WTO's Trade Liberalization: Implications for Pakistan's Crop Sector

By

MUHAMMAD ZULFIQAR

A thesis submitted to the Department of Agricultural Economics, NWFP Agricultural University Peshawar Pakistan in Partial fulfillment of the requirements for the degree of

Doctor of Philosophy in Agriculture
(Agricultural Economics)

Department of Agricultural Economics
Faculty of Rural Social Sciences
NWFP Agricultural University
Peshawar-Pakistan
March 2008
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DEPARTMENT OF AGRICULTURAL ECONOMICS
FACULTY OF RURAL SOCIAL SCIENCES
NWFP AGRICULTURAL UNIVERSITY
PESHAWAR PAKISTAN
March 2008
"WTO'S TRADE LIBERALIZATION: IMPLICATIONS FOR PAKISTAN'S CROP SECTOR"

BY

Muhammad Zulfiqar

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Muhammad Zulfiqar

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<td>African, Caribbean and Pacific</td>
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<tr>
<td>AMS</td>
<td>Aggregate Measure of Support</td>
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<td>AoA</td>
<td>Agreement on Agriculture</td>
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<td>AWP</td>
<td>Adjusted World Price</td>
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<td>CAP</td>
<td>Common Agriculture Policy</td>
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<td>CCC</td>
<td>Commodity Credit Corporation</td>
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<td>CMOs</td>
<td>Common Market Organizations</td>
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<td>COA</td>
<td>Common Organization of the Agricultural Markets</td>
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<td>CRP</td>
<td>Conservation Reserve Program</td>
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<td>CSE</td>
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<td>CSP</td>
<td>Conservation Security Program</td>
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<td>DEIP</td>
<td>Dairy Export Incentive Program</td>
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<td>DMLP</td>
<td>Dairy Market Loss Payments</td>
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<td>EAGGF</td>
<td>European Agricultural Guidance and Guarantee Fund</td>
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<tr>
<td>EBA</td>
<td>Everything But Arms</td>
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<tr>
<td>EEP</td>
<td>Export Enhancement Program</td>
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<tr>
<td>ELSC</td>
<td>Extra-Long Staple Cotton</td>
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<td>EQIP</td>
<td>Environmental Quality Incentives Program</td>
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<td>ERDF</td>
<td>European Regional Development Fund</td>
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<td>ERS</td>
<td>Economic Research Service</td>
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<td>ESF</td>
<td>the European Social Fund</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>FAIR Act</td>
<td>Federal Agriculture Reform and Improvement (FAIR) Act or Freedom to Farm Law</td>
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<td>FAPRI</td>
<td>Food and Agriculture Policy Research Institute</td>
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<td>FAS</td>
<td>Foreign Agricultural Service</td>
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<td>FFP</td>
<td>Food for Progress</td>
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<td>FIGF</td>
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<td>FSRIA</td>
<td>Farm Security and Rural Investment Act</td>
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<td>GATT</td>
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<td>GSP</td>
<td>Generalized System of Preferences</td>
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<td>HWW</td>
<td>Hard White Wheat</td>
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<td>IVCA</td>
<td>Integrated Value Chain Analysis</td>
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<td>LDCs</td>
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<td>NAMA</td>
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<td>OECD</td>
<td>Organization for Economic Cooperation and Development</td>
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<td>OTDS</td>
<td>Overall Trade-Distorting Domestic Support</td>
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<td>PAC</td>
<td>Political Action Committee</td>
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<td>PCPs</td>
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<td>PFC</td>
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<td>PIK</td>
<td>Payment-in-kind</td>
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<td>PSE</td>
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<tr>
<td>RMG</td>
<td>Ready Made Garments</td>
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<tr>
<td>ROO</td>
<td>Rule of Origin</td>
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<tr>
<td>SCGP</td>
<td>the Supplier Credit Guarantee Program</td>
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<td>SMP</td>
<td>Skimmed Milk Powder</td>
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<td>SP</td>
<td>Sensitive Product</td>
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<td>US Agency for International Development</td>
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<td>United States Department of Agriculture</td>
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<td>World Trade Organization</td>
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Muhammad Zulfiquar
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Department of Agricultural Economics, Faculty of Rural Social Sciences,
NWFP Agricultural University Peshawar (Pakistan)
(March 2008)

his study of Pakistan’s crop sector includes research on seven major crops (wheat, Basmati rice, cotton, sugarcane, onion, potato and rapeseed), develops econometrically estimated supply and demand functions, identifies government policies and interventions, estimates welfare effects associated with existing policies and interventions and analyses implications of the implementation of WTO’s trade liberalization in the country and abroad. The study points out that there has been different policy interventions exercised in Pakistan’s crop sector. Wheat has been subjected to ‘price tax-cum-import subsidy’ regime during 1985-1995 and ‘price support-cum-import tax’ regime during 1995-2005 study sub-period. Basmati rice has remained under ‘price tax-cum-export tax’ regime during entire time while cotton crop under ‘Export-tax’ regime during the earlier and ‘depressed prices’ regime during the latter period. Sugarcane has been governed by ‘price support-cum-import tax’ policy during entire study period. Rapeseed was not permitted to be internationally traded during earlier period (1985-1995) but allowed to be exported during latter period (1995-2005). Onion and potato have been the only crops amongst the ones studied, which were freely traded within Pakistan’s domestic market. The study reveals that the stated policy interventions have lessened during latter period of the study (1995-2005) as compared between Pakistan’s domestic prices and world prices narrowed down relative to the earlier 1985-1995 period.

he interventions produced net welfare gains in almost all cases (with the exception of rapeseed) when import and export tax earnings associated with such interventions were taken into account. However, such tax earning would vanish in case trade was liberalized and only producers and consumers’ surpluses would remain for a comparative evaluation of welfare effects. When changes in producers and consumers’ surpluses associated with existing interventions were compared, losses were found heavier than gains in all seven commodities studied. In Basmati rice and cotton, the interventions caused higher losses to producers (Pak Rs.649.48 million and Rs.12648.44 million per year) than benefits to consumers (Rs.430.19 million and Rs.12463.10 million per year) during 1995-2005. In case of wheat, sugarcane and rapeseed, losses to consumers (Rs.967.95 million, Rs.208424.66 million and Rs.2275.22 million per year) remained higher than gains to producers (Rs.918.91 million, Rs.199521.21 million and Rs.1183.34 million per year) during the same period. In the remaining two crops, onion and potato, free trade situation had prevailed, which caused minimal but higher losses to producers than gains to consumers.

ree trade simulation results showed that, in case free trade was introduced in Pakistan’s domestic economy, gains would have been greater than losses in terms of producers’ and consumers’ surpluses for all the commodities studied. In two crops, Basmati rice and cotton, gains to the producers would have been higher than losses to consumers whereas, in cases of three crops, wheat, sugarcane and rapeseed, higher consumers’ gains would have been accrued relative to losses to producers. If trade liberalization was introduced in world market, it would have resulted in additional gains in terms of producers and consumers’ surpluses in five of the seven cases studied, with negligible effects in two cases of onion and potato. Of the five other
uses, in case of wheat crop, net social gains would have been in the range of Rs.76.88 million to Rs.320.80 million per year during pre-WTO and Rs.40.90 million to Rs.168.54 million per year during post-WTO period. However, consumers’ gains would have been higher than producers’ losses in both the periods. In case of Basmati rice, net social gains would have been in the range of Rs.276.65 million to Rs.451.60 million per year during earlier and Rs.333.45 million to Rs.637.40 million per year during the later period. However, producers’ gains would have been higher than consumers’ losses in both the periods. In case of cotton, net social gains would have been in the range of Rs.302.11 million to Rs.1616.48 million per year during earlier and Rs.78.50 million to Rs.660.88 million per year during the later period. However, producers’ gains would have been higher than consumers’ losses in the earlier period and consumers’ gains would have been higher than producers’ losses during the later period. In case of sugarcane, net social gains would have been in the range of Rs.8400.20 million to Rs.9096.65 million per year during earlier and Rs.26677.00 million to Rs.27939.61 million per year during the later period. However, consumers’ gains would have been higher than producers’ losses in both the periods. In case of rapeseed, net social gains would have been in the range of Rs.0.26 million to Rs.1.85 million per year during earlier and Rs.732.40 million to Rs.2940.61 million per year during the later period. However, producers’ gains would have been higher than consumers’ losses in the earlier period and consumers’ gains would have been higher than producers’ losses during the later period.

Based on the analysis, the study presents the following recommendations. First, government interventions should be minimized and the trend of narrowing down gap between domestic and international prices should be continued till the two prices arrive at the same level. Second, apply of various fertilizers, availability at appropriate times and use on crops in recommended proportions should take prime attention in formulation of input market policy. Third, trade liberalization process should be stepped up, and more specifically, world prices should be allowed to prevail in domestic wheat market. Gap between domestic and export prices of Basmati rice should be narrowed down and more and more exporters should be allowed to export Basmati rice rather than restricting Basmati exports to a group of exporters acting as a cartel. World prices should be allowed to prevail in cotton’s domestic market and cotton breeders should also develop cotton varieties capable of producing quality fiber, whose demand is on increase with advancement in textile industry. World level sugar prices should be allowed to prevail to help vanishing existing welfare losses due to sugar prices policy. Quality improvements should be the priority actions to help producers and exporters of onion and potato to get benefits of higher world prices. In case of rapeseed, world prices should prevail to minimize existing welfare losses. Fourth, Pakistan should also work for implementation of WTO’s induced trade liberalization on global basis and especially in major global economies of US, EU and other OECD countries. Fifth, Government of Pakistan should gradually reduce its role in trading through State Trading Enterprises (STEs), setting minimum export or maximum import price levels, allowing limited numbers of private traders to export or import and banning import or export trade. Rather it should step up its role as facilitator of trade as envisaged in the ‘Green Box’ of Agreement on Agriculture and other WTO agreements. More importance should be given to research, development and out-react areas and to the introduction and adoption of international quality standards developed by FAO/WHO’s Codex Alimentarius Commission.
CHAPTER 1

INTRODUCTION

Pakistan’s crop sector

Agriculture is one of the major income generating sectors of Pakistan, contributing 20.9 percent to the country’s Gross Domestic Production (GDP). The agriculture sector is further composed of crops, livestock, forest and fisheries sub-sectors, which respectively contribute 10 percent, 10.4 percent, 0.2 percent and 0.3 percent. Thus, crop sector accounts for around 48 percent of agricultural GDP (Government of Pakistan, 2007). The major crops of Pakistan are wheat, Basmati rice, IRRI rice, maize, sugarcane, cotton, mung, millets, sorghum, onion, potato, barley, chickpea and rapeseed (Table 1.1).

