group have increased at a higher rate; at 11.93 % per year as compared to 10.02% a year for food grains. As a result, with the passage of time increasingly higher quantities of food grains have been required to buy a given quantity of farm inputs, reflecting decline in their purchasing power and a deterioration in terms of trade. Other studies have also reached similar conclusions (Khan, et. al. 2005, Niazi, et. al. 2010, and Salam, 2011). The purchasing power of wheat, paddy and maize is estimated to have fallen in the context of different inputs. The situation has been especially bad in the context of tractor rentals and DAP fertilizers and particularly so for maize and IRRI paddy.

Deteriorating terms of trade underline, the need to arrest the increasing imbalance in the prices received and prices paid by the farmers. Left to the vagaries of the imperfect markets there is not much of a hope for improvement in terms of trade for agriculture. Levying of the general sales tax on farm inputs has added to the farmers' woes which may not be addressed through special packages unless the root cause of the problem is addressed.

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