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<tr>
<td>Wheat</td>
<td>7241.20</td>
<td>7598.40</td>
<td>8058.50</td>
<td>8306.60</td>
<td>8165.90</td>
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<tr>
<td>Basmati Rice</td>
<td>821.66</td>
<td>981.10</td>
<td>1093.88</td>
<td>1187.80</td>
<td>1389.24</td>
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<tr>
<td>IRRI Rice &amp; others</td>
<td>1155.18</td>
<td>1056.10</td>
<td>1005.06</td>
<td>1146.02</td>
<td>950.00</td>
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<td>Seed Cotton</td>
<td>2260.68</td>
<td>2590.62</td>
<td>2825.22</td>
<td>2988.34</td>
<td>3056.78</td>
</tr>
<tr>
<td>Maize</td>
<td>787.90</td>
<td>848.80</td>
<td>884.40</td>
<td>945.80</td>
<td>957.60</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>896.64</td>
<td>822.92</td>
<td>927.26</td>
<td>1029.74</td>
<td>1012.50</td>
</tr>
<tr>
<td>Gram</td>
<td>914.14</td>
<td>990.16</td>
<td>1041.10</td>
<td>1074.02</td>
<td>340.64</td>
</tr>
<tr>
<td>Mung</td>
<td>74.10</td>
<td>84.70</td>
<td>129.50</td>
<td>172.60</td>
<td>217.84</td>
</tr>
<tr>
<td>Millet</td>
<td>543.38</td>
<td>462.74</td>
<td>403.66</td>
<td>385.62</td>
<td>398.42</td>
</tr>
<tr>
<td>Sorghum</td>
<td>388.04</td>
<td>401.34</td>
<td>401.36</td>
<td>370.72</td>
<td>340.64</td>
</tr>
<tr>
<td>Onion</td>
<td>45.48</td>
<td>54.46</td>
<td>67.07</td>
<td>87.06</td>
<td>110.81</td>
</tr>
<tr>
<td>Potato</td>
<td>47.78</td>
<td>65.08</td>
<td>76.41</td>
<td>97.87</td>
<td>108.84</td>
</tr>
<tr>
<td>Barley</td>
<td>226.80</td>
<td>165.90</td>
<td>156.18</td>
<td>149.44</td>
<td>105.92</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>370.72</td>
<td>312.60</td>
<td>288.74</td>
<td>331.96</td>
<td>336.52</td>
</tr>
<tr>
<td>Area under major crops</td>
<td>15773.70</td>
<td>16434.92</td>
<td>17358.34</td>
<td>18273.59</td>
<td>17491.65</td>
</tr>
<tr>
<td>Total Cropped Area</td>
<td>19955.00</td>
<td>20796.00</td>
<td>22000.00</td>
<td>22790.00</td>
<td>22290.00</td>
</tr>
<tr>
<td>% Area under major crops</td>
<td>79%</td>
<td>79%</td>
<td>78.9%</td>
<td>80.2%</td>
<td>78.5%</td>
</tr>
</tbody>
</table>

Table 1.1: Area under major agricultural crops of Pakistan
(5 yearly averages, area in ‘000’hectares)

Source: FAO (www.fao.org) and Agricultural Statistics of Pakistan (various issues).

It appears that the above listed 14 major crops have dominated Pakistan’s cropping pattern for the last 2 to 3 decades; these crops consistently occupied about 80 percent of Pakistan’s cropped area.

Whereas production of various crops in Pakistan has been in the hands of private producers, marketing and trade of such commodities have mainly been regulated or managed by government in one or the other way. A discussion on how Pakistan’s crop sector has been confronted with problems relating to domestic or international trade
policies is provided in the following paragraphs.

**Specific problem areas of Pakistan's crop sector**

First, the major policy of Government of Pakistan has been to announce 'support prices' for major crops at the advent of the each crop season. The policy of announcement of the 'support prices', which had been based on the recommendation of Agricultural Prices Commission (APCOM), has now been abandoned under World Trade Organization (WTO) requirements. In practice, Government of Pakistan used such prices for procurement purposes. The announcement of 'support or procurement prices' and size of stocks procured have affected production and trade of the commodities involved.

Second, as previously mentioned Government of Pakistan has used State Trading Enterprises (STEs) to manage trade of some major agricultural commodities. These STEs act as monopoly buyers or sellers of products for a country. Although lately Pakistan has taken certain measures to liberalize trade but still according to Trading Corporation of Pakistan (2006) it is involved in procurement of cotton, wheat and sugar. It is also involved in export of cotton and sugar as well as inspection of export purpose rice. Import of wheat, soybean and nutrient-fertilizers etc is also made through state trading.

Third, import tariffs and export duties remained a common feature for Pakistan's trade. According to William, et al. (1990), in addition to imposition of export duties on Basmati rice, IRRI rice and cotton, several other commodities particularly livestock remained under minimum export price system.

Fourth, Pakistan's trade and its production in turn suffer from protection policies and interventions of Pakistan's business partners. The historic major trade partners of Pakistan have been OECD countries with US occupying top rank followed by EU (Government of Pakistan, 2006). As reflects from the review of the major players in international trade in Chapter II on Review of Literature, the OECD countries in general and US and EU in particular exercise protectionist policies in their domestic economies and encourage export through subsidies. In domestic economies, these countries provide heavy subsidies on domestic production, which result in surplus outputs. These surplus outputs discourage foreign trade of developing countries including Pakistan. In addition, the developed countries impose heavy tariffs on exports from developing countries, which further retard developing countries foreign trade. The surpluses produced with heavy support in the developed countries are then exported with the help of heavy export subsidies causing problems for trade from developing countries.
Fifth, in addition to the developed countries, the policies of developing countries are also expected to affect Pakistan's trade and production.

Need for research and its nature
In spite of significant contribution of crop sector in Pakistan's economy, there has been little analytic research carried out on this sector or its individual crops, with the exception of some research on cost of production, supply response and demand elasticities. Even studies carried out on cost, supply and demand do not provide complete or full information; for instance most of the studies on cost of production provide different estimates for the same crop and year due mainly to over or under estimation (Arifullah, 2007). Studies on supply response in Pakistan are found in a good number relative to studies on other aspects; however, these studies are restricted to a few crops. Falcon (1964) covered only two crops (wheat and cotton), Cumming (1975) three crops (wheat, cotton and rice), Ahmad and Chaudry (1987) and Tweeten (1986) covered four crops (wheat, cotton, rice and sugarcane) and Ali (1988) five crops (wheat, cotton, rice, sugarcane and maize). In some more recent studies (Chishti, 1994; Ashfaq, Griffith and Parton, 2001; Mushqaad and Dawson, 2003) only three crops namely Basmati rice, wheat and cotton have been covered. In addition, these studies do not provide econometrically estimated full production or supply functions, which are expected to reflect the major determinants of supply of the commodities involved. On demand side, fewer studies covering only two crops namely wheat and rice are available (Cornelisse and Kuipers 1987; Ahmad et al. 1987; Hamid et al. 1987; Alderman 1988; Chishti 1994; Ashfaq, Griffith and Parton 2001). As far as specific problems confronting Pakistan's crop sector are concerned, research on these and similar problems has found little space in available research literature.

For quantitative and analytic research, one needs at least four econometrically estimated supply and demand functions (domestic supply, domestic demand, export or import supply and export or import demand functions) for each commodity involved. Since no systematic research work has been carried out for development of econometrically estimated functions, there have been thus no mentionable research studies found on price and policy analysis, government interventions and associated welfare effects. Most specifically, after the establishment of World Trade Organization (WTO) in 1995, research on liberalization and effects of WTO were badly needed. But these aspects got little attention at both public and private levels.
Proposed study

The aforementioned discussion necessitates carrying out a comprehensive research study of Pakistan’s crop sector, which includes research on development of supply and demand functions of major component crops, government policies and interventions and associated welfare effects of these policies and interventions. The study should also include the possible effects and implications of the introduction of WTO’s trade liberalization in the country and abroad. This writer intends to carry out such a study with specific objectives given below.

Objectives of the study

The following objectives would specifically be pursued:

i. To study Pakistan’s crop sector.

ii. To develop and estimate supply and demand functions of Pakistan’s major crops.

iii. To identify various protection policies and interventions remained in practice in Pakistan.

iv. To estimate welfare effects associated with existing protection policies.

v. To study implications of trade liberalization of implementation of WTO in Pakistan’s domestic economy and abroad.

vi. To recommend policy prescriptions based on findings of the study.

Organization of the research study

The research study has been organized into seven chapters. In the first chapter, topic and theme of the study has been introduced along with objectives of the study. The second chapter has been devoted for review of relevant literature on agreements of WTO, agricultural policies of main players and competitors in the international markets and existing situation of negotiation on Agreement on Agriculture. The third chapter has dealt with the methodological part that was used for analytical purposes. The Detailed quantitative analysis has been carried out in the fourth to sixth chapters wherein the fourth chapter develops and estimates supply and demand functions, fifth chapter identifies protection policies in practice in Pakistan and estimates their associated welfare effects in terms of producers’ and consumers’ surpluses and sixth chapter evaluates how WTO’s trade liberalization would affect Pakistan’s crop sector. The seventh and final chapter presents summary, conclusion and recommendations.
CHAPTER II

REVIEW OF LITERATURE: WTO, MAJOR PLAYERS AND EXISTING SCENARIO

As explained in Chapter I, there is a need to assess Pakistan’s crop sector in the wake of WTO’s trade liberalization. To get an in-depth understanding of the subject, the review of relevant material has been carried out in this chapter. For this purpose this chapter has been organized into four sections. The first section introduces relevant WTO agreements. The second section covers available literature relevant to Pakistan’s crop sector. The third section reviews agriculture policies of the major players of the world. The fourth and final section reflects on present scenario regarding implementation schedule of Agreement on Agriculture (AoA)/WTO.

2.1 WTO and its Agreements

WTO: An introduction

The World Trade Organization (WTO) was established on the 1st January 1995. However its origin dated back in the General Agreement on Tariffs & Trade (GATT), which came in to being along with the International Monetary Fund (IMF) and World Bank (WB), with effect from the 1st January 1948. However, when GATT was established, its scope was kept limited to the reduction of tariffs on import of industrial goods. Agriculture sector was kept out of its purview. This limitation of the GATT gave rise to a number of problems. Domestic support and export subsidies on industrial and agricultural products coupled with protection of domestic agriculture sector through import quotas and imposition of tariffs resulted in undue production surpluses in developed countries and its dumping on developing world. Both developed and developing countries suffered; the developed world began to produce surpluses on heavy costs in the form of domestic support and export subsidies and the developing countries domestic producers faced losses due to dumping of low-priced heavily subsidized developed world’s exports. This realization helped persuaded 118 countries of the world to initiate consultations on such problems in Uruguay in 1986. The famous Uruguay Rounds of talks continued for 8 years and ended in 1994, with signing of more than a dozen agreements covering various fields. The participants also decided to establish a global organization and held it

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1 This discussion is mainly based materials contained in WTO website: (www.wto.org).
responsible for the implementation of the agreements signed. This is how the World Trade Organization (WTO) came into being with effect from the 1st January 1995.

Establishment of WTO and implementation of its various agreements have serious practical implications for all fields of agriculture sector. Whether it is a crop grower, livestock raiser or food processor, he or she has to adopt the changes required and necessitated under various WTO’s agreements. Theme of the major WTO agreements is studied to understand how these would affect agriculture and livestock sectors.

**Agreement on Agriculture (AoA):**

- AoA includes all raw commodities and processed products belonging to agriculture and livestock sectors enlisted in HS Chapter 1 to 24, with the exception of fisheries. In addition, some organic chemicals based on agricultural products and commodities like hides & skins, raw silk, animal hair & wool, cotton, raw flax and hemp are also covered.
- AoA specifically asks for major reductions in domestic support, import tariffs & non-tariff barriers on import of agricultural products and export subsidies.
- It sets specific quantitative targets for cuts in each of the three areas of domestic support, import tariffs/barriers and export subsidies, to be achieved during certain specified period.

**Agreement on Textile & Clothing:**

- Acts as a successor of Multi-Fibre-Arrangement (MFA)
- Asks for quota elimination w.e.f. 1st January 2005. It has already been implemented.

**General Agreement on Tariff and Trade (GATT) - 1994**

- Governs import & export trade; does not differentiate between agricultural & non-agricultural products; necessitates to maintain a Tariff Schedule; requires to limit all fees to the approximate cost of services rendered; prohibits the use and levying such fees for protection or fiscal purposes; prohibits quotas and import & export licenses.
- Necessitates Most Favored Nation (MFN) treatment, National treatment, Freedom of Transit, Transparency and publication of trade measures & regulations before they are applied.
- Discourages the use of export subsidies on primary products (export subsidies are prohibited on other-than-primary products since 1958); necessitates to run State
Trading Enterprises in a way that do not discriminate against private sector activities.

- Allows import restrictions to safeguard the Balance of Payment situations, if necessitates; or if import surge threatens to cause serious injury to domestic producers.

Agreements on Anti-Dumping (AAD), Subsidies & Countervailing Measures (ASCM) and Safeguards (AoS):

- AAD allows to impose special duties on imports if Dumping occurs and causes Injury to domestic industry, (where dumping is selling below Normal price); asks for to provide evidence of dumping, injury and a causal link between the two; sets a de minimis dumping margin = 2%.

- ASCM categorizes export subsidies as Prohibited (ones contingent on export performance), Actionable (which may only be maintained if they do not injure domestic industry of importing country) and Non-Actionable (which may be maintained) and sets out conditions under which Countervailing duties may be imposed.

- AoS sets out when and how members may resort to Escape clause (possibility of emergency action to protect domestic industry from an unforeseen increase in imports which is causing or likely to cause serious injury to domestic industry); explains criteria for safeguard investigation (including public notice for hearings) and imposes a de minimis safeguard rule margin (which makes safeguard action non-applicable if a developing country share of imports < 3% and applicable if collective share of developing countries > 9%.

Agreement on Sanitary & Phytosanitary Measures (SPS):

- Preserves the right of governments to take Sanitary & Phytosanitary measures; encourages members to base such measures on international standards; allows members to introduce or maintain higher standards if there is scientific justification.

- Prohibits to use such measures as disguised barriers to trade; sets out detailed procedures governing Transparency of regulations, Notifications and establishment of National Enquiry Points’

Agreement on Technical Barriers to Trade (TBT):

- Encourages members to use appropriate international standards for products and
related processes & production methods, as well.

- Sets a code of good practice for the preparation, adoption and application of standards and ensures that technical regulations and standards, including packaging, marking and labeling requirements, do not create unnecessary obstacles to international trade.

**General Agreement on Trade in Services (GATS):**

- Covers all trade in services except bilateral aviation rights and services purchased and supplied by the government.
- Requires to ensure the MFN treatment & Transparency as general obligation, and Market access & National treatment for services specified in member country's schedule of commitment.

**Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)**

- Relates to and covers copyright, patents, trademarks, geographical indications, industrial designs, and protection of trade secrets.
- Advocates to apply standards of protection contained in the Paris Convention (1967 revision), the Berne Convention (1971 revision) and the Rome Convention.
- Gives members freedom of choice to determine the appropriate method to implement the provision of the Agreement within their own legal system.
2.2 Pakistan’s Crop Sector

Pakistan’s crop sector: Review of studies

Various aspects of Pakistan’s crop sector have been studied by a number of researchers in the past. Investigating the effects of wheat procurement prices on production of wheat for the period from 1967-68 to 1984-85, Pinckney (1989) found that short and long run area response elasticities for wheat with respect to own prices were 0.09 and 0.20, yield response elasticity to own price was 0.34, area response to nutrient-fertilizers prices was -0.06 and wheat yield response to cotton prices was -0.04. Chaudhry and Kayani (1991) studied the implications of the implicit taxes in Pakistan’s agriculture using Nominal Protection Coefficients\(^2\) (NPCs) and found that the value of the NPC was near to unity in early 1970’s that fell to 0.41 for cotton, 0.29 for Basmati, 0.20 for IRRI, 0.37 for sugarcane and 0.48 for wheat during 1974. Domestic farm gate prices of most commodities rose during 1974-80 but again slid in 1984-85 equating NPC 0.33 and 0.52 for Basmati rice and wheat respectively. During 1984-90, domestic prices were only half of those of the international prices indicating implicit taxation. It was concluded that low agricultural commodities prices and the variation of NPC across commodities resulted in worsening of resource use efficiency, lessened growth, and heightened the income inequalities in Pakistan. Ender (1992) estimated commodity wise producers and consumer subsidy equivalents (PSE and CSE) to estimate government interventions in agricultural sector of Pakistan and found negative average aggregate PSEs for three of the five crops studied. Additionally, the overvaluation of exchange rates in Pakistan resulted in an additional tax on producers. This resulted in higher output and input prices for producers of wheat, cotton and Basmati rice. The producers of sugarcane squeezed within higher input and lower output prices. On the CSE side, the important changes predicted were increase in the prices of wheat, staples and cotton. Studying the impact of support (procurement) price package on the production of wheat as an important tool of policy package used to increase the production of wheat, Javed, et al. (2001) found that the rise in support price was found to have a positive impact on the area, production and consequently on the marketable surplus of the wheat.

Cornelisse and Kuijpers (1987), presuming that farmers’ decision process on the area to be sown obey the rules of the adaptive expectation hypothesis, found that econometric

\(^2\) a ratio between domestic (procurement) prices and the import or export parity prices
equations in case of wheat and rice were well-behaved in the sense that farmers responded to price changes in line with economic theory. This is further supported by Arifulah (2007) stating that NPC for Basmati rice for the years 1981-90 remained in the range of 0.3-0.4 indicating that its mean domestic price remained 30-40% of its export parity price. Meaning thereby that Basmati rice was taxed 60-70% of its export parity price during this period. In mid 1990s the position was improved but again deteriorated and during 2003 the NPC for Basmati rice was 0.78. In case of cotton the NPC remained in the range of 0.48-0.83 from 1981-95. Lately its NPC improved but remained below 1 till 2003. Similar was the case for wheat, NPC of which remained in the range of 0.46-0.74 from 1981-03.

On the trade front, Pakistan has a very narrow export base. This is also pointed out by William, et al. (1990) stating that Pakistan's export base is very narrow as more than 60% of the total foreign exchange earnings were derived only from cotton, textiles and rice. The export base was not only concentrated but also experienced instability in exports. The similar arguments were also made by the World Bank (2006), Farzana (2006) and Azhar (1996) stating that Pakistan has a narrow and concentrated agricultural export base. Arguing upon prevailing situation, Faruquee, Ali and Choudhry (1995) reflected that Pakistan's State Trading Enterprises (STEs) in agriculture have inhibited the development of an efficient market in agricultural services. The long-run cost of price intervention on agricultural producers was estimated in terms of transfer out of agriculture amounting to around 10 percent of produce value that adversely affected farmers' incentives for agricultural investment. The government's strategy of stabilizing prices year-round and imposing uniform geographical pricing have held back the development of private storage and distribution capacity. Siddiqui (2006) and Farzana (2006) have argued that inefficient input markets, and government intervention in the product and inputs markets has led to stagnation in agricultural growth in Pakistan. Azhar (1996) referring Scott, et al. (1988) also referred to trade related inefficiencies associated with public sector enterprises such as Rice Export Corporation of Pakistan and Cotton Export Corporation of Pakistan. Ackerman and Dixit (1999) pointed out that while the 1994 GATT contained explicit provisions for disciplining export subsidies, they did not extend to the export-enhancing activities of STEs. Therefore, countries having STEs may circumvent 1994 GATT provisions curtailing export subsidies.

William, et al. (1990) stating that the instability in Pakistani exports was due to trade
related taxes, structural biased against exports and administrative barriers such as bans, quota and duties. Faruqee, Ali and Choudhry (1995) were of the view that Pakistan’s pursuit of noncommercial goals, noncommercial pricing, and a drive for import protection have led to operating inefficiency, high cost structure, and inadequate capitalization to meet potential demand. The similar findings were offered by the World Bank (2006) stating that till late 1990s, Pakistan had strong protectionist, inward-oriented import substitution policies including regulatory duties and export restrictions on certain commodities. All such policies aimed at anti-export bias of the trade regime. Import regime of Pakistan has also been marked by strong protectionist policies including high tariffs, import quotas and import surcharges. Till 1985 most of the agricultural commodities faced 120% import tariff which in 2001 stood at 25%. The tariff bands were 42 in 1985 which has been decreased to 4 by 2001 (Farzana, 2006).

Anderson, Martin and Mensbrugghe (2006) estimated the impact of removing all trade related distortions inclusive of agricultural subsidies and found that a move to free merchandise trade would increase farm employment, the real value of agricultural output and exports, real returns to farm land and unskilled labor, and real net farm incomes in developing countries. The studies by Siddique (2003) and Ahmad (2003) have also shown similar results for the horticultural crops of Pakistan. This would occur despite the decline in international terms of trade for some developing countries that are net food importers or are enjoying preferential access to agricultural markets of developed countries.

Pakistan’s crop sector: Commodity-wise policies and protection practices

As reflects from preceding paragraph, Pakistan has a history of trade related restrictions on agricultural commodities. These restrictions included direct restrictions such as absolute bans, quantitative restrictions such as quotas and indirect restrictions for example export duties, application of Minimum Export Price (MEP), involvement of State Owned Enterprises (SOEs) in agricultural trade and restricting private sector involvement (Scott, 1990). Akhtar (1998) states that government in Pakistan initiated nationalization of its economy in 1970 and got control over domestic markets, import and export and trade in agricultural inputs and commodities at pre-specified prices. The public sector intervened directly or indirectly by controlling producers and consumers prices of important crops and food products through State Operating Enterprises such as Rice Export Corporation (RECP) and Cotton Export Corporation of Pakistan (CECP) or
boarder control and taxes. Dotosh and Valdes (1990) argued that production of most of the agricultural commodities in Pakistan remained lower mainly due to government interventions through support prices and procurement policies. The prices of major crops would have been 40 percent higher if there were no intervention policies. Late 1980s and 1990s were the times when trade liberalization measures were undertaken. An emphasis was given on decentralization and deregulation of many SOEs. Liberal import and export policy and involvement of private sector in the domestic market and import and export trade was introduced. The Trade Policy Review (2008) of Pakistan states that Pakistan continuously lowering its average level of tariff protection. However, border protection and domestic support still varies by sector, thus constituting potential impediments to the efficient allocation of resources (WTO, 2008). A commodity-wise brief account of restrictions and protection policies remained in practice in Pakistan is provided, as follows.

Wheat
At domestic level, wheat economy has been governed by support (procurement) price mechanism. According to Akhtar M. R. (1999), procurement price for wheat is announced annually by the government of Pakistan. Pakistan Agricultural Storage and Services Corporation (PASSCO), a state operating enterprise established in 1973, and provincial Food departments procure wheat from farmers on procurement price. The government than supplies the wheat to mills at a fixed issue price. The issue price to mills is usually less than the overall cost (procurement price + incidental charges) borne by the government, thus involving a subsidy element for consumers of wheat across the board. For the year 1997-98, a subsidy of Rs.500 per M. ton was born by the provincial governments. Even imported wheat, which is usually imported on higher prices than domestic procurement prices, is supplied to mills on the same issue price. During the year 1997-98, wheat was imported at average cost of Rs.9000 per M. ton while the same was supplied to mills at fixed issue price of Rs.6500 per M. ton. This means that procurement price of wheat in Pakistan has been lowered than the international prices. However, subsidy involved in imported wheat was met out by the federal government. The total subsidy element for the year 1996-97 was estimated to the tune of Rs.9530 million. Estimating impact of trade liberalization using time series data from 1981 - 1998, it has been stated that wheat prices would increase internationally by 7 percent and domestically by 14 percent. This would result in a gain of Rs.15771. million in producers’
surplus and a loss of Rs.19482 million in consumers’ surplus. The Government of Pakistan (2007a) reports wheat procurement price at Rs.10625 and issue price Rs.10750 per M. ton for the year 2007. The domestic support (procurement) price wheat was kept less than world prices and import were subsidized (Akhtar, 1999).

As far as export of wheat is concerned, it mostly remained a banned item for export. The first ever ban on export of wheat was imposed in 1953. Scott et al. (1990) reporting the data for 1984-89 states that there was a ban on wheat export during said period. The import of wheat, at the time of need, has been made only through the Ministry of Food and Agriculture, Government of Pakistan (Akhtar 1998). WTO (2008) reveals that Wheat exports remain effectively banned in Pakistan. Although it was allowed by an exceptional export quota in January 2007, but subsequently suspended to stabilize domestic prices. It has also been reflected that Trading Corporation of Pakistan, is still involved in the foreign trade of wheat while at domestic level PASSCO intervenes in procurements on support (procurement) price for government reserves and issuing to millers. Referring to government of Pakistan, Ministry of Food, Agriculture and Livestock data, it has been stated that domestic wheat prices have been on average 20 percent below import parity in recent years, suggesting that the market price support arrangements are actually penalizing wheat farmers. Wheat policies since last few years are continuously reflecting raise in procurement prices and encouraging private imports however, Government subsidies to millers, that is sale at prices that are below market prices and do not cover the procurement costs of imported or domestic wheat plus storage and handling leaves no incentives for private wheat imports.

The most recent wheat policy initiatives aim at reducing government intervention and a more market-based approach with guaranteeing minimum producer prices. Its essential elements are a clear distinction between guaranteed minimum prices (fixed and announced prior to the season) and procurement prices (variable depending on market conditions); setting of a price band for procurement and marketing within which the private sector can operate freely. Imports and exports to remain generally open to the private sector subject to occasional adjustments; producers are free to sell to the Government or privately.

Rice
The Rice Export Corporation (RECP) was established in 1974, mainly to carry out business of export of rice. The related activities such as procurement, milling, cleaning,
storage, packing and sale for export was the exclusive mandate of the RECP. The RECP enjoyed monopoly in rice business in Pakistan till 1987 when private sector was allowed to export Basmati rice. Since 1990, the private sector was also allowed to export IRRI rice from Pakistan. The procurement of rice by RECP was abandoned in 1996 and it stopped exports from 1997.

According to Scott (1990), the Basmati rice was put under export duty of Pak. Rs.650 per M. ton. This was in addition to ‘regulatory’ export duty of Rs.3350 per M. ton on Basmati rice that abolished in 1989. A minimum export price for Basmati rice was to be announced by the Rice Export Corporation of Pakistan, a state operated enterprise, on annual basis. During the last year of study period, the minimum export price of Basmati rice was fixed at US$590 per M. ton. An additional US$50 was added to 1 – 2 kg packages and US$25 for 3 – 25 kg packages of export purposes. The Rice Export Corporation has been a major stakeholder in rice export till 1980s. The private sector was restricted through various restrictive measures. For example, there was an export duty of Rs.5000 per M. ton on private sector rice exporters which was eventually abolished. Additionally, private sector was not allowed to export IRRI rice whereas export of Basmati rice was not allowed by minimum export price. One of the reasons behind fixing minimum export price is to protect State Operating Enterprises which otherwise could not compete private exporters. This leads to stagnation in export trade due to lack of competition. Akhtar (1999) states that Rice Export Corporation had a monopoly on procurement and export of rice till 1995. The producers of rice were receiving considerably less prices than world prices whereas. A 7 percent increase in the international rice market has been estimated as a result of trade liberalization under WTO. This would result in a gain of Rs.1872.37 million in producers’ surplus and a loss of Rs.1190.54 million in consumers’ surplus.

WTO (2008) referring to Trade Policy Review 2008 of Pakistan argued that although rice export has been allowed through private sector but rice exporters must belong to the Rice Exporters Association, a private association may be referred to cartel. Commenting upon domestic pricing, it has been stated that rice growers, especially of basmati, appear to have been heavily penalized by pricing arrangements in recent years; in 2005-06 and 2006-07 the domestic price of basmati paddy rice was some 25 percent and non-basmati paddy rice was 10 percent below export parity price.
Cotton
Cotton Export Corporation of Pakistan (CECP) was established in 1973, initially to exclusively handle export business of raw cotton. Later on it was also entrusted to implement government policies including price support operations, standardization, storage and import of cotton. There was a monopoly of CECP in cotton export business till 1990s and than private sector was allowed to export raw cotton from Pakistan (Akhtar, 1998). At the domestic level, there has been intervention price mechanism. The Government of Pakistan (2007a) reports intervention price for seed cotton at Rs.25625 per M. ton for the year 2007. At export level, the duty on export of raw cotton was based on minimum export price. The minimum export price was to be announced on daily basis by a committee of the Cotton Board. The calculations were made as minimum export price minus Rs.715 per 37.5kg of raw cotton. Thus more the export price, more was the duty charged. The duty rate calculated on cotton export for the last year 1998 was estimated at Rs.41 percent of market price. Initially the private sector was not freely allowed to export cotton. During 1990s, the export of cotton below minimum export price was not allowed to private sector. Due to these interventions producers of cotton were receiving considerably less price than world price (Akhtar, 1999 and WTO, 2008). Trading Corporation of Pakistan is still involved in the export of cotton as it purchased 2.4 million cotton bales valued at Rs.21.7 billion during 1999-05. Although private sector has been allowed to export cotton but export contracts of cotton must be registered with Trading Corporation of Pakistan while Cotton exports are also subject to mandatory quality inspection and certification (WTO, 2008).

Sugarcane
Akhtar (1999) states that sugarcane remained protected in Pakistan. WTO (2008) states that provincial governments maintain sugar support prices in conjunction with the Federal Government. The domestic price for sugar was some 10-15 percent above import parity in 2005-06 and 2007-08, but some 5 percent below import parity in 2006-07. Nevertheless, the farmers have been substantially assisted in earlier years by domestic sugar prices being set at some 50-60 percent above world levels.

Rapeseed/oilseed
According to Scott (1990) export of rapeseed was banned from Pakistan. WTO (2008) states that the Pakistan Oilseed Development Board promotes the oilseed sector funded by a ‘cess’ of Rs. 0.05 per kg levied on imported edible oils and from 10 percent of the
tariff duty collected on oilseeds imported for crushing. The Board no longer sets support prices and oilseed prices are set in the open market. The All Pakistan Solvent Extractor's Association, in coordination with the Board, sets voluntary procurement prices for sunflower and canola, based on the cost of imported edible oils and prevailing domestic market conditions; for the 2006-07 crop year these are Rs.830 per 40 kg bag and Rs.750 per 40 kg bag, respectively. The Board operates three mini-oilseed processing plants for processing quality sowing seed on a non-profit basis.
2.3 Agricultural Policies of World's Major Players

In view of the importance of Pakistan's crop sector and related problem areas identified in Chapter 1, the agricultural policies of major players of world market as well as Pakistan's competitor countries are reviewed in this section.

US agricultural policies

The current US Farm Security and Rural Investment Act (FSRIA) 2002 ensures that producers have access to direct payments, counter-cyclical payments (CCP) and marketing loans as farm income support. The decoupled payments have been redesignated as "direct payments". These were estimated to amount to about US$5 billion annually and program crops include wheat, upland cotton, rice, corn, sorghum, barley, oats, soybeans, minor oilseed and peanuts (USDA, 2004a). Beside direct payments, the farmers would also receive from programs that triggered by low market prices including marketing loan program. The rate of Direct Payments has been enhanced over the previous years. A comparison of direct payments offered in the Farm Bills of 1996 & 2002 is given in the table below:

<table>
<thead>
<tr>
<th>Crops</th>
<th>1996 Farm Bill 2002 Rate</th>
<th>2002 Farm Bill 2002-07 Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn ($)/bu</td>
<td>0.2610</td>
<td>0.2800</td>
</tr>
<tr>
<td>Sorghum ($)/bu</td>
<td>0.3140</td>
<td>0.3500</td>
</tr>
<tr>
<td>Wheat ($)/bu</td>
<td>0.4610</td>
<td>0.5200</td>
</tr>
<tr>
<td>Upland Cotton ($)/lb</td>
<td>0.0572</td>
<td>0.0667</td>
</tr>
<tr>
<td>Rice ($/cwt)</td>
<td>2.0500</td>
<td>2.3500</td>
</tr>
<tr>
<td>Barley ($)/bu</td>
<td>0.2020</td>
<td>0.2400</td>
</tr>
<tr>
<td>Oats ($)/bu</td>
<td>0.0220</td>
<td>0.0240</td>
</tr>
<tr>
<td>Soybeans ($)/bu</td>
<td>N/A</td>
<td>0.4400</td>
</tr>
<tr>
<td>Minor Oilseed ($)/lb</td>
<td>N/A</td>
<td>0.0080</td>
</tr>
<tr>
<td>Peanuts ($)/ton</td>
<td>N/A</td>
<td>36.000</td>
</tr>
</tbody>
</table>

Source: USDA (www.usda.gov)

The US government has been providing loan to farmers in collaboration with Commodity Credit Corporation (CCC). The loan rates were added for several commodities (dry peas, lentils, small chickpeas and peanuts, and for mohair, wool and honey) in the Farm Bill 2002. A comparison of loan rates in the current and its predecessor Act is reflected in

---

3 The terminologies used in agricultural policies of various countries have been defined in Annex-1 to this chapter.
following table:

<table>
<thead>
<tr>
<th>Crops</th>
<th>1996 Farm Bill 2001 Rate</th>
<th>2002 Farm Bill 2002-03 Rate</th>
<th>2002 Farm Bill 2004-07 Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn ($/bu)</td>
<td>1.8900</td>
<td>1.9800</td>
<td>1.9500</td>
</tr>
<tr>
<td>Sorghum ($/bu)</td>
<td>1.7100</td>
<td>1.9800</td>
<td>1.9500</td>
</tr>
<tr>
<td>Wheat ($/bu)</td>
<td>2.5800</td>
<td>2.8900</td>
<td>2.7500</td>
</tr>
<tr>
<td>Upland Cotton ($/lb)</td>
<td>0.5192</td>
<td>0.5200</td>
<td>0.5200</td>
</tr>
<tr>
<td>Rice ($/cwt)</td>
<td>6.5000</td>
<td>6.5000</td>
<td>6.5000</td>
</tr>
<tr>
<td>Barley ($/bu)</td>
<td>1.6500</td>
<td>1.8800</td>
<td>1.8500</td>
</tr>
<tr>
<td>Oats ($/bu)</td>
<td>1.2100</td>
<td>1.3500</td>
<td>1.3300</td>
</tr>
<tr>
<td>Soybeans ($/bu)</td>
<td>5.2600</td>
<td>5.0000</td>
<td>5.0000</td>
</tr>
<tr>
<td>Minor Oilseed ($/lb)</td>
<td>0.0930</td>
<td>0.0960</td>
<td>0.0930</td>
</tr>
<tr>
<td>Peanuts ($/ton)</td>
<td>N/A</td>
<td>355.0000</td>
<td>355.0000</td>
</tr>
<tr>
<td>Dry Peas ($/cwt)</td>
<td>N/A</td>
<td>6.3300</td>
<td>6.2200</td>
</tr>
<tr>
<td>Lentils ($/cwt)</td>
<td>N/A</td>
<td>11.9400</td>
<td>11.7200</td>
</tr>
<tr>
<td>Small Chickpeas ($/cwt)</td>
<td>N/A</td>
<td>7.5600</td>
<td>7.4300</td>
</tr>
</tbody>
</table>

Source: USDA (www.usda.gov)

There were two types of provisions under commodity loan program i.e. price support program and income support program. The US government announced the loan rate for all the covered crops in advance. A farmer could get commodity loan after harvest for whole or part of his/her produce by pledging the production as loan collateral, produce to be stored in a government designated store in order to preserve the quality of produce. The amount of loan would be equal to the product of units of produce pledged as collateral and loan rate per unit for that year. If the market prices were below the loan rate (loan rate plus interest), the farmer would benefit by forfeiting the produce and keeping the higher loan rate. However, if the market prices were above the loan rate plus interest, the farmer would repay the loan plus interest and would benefit from the higher market prices.

Besides commodity loan, farmers have another option also for income support known as marketing loan. The marketing loan has been designed in a way that provides incentive to farmers for retaining ownership of produce for marketing him/her self rather then forfeiture. The marketing loan could be obtained through one of the two channels called loan program and Loan Deficiency Payment (LDP). Under the loan program, the farmer would pledge the produce similarly as described earlier under commodity loan program.
But in this case, rather re-paying the full loan amount plus interest, the farmer would re-pay the loan at a lower loan rate at any time during the loan period provided that prices were below the loan rate plus interest. Except rice and cotton whose prices were based on world market prices, rests of the commodities’ prices were based on local posted county prices. When a farmer repaid the loan at a lower rate, the program also waives any accrued interest on the loan. Thus the difference between the loan rate plus interest and loan re-payment rate represented the program benefit to the farmers called marketing loan gain. Alternatively, a farmer could choose marketing loan deficiency payment (LDP). The LDP allowed the farmers to receive the marketing loan benefit without having to take full amount of loan and subsequent re-payment. The LDP rate would be the amount by which the loan rate exceeded the posted county prices or the world market prices as the case may be and thus equivalent to marketing loan gain that a farmer could receive for his/her crops.

The counter-cyclical payments (CCP) were made when the sum of the market price (or loan rate if the market price is lower) and the fixed direct payment were less than the target price. Both the direct fixed payments and counter-cyclical payments were made on 85 percent of base acreage and payment yield determined under the Bill. The target prices in the Farm Bill 2002 for the new counter-cyclical payments are shown in the following table.

<table>
<thead>
<tr>
<th>Crops</th>
<th>2002-03</th>
<th>2004-07</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn ($/bu)</td>
<td>2.6000</td>
<td>2.6300</td>
</tr>
<tr>
<td>Sorghum ($/bu)</td>
<td>2.5400</td>
<td>2.5700</td>
</tr>
<tr>
<td>Wheat ($/bu)</td>
<td>3.8600</td>
<td>3.9200</td>
</tr>
<tr>
<td>Upland Cotton</td>
<td>0.7240</td>
<td>0.7240</td>
</tr>
<tr>
<td>($/lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice ($/cwt)</td>
<td>10.5000</td>
<td>10.5000</td>
</tr>
<tr>
<td>Barley ($/bu)</td>
<td>2.2100</td>
<td>2.2400</td>
</tr>
<tr>
<td>Oats ($/bu)</td>
<td>1.4000</td>
<td>1.4400</td>
</tr>
<tr>
<td>Soybeans ($/bu)</td>
<td>5.8000</td>
<td>5.8000</td>
</tr>
<tr>
<td>Minor Oilseed</td>
<td>0.0980</td>
<td>0.1010</td>
</tr>
<tr>
<td>($/lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peanuts ($/ton)</td>
<td>495.000</td>
<td>495.000</td>
</tr>
</tbody>
</table>

Source: USDA (www.usda.gov)

There were three options available under counter-cyclical payments for each individual crop to determine program payment yields. These options include (i) using current program yields; (ii) updating yield by adding 70 percent of the difference between
program yields and the farm's average yields per planted acre for the period 1998-2001 and (iii) updating yield to 93.5 percent of 1998-2001 average yields per planted acre. The annual payment limitations for individual producers on direct payments, countercyclical payments and marketing loan payments (LDPs and marketing gains) were US$ 40,000, US$ 65,000 and US$ 75,000, respectively. However, according to "three-entity" rule an individual producers can receive a full payment directly and up to a half payment from two additional entities (David, 2003).

The legacy of special programs protecting sugar, dairy and peanuts, including import restrictions, were intact in the US Farm Bill 2002. In case of sugar fundamentally no liberalization of the market was attained while loan rates continued to provide a floor under domestic market prices. The forfeiture penalty was eliminated, marketing assessments that had been adopted previously to provide a small amount of revenue to the government were stopped and interest rate on CCC loans were reduced, making the sugar program more lucrative for producers. To make these new sugar provisions operational, authorization for a PIK was continued and authority was entrusted to USDA to control supply through domestic marketing allotments as long as imports were below 1,360 thousand metric tons. Thus, under the US Farm Bill 2002 the sugar program would continue to be governed with tight import restraints, which sets the farm bill firmly against sugar trade liberalization.

Development and expansion of commercial outlets for US commodities in the world markets for high-value and value-added products and export programs tilting toward development of commercial markets has been given strong emphases in the US farm Bill 2002. The subsidizing Export Enhancement Program (EEP) was the key indicator to that direction. Additionally, the Farm Bill 2002 introduces several new technical trade barriers. Country of origin labeling is mandated by 2004 for meats, fresh fruits and vegetables (USDA, 2004b). This requirement will impose implementation costs that could reduce access of foreign products to the US market.

Tariff reduction was one of the most important aspects of the Uruguay Round of multilateral trade negotiations. However USA smartly secured a complicated tariff system for itself to keep high levels of tariff. Jansen, Tarp and Finn (2002) and Aksoy (2004) affirmed that the US has specific, compound, or mixed rates in 40 percent tariff lines. The US also has exercised duties that vary according to the content of the products in 4 percent and 1 percent of its tariff lines whereas almost all categories of products non-ad-
valorem rates between 30 and 60 percent of tariff lines. Similarly the Tariff Rate Quotas (TRQs) are of more complex tariff regimes. Although the number of tariff lines under TRQs are small but these lines covered main agricultural commodities produced with some of peaks ranging to 136 percent on final fruit products and 186 percent on cocoa products (Aksoy, 2004). He further reported that the tariff lines with non ad valorem tariffs increases with the degree of processing. The non-ad-valorem tariff lines’ makes the reported ad valorem equivalents of specific duties much higher then the ad valorem rates there by escalating protection with the level of processing. Diop, Beghin and Sewadeh (2005) also pointed out that the non tariff trade barriers in the name of health safety standards are becoming more and more stringent resulting in new barriers to trade.

The US Department of Agriculture (USDA) and the US Agency for International Development (USAID) promote exports of certain products through a number of ways (David, 2003) and (USDA, 2004d). The Export Credit Guarantee Programs (ECGP) were designed to help foreign importers that face foreign exchange constraints and need credit to purchase wheat. CCC operates the Export Credit Guarantee Program and the Intermediate Export Credit Guarantee Program (IECGP). Export Credit Guarantee Program covers private credit extended for up to 3 years while Intermediate Export Credit Guarantee Program covers private credit extended for 3 -10 years. The Supplier Credit Guarantee Program (SCGP) insures short-term, open-account financing. Under SCGP, CCC guarantees a part of payments due from importers under short-term financing (up to 180 days) that exporters have extended directly to importers for the purchase of US agricultural products. The US Government provides overseas food aid through the P.L. 480 program, the Section 416 program and the Food for Progress (FFP) Program. Under P.L. 480’s Title I, USDA makes concessions in sales that provide low-interest loans to qualified developing countries purchasing US commodities. The Title II program administered by USAID donates wheat and wheat products to least developed countries. The Section 416(b) of the program offers donations of CCC-owned surplus commodities to developing countries. The Foreign Market Development Program also known as the cooperator program is administered by USDA’s Foreign Agricultural Service (FAS). The objective of the program is to develop, maintain and expand long-term export markets for US agricultural products.
Impact of farm bills of 1996 & 2002

Commenting upon the distributive effects of payments made under the Farm Bill 1996, USDA (2004a) and Dimitri (2005) stated that the benefits were largely directed to specific commodity producers reaching only about 40 percent of US farms yet there was no direct relationship between benefits received and financial status of the farm. The commodity-oriented approach to farm support did not recognize existing wide differences in production costs, marketing approaches, or overall management capabilities that delineate competitive and noncompetitive operations. For example, highly efficient commercial farms benefit enormously from price supports, enabling them to expand their operations and lower costs even more. Other farms have not received enough benefits to remain viable and have been engrossed along the way. Another unintended consequence stems from the increasing separation between land ownership and farm operation. While program benefits were intended to help farm operators, most support eventually accrues to landowners, in the short run through rising rental rates and in the longer term through capitalization into land values. For many farm operators, renting land is a key strategy to expand the size of the business and capture the size economies, as evidenced by 42 percent of farmers renting land in 1999. Clearly, operators farming mostly rented acreage may receive little benefit from the programs. While the 1996 Farm Bill made large step towards greater market orientation, a cautious evaluation in the context of diverse farm structure and increasingly consumer-driven marketplace revealed severe misalignment among policy goals, program mechanisms, and outcome.

Paul and Young (2004) stated that direct government payments to the US agricultural sector and other farm program benefits increased farm income, particularly during 1999-2001 when direct government payments surpassed US$20 billion annually. More than a third of these direct payments were paid out as emergency assistance, which amplified direct government payments from existing farm commodity programs, such as Production Flexibility Contract (PFC) payments and marketing loan benefits i.e. loan deficiency payments and marketing loan gains as well as payments from conservation programs. (USDA, 2002).

Carrying out initial assessments of the 2002 Farm Bill on major field crops, the USDA (2004b) has shown that changes in acreage and production tends to change equilibrium level of prices and demand. During the initial years, major impact on commodity markets for major field crops come from marketing loans those were coupled with production and
led to increased acreage by 2 million particularly of wheat, corn and sorghum acres till 2004 when prices would not be at such a level that marketing loan benefits were higher. The acreage under soybean would decline in the initial years as loan rate would be small comparing its competing crops such as corn thus acreage switched to other crops. However, this would be an inelastic aggregate acreage response in view of economic incentives provided through prices and net return. From the year 2005 onward, total acreage under major crops starts reducing under 2002 Farm Bill as the marketing loan impacts shrink because commodities prices were above the level where marketing loans benefit. In the short run i.e. in the initial years the prices of wheat, corn and sorghum trim down while the prices of soybean and soybean products appreciate. In the long run scenario, the acreage under major crops reduces and prices were generally greater.

**European Union’s common agricultural policy (CAP)**

The CAP is encompassed of a set of rules and mechanisms which regulate the production, trade and processing of agricultural products in the European Union (EU) with attention being focused ever more on rural development (Europa, 2005a). Initially the CAP contemplated to maintain and increase food production. The CAP provided subsidies and guaranteed prices to farmers, offering incentives for them to produce. These subsidies developed into a comprehensive framework of ‘common market organizations’ (CMOs) for several crop and livestock products. This could not create balance between supply and the demand of agricultural products resulting in ever growing surplus. In 1988, the European Council agreed on a package of reform measures including the "agricultural expenditure guideline" which restricted the percentage of CAP expenditure in the overall budget.

Export subsidies have been used by EU member states whose domestic prices were supported above world price levels. Price supports encouraged production frequently resulting in a production surplus. Export subsidies were employed to bring the price of the commodities down to world price levels in order to export surpluses. As the export subsidies used to increase the world supply of commodities, thereby depressing world prices. The EU has been the largest user of export subsidies in both value and volume. Referring to the official notifications of the WTO on export subsidy use, Susan (2005)
found that the EU spent on average US$ 6 billion annually from 1995 to 1998\textsuperscript{4} subsidizing exports which were 90 percent of total export subsidies provided by various countries. Over the same period, the EU’s volume of subsidized exports averaged about 28 million tons a year plus 3.6 million hectoliters (95 million gallons) of liquids (wine and alcohol).

According to European Commission (2004), the ability of EU agriculture to produce large quantities of agricultural products and the diversity and quality of those products means that the EU has become a major exporter of many foodstuffs, the second biggest exporter globally with agricultural exports worth US$64.75 billion in 2002. Despite high import tariff, the EU has also been the biggest importer of agricultural products in the world. In 2002, EU imports of agricultural products were valued at US$ 66.01 billion.

In the case of grains and beef, the EU employs intervention systems that purchase domestic products at guaranteed prices which acted as price floors. There was one intervention price for all grains, set US$102/ton and has been subject to reduction to US$93.7/ton for the period 2001/02 to 2006. The domestic price structure has encouraged barley and other coarse grains production. Grain and beef producers also received direct payments. Sugar and dairy production supported by high guaranteed prices and production fixed by quotas (Susan, 2005).

Europa (2004) and Europa (2005a) argued that Governments of the Member States of the European Union accomplished an agreement known as “Agenda 2000” on the 25th day of March 1999 in Berlin that was basically a sketch of agricultural reforms proposed for a period 2000-06. The sole aim of preparing an agenda was that it should be multifunctional, sustainable and competitive besides ensuring a secure income for the farming community in EU States. The Agenda was also to take care of consumers’ concerns and demands vis-à-vis food quality and safety, environmental protection and animal welfare along with increased transparency and simplifying procedures. The main features of Agenda (Europa, 2005) presented in the form of CAP 2000 included:

i. A Single Farm Payment (SFP) for Union farmers independent from production however, limited coupled elements may be maintained to avoid desertion from production;

ii. Linkages of SFP with environmental, food safety, animals and health of animals’

\textsuperscript{4} During this period export subsidy amounting to over US$27 billion was provided by various countries.
welfare standards, as well as requirements to keep all farm lands in good agricultural and environmental conditions i.e. cross compliance;

iii. A reinforced rural development policy with more Union money, new measures to promote the environment, quality and animal welfare and to help farmers to meet Union production standards starting from 2005;

iv. Initiating “modulation” i.e. reduction in direct payments for bigger farms to finance the new rural development policy;

v. An agreement on financial discipline to ensure that the farm budget fixed in anticipation of 2013 is not exceeded;

vi. Revision of market policy of the CAP such as;
   a) Asymmetric price cuts in the milk sector i.e. intervention price for butter reduced by 25% over four years and for skimmed milk powder by 15% over three years.
   b) Lessening of monthly increments in the cereals sector by half.
   c) Reforms in the rice, durum wheat, nuts, starch potatoes and dries fodder sectors.

vii. Introduction of reforms concerning the so-called Mediterranean products for example olive oil, tobacco, cotton to take place by 2003 within the existing budgetary framework.

IATP (2003) commenting upon CAP reforms has argued that decoupling the payments shift the EU’s subsidies mostly from Blue Box to the Green Box. It means existing trade distorting subsidies linked to production constraints will shift to Green Box where subsidies were considered to cause little or no trade distortion. However, according to estimates at least two-third of the EU Blue Box subsidies turned to US$ 18 billion would be considered to be in the Green Box on account of reform package by the end of 2013. It is also argued that EU member states may opt for 100 percent decoupled payments for arable crops making it easier to run the program instead of running two parallel systems of farm subsidies i.e. coupled and decoupled.

The EU provides financial assistance for investments in farm businesses which must meet objectives such as: (i) Reducing production costs (ii) Improving product quality (iii) Preserving and improving the environment (iv) Meeting hygiene and animal welfare conditions (v) Encouraging diversification in agricultural activities and (vi) Transfer of farm businesses from one generation to another. The last objective means assistance to
young farmers to start up in farming and through the encouragement of early retirement so that farms can be made available for the next generation.

According to Europa (2005c), the 2000 - 2006 financial perspective establishes for each of the years covered the amounts of expenditure in terms of appropriations for commitments. The ceilings in the financial perspective were set initially in 1999 have been revised in 2004. The new perspective contains eight main headings (agriculture, structural operations, internal policies, external action, administration, reserves, pre-accession strategy and compensations). Agriculture and structural operations account for the bulk of expenditure under the financial perspective. The reform of the common agricultural policy under Agenda require an initial increase in agricultural expenditure US$ 44.60 billion in 2000 to US$ 49.92 billion in 2006.

The World Bank (2001), Jansen, Tarp and Finn (2002) and Aksoy (2004) indicated that EU has a lot to reform in areas of tariff and non tariff barriers in light of the AoA. They argued that the EU has specific, compound, or mixed rates in 44 percent tariff lines. The EU has adopted duties that vary according to the content of the products in 4 percent. The main agricultural commodities of the Union such as grains, sugar and milk etc are on non-ad-valorem tariffs in more then 90 percent of tariff lines. The TRQ regime of the Union has very high peak tariff rates for certain products that sky up to 98 percent on processed fruits, 146 percent on processed vegetables and 63 percent on cocoa products. The European Union has non-ad-valorem tariff lines’ share of 22 percent for raw materials, 43 percent for intermediate and 58 percent for final products. This system makes the reported ad valorem equivalents of specific duties much higher then the ad valorem rates that means protection escalates with each processing step. The border protection in the EU is further strengthened with the application of SPS and TBT standards, non tariff barriers, which are becoming increasingly stringent as referred by Diop, Beihin and Sewadeh (2005) while discussing African countries difficulties meeting EU’s quality standards.

The market distorting effects of EU subsidies could be judged from the findings of the European Commission (2003b) which said that refund rate on export as percentage of the world price for sugar and butter was 229% and 122% respectively. This is a simple example to understand the distortions created in the world market and keeping out the products from developing countries to compete in the international market thereby snatching their right to stay in farming business and forcing them to live in the vicious
circle of poverty for generations to come as was also referred by Ranjan and Koshy (2005).

**Impact of the CAP reforms**

The CAP costs about US$46 billion per year. Less than 1% of GDP is spent on the 5.5% of the population who farm (in the EU of 15 countries, before the 2004 enlargement). Although now the share of CAP in EU GDP is small and declining, going towards 0.33% by 2013. On average every citizen puts in around 2 euros a week to finance the CAP (Europa, 2004). This is barely a high price to pay for a healthy supply of food and a living countryside. As a matter of fact the money spent on CAP has been changing in term that less for export subsidies, less for market support (intervention stocks etc) and more direct aid to producers.

Europa (2005) and the European Commission (2003) in an analysis reflected that the new CAP approach would be important for developing countries as it is expected to lead to substantial reductions in subsidized EU exports. Apparent threats to third country markets from EU exports would thus be greatly diminished. The EU has made major efforts to redirect its farm policy towards more transparent and non trade-distorting instruments with at least two-thirds of farmer payments not being linked to production at the moment and future direction of this figure will depend on how the June 2003 reforms are implemented. However, the EU continued to argue for the retention of certain support measures that were linked to production limits. But for sure, the impact on trade of such measures would be less trade-distorting than market price support or payments based on output. Additionally, the EU’s record of importing agricultural products from developing and least developed countries has been impressive and was greater than the US, Japan, Australia, and New Zealand together.

It has also been argued that the CAP reform proposals would result in changes in land allocation. The total area under cereals would reduce by 2.6% i.e. more than 0.9 million hectares through 2009, with rye and durum wheat areas experiencing the strongest falls 9.3% and 10.4% respectively. Most of the fall in cereal area would come from the new competition from energy crops, with the cut in cereal price support and the introduction of decoupling having a minor effect. The oilseed area is projected to decline by 2.9%, whereas energy crops would develop on an area estimated at between 0.8 and 0.9 million hectares which were largely allocated to cereals. On the other hand, decoupling would generate an increase involuntary set-aside (i.e. abandonment of production) by
approximately 30%, i.e., 0.7 million hectares due to the fact that land with low profitability would go out of production (European Commission, 2003). These changes were summarized as follow:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cereals</td>
<td>35.7</td>
<td>35.6</td>
<td>35.7</td>
<td>35.7</td>
<td>35.7</td>
<td>35.6</td>
</tr>
<tr>
<td>-3%5</td>
<td>-3.1%</td>
<td>-1.0%</td>
<td>-2.8%</td>
<td>-2.7%</td>
<td>-2.5%</td>
<td>-2.6%</td>
</tr>
<tr>
<td>Soft wheat</td>
<td>14.0</td>
<td>13.9</td>
<td>14.0</td>
<td>13.9</td>
<td>14.0</td>
<td>13.9</td>
</tr>
<tr>
<td>-1.4%</td>
<td>-1.0%</td>
<td>-0.9%</td>
<td>-1.2%</td>
<td>-0.6%</td>
<td>-1.4%</td>
<td></td>
</tr>
<tr>
<td>Durum Wheat</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>-8.3%</td>
<td>-10.4%</td>
<td>-9.9%</td>
<td>-10.4%</td>
<td>-11.0%</td>
<td>-10.4%</td>
<td></td>
</tr>
<tr>
<td>Barley</td>
<td>10.1</td>
<td>9.9</td>
<td>10.1</td>
<td>9.9</td>
<td>9.9</td>
<td>9.7</td>
</tr>
<tr>
<td>-1.8%</td>
<td>-3.3%</td>
<td>-0.5%</td>
<td>-1.8%</td>
<td>-0.8%</td>
<td>-0.9%</td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>4.1</td>
<td>4.1</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>-1.6%</td>
<td>-1.3%</td>
<td>-0.6%</td>
<td>-1.2%</td>
<td>-0.2%</td>
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<td>Voluntary set-aside</td>
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<td>28.8</td>
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Source: European Commission 2003

Total cereal consumption and exports were projected to be declined slightly because of the reduced production coupled with higher cereal prices. The overall reduction in the production level would make possible the balance of EU cereal markets to be restored, with total stocks dropping by some 10 million tons by 2009. The EU rye market would present the strongest improvement. After a short-term fall, the cereal prices in the EU would gradually recover. In case of rice, the strong cut in the rice support price levels, partially compensated by the granting of direct payments, would result in a 10 percent fall in planted area and a 4 percent drop in average yield thereby necessitating a reduction in EU rice production by 14 percent through 2009 (European Commission, 2003). This is argued would lower domestic prices and would boost domestic consumption reducing the EU attractiveness as an import market, resulting in a swift and significant improvement in the overall balance of the EU rice market.

Compared to the continuation of the Agenda 2000 policy measures, the CAP reform proposals were projected to display a very judicious impact on the income situation of the

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5 Percentage deviation from baseline
agricultural sector. Agricultural income, expressed per labor unit i.e. full-time equivalent and in real terms, was expected to rise by 8.5% between 2001 and 2009 under the CAP reform proposals. After a short-term relative decline in line with the fall in cereal, meat and milk prices, agricultural income was projected to recover sharply as cereal and meat prices begin rising.

The EU has also been helping some of the developing countries through Generalized System of Preferences. Sajid (2005) stated that EU Generalized System of Preferences (GSP) has been the preferential trade regime. This facility was available to the developing countries of the world since 1970s. The trade allowed under GSP remained worth more than US$48 billion annually. This amount is above the aggregate preferential access schemes of the US, Canada and Japan together, making it the most important preferential trading regime granting market access to developing countries. Along side, the EU is working on simplifying and where appropriate, relaxing the Rule of Origin (ROO) thereby allowing the developing countries to get full advantage of GSP.

The medium-term economic evaluations/analyses of the CAP revealed that the orientation towards a more competitive, market oriented and sustainable agriculture, through the proposed market reforms and the move towards more decoupled, non-commodity specific policy instruments and introduction of a single farm payment scheme, would contribute to an improved allocation of resources leading to greater income transfer efficiency. The adjustment of production in several commodity sectors, notably those where production were strongly influenced by the level of support and by the coupled instruments have also been projected. According to modular results the total cereal production would reduce as area under cereal to be forced out by the land allocated to energy crops, the rise in voluntary set-aside and the changes in the support level in this sector. Rye and durum wheat would be the most affected cereals. Total cereal consumption would in turn display slower growth due to lower availability, sustained prices and a projected reduction in feed demand from the animal sector. This scenario would also play a significant down ward trend in cereal exports from EU.

Agricultural policies of OECD countries

OECD (2003) stated that recognizing the society’s demand for the 21st century, the OECD countries have agreed to an optimistic reform agenda towards agricultural policies based on the principles settled by the ministers in 1987. The fundamental feature of these
principles was the reduction of such support that led to markets distortions. In the OECD countries, the intensity of support provided to farmers (the Producer Support Estimate) was US$ 235 billion in 2002 that represented 31% of total farm receipts in the OECD area. 76% of this support was provided under output-based support and input subsidies. However, if we look at 1986-88 figures, this support i.e. output-based support and input subsidies were 90%. It has been argued that the contemporary policies led to higher prices which stimulate output and hence input demand with the result that much of the increase in receipts was paid back to input suppliers or capitalized into land values. The direct income payments that were “decoupled” from agricultural activity altogether have been stated to be the most effective form of support as in this case payments would have some impact on output but insofar as those payments do away with the incentive for additional production, money did not trickle down to the owners of other resources (land, inputs). Additionally, direct income payments could be targeted and delivered to those households that policymakers decide to be in need of support. Although, the global gain from agricultural trade liberalization were anticipated to the tune of about US$ 60 billion per annum (OECD, 2003) that would have been shared by all OECD countries through both multilateral and unilateral liberalization. But trade protection associated with inefficient domestic policies off set the benefits expected from specialization and free trade, according to comparative advantage.

OECD (2002) reported that in 2000, total support to agriculture in OECD countries amounted to US$311 billion. Almost three quarters of this support to agriculture was acquired by the producers and rest was used to provide general services in the form of infrastructure, inspection, research and marketing. However, a decrease by US$10 billion in the amount of this support to agriculture was observed from 2000 onward, accounting for 1.3% of the GDP in the OECD area. The support to agricultural producers accounted for 31% of total farm receipts in the OECD area during 2001, compared with 32% in 2000 and 38% in 1986-88. One of the reasons for decrease in support has been attributed to the increase in the world prices, causing a fall in price support. The share of market price support and output payments, which were among the most production and trade distorting measures, remained high at 69% of producer support, though down from 82% in 1986-88. Prices received by OECD farmers in 2001 were still on average 31% above world prices, compared with 58% in the mid 1980s, shielding farmers in many countries from world market signals.
Agricultural policies of Japan

Wheat and Barley:
Although Japan overhauled its wheat and barley policies in 2000 however, essentially the pattern of subsidies aimed at encouraging production of these crops remained in place the burden of which is ultimately being paid by Japan's consumers and taxpayers. According to Hisao, Dyck and Stout (2004), the important features of the policy include:

(i) The Income Stabilization Fund: The Food Department provided a standard Income Stabilization Fund (ISF) which was US$0.844 per kg for wheat in 2003. Farmers received the price at which they sold the wheat to private buyers plus the government subsidy from the ISF. Japan classifies the 2000 policy as part of its Aggregate Measurement of Support (AMS) i.e. amber box to the WTO.

(ii) Payments for feed barley production: These were the payments made to the farmers to produce barley for feed use. The reported payments for the year 1999 were to the tune of US$8 million however, declined to about US$2 million in 2002.

(iii) Wheat and barley planted on rice paddies (the rice diversion program): Rice crop diversion program payments for per 1 hectare for Wheat, barley, and soybeans were US$6610, for Vegetables US$1035.4 and for Long-life crops (fruit orchards) were US$1194.6 respectively.

(iv) Insurance: The government contributes at least 50 percent of the premium and in some cases as much as 55 percent.

(v) Border Policies - Tariffs, tariff-rate quotas and state trading: A single tariff-rate quota (TRQ) covered wheat and many products derived from it, including wheat flour. Another TRQ covered barley and some of its products. Only the Food Department of MAFF has the right to import products within the wheat and barley TRQs. Only firms that have been approved by MAFF can import within the barley malt TRQ. In practice, the TRQs for wheat and barley allowed importation of very large quantities of unmilled grain but very little processed wheat and barley products. For firms desiring to import processed wheat or barley products within the quota, faced three barriers in the way:

(vi) Special programs for imported wheat: Under this program, MAFF permitted flour millers to import wheat outside of MAFF's control as long as they exported an equivalent amount of wheat flour. This self-styled "free wheat" was imported at world prices (less than half of MAFF's resale price) and was thus very profitable. This system also provided
milers with an export market for their inferior quality flour which otherwise would have diminutive value in the domestic market.

Rice:

According to Hisao, Dyck and Stout (2003), Japanese government has kept rice import restrictions for over 30 years. However, it was in 1995 at the Uruguay Round (UR) trade negotiations when Japan agreed to a quota on rice imports. Alongside, the Japanese government initiated new policies that relinquished some control over rice marketing. But subsidies to rice production remained large. In 1999, government spending to support rice production was US$1.82 billion besides spending about US$1 billion in payments to divert rice paddies out of rice production. The amount spent on the stockpiling of rice and subsidizing rice used in school lunch programs as well as research and farmer pension expenditures is in addition thus making the total burden of domestic rice policies on taxpayers over US$2.8 billion per year. The aggregate expenditure on rice amounted to over $340 per ton of milled rice produced in 1999.

Wailes, Ito and Cramer (1991) stated that the Japanese government self purchased the rice and kept ceased rice imports to shield the farmers from foreign competition. Hisao, Dyck and Stout (2003) reported that reforms in rice marketing regime of Japan were introduced during late 1990s. Farmers were made free to choose any marketing channel, wholesale and retail marketing. That policy resulted in falling rice retail prices in the country. However, when prices fell below an historical average price, average of last seven years prices excluding highest and lowest ones, the government offered compensation to farmers through a program called Income Stabilization Program from 1998 onward. The market price compensation offered was 80 percent of the difference between the current year price and the standard price multiplied times current production. The compensation for marketing loss offered to rice farmers in 1999 was to the tune of US$815 million.

Since 1999, Japan has been using a tariff-rate quota (TRQ) system for rice imports. Within the quota, the tariff is zero. However, since the MAFF's Food Agency has the sole right to import rice within the quota, the tariff level was irrelevant. Imports outside the quota were legally possible but are effectively prohibited by the high tariff applied to them: US$2,819/ton in 2001, equivalent to a tariff of 793 percent. The Food Agency could collect a markup of up to US$2.41/kg in 2001, called state trading markup. By isolating its markets from world rice markets, Japanese policies have caused domestic
prices to be higher viz a viz free trade. Higher prices have affected both supply and demand. Other similar rice cultivar producing regions were Korea, Taiwan, northern China, California and New South Wales (Australia) all producing rice at a lower price than most Japanese farmers. In recent years, typical prices received by Japan’s producers have been 60 percent higher than in South Korea and more than 10 times higher than US prices. At retail, Japan’s rice prices tend to be 2.5-3 times higher than U.S. prices.

Agricultural policies of China

China’s Agriculture had been characterized by a number of taxes to generate revenue for the government. However, it was in 1980s that Household Responsibility System returned control of land to farmers and markets were gradually liberalized (USDA, 2005c). During the period of 1994-96 low grain production resulted in price inflation which led to a quick increase in grain procurement prices. This situation led to introduction of the Governors' Responsibility System popularly known as the Governors’ Grain Bag policy aimed at increasing grain production. The grain bag policy led to surplus production consequently falling prices in late 1990s. In order to bring a balance, the government brought about the system of price supports and subsidies for grain storage, marketing and exports (Fred, Lohmar and Tuan, 2005).

USDA (2005c) stated that during late 1990s subsidies were introduced for procurement, storage and export to protect and support agricultural prices. The period 2000 to 2003 saw an increased reliance on markets; privatization of grain and cotton marketing and testing of rural tax reform and direct subsidies. Whereas nationwide direct subsidies and agricultural tax elimination was initiated in 2004.

USDA (2004f) and USDA (2004g) reported that in 2004, China introduced the first national direct subsidies to farmers and announced elimination of agricultural taxes. Fred, Lohmar and Tuan (2005) stated that The Chinese Government, in 2004 set up its priority towards increasing rural incomes. To achieve this goal, a number of policies have been introduced. However, from agriculture point of view two were considered most prominent namely direct subsidies to farmers and elimination of taxes on farmers. The reported grain subsidies were $1.4 billion. The standard amount per acre has been reported approximately $7.33 for area planted in grain. According to USDA estimates these subsidies were less than 2% of the gross value of grain production. On the front of agricultural tax which was 2-3 percent (US$7 billion) of all taxes collected in China, the Chinese Government would be eliminating the agricultural tax in 5 years. As a first step,
the tax was reduced by 3 percentage points in 2004 and an additional 1 percentage point per year in subsequent years. China has also eliminated the specialty crop tax leaving out tobacco and taxes on grazing livestock. In lieu of agricultural tax elimination, the central government would transfer funds to local governments to make up for lost tax revenue used for basic education and other local government activities.

Under new policies, subsidies would also be available for high-quality seeds including high-oil soybeans, special-use corn, wheat and high-quality rice varieties through seed supply companies. These companies were expected to pass on the subsidies to farmers. An additional subsidy amounting to US$5 million has been allocated for purchases of farm machinery (up to 30 percent of the purchase price) in large grain producing provinces. China has been abolishing protection prices since 1990s. In 2003, protection prices were left only for grain. However, during 2004, the government maintained minimum “protection prices” for rice only due to the political sensitivity of rice being staple food grain of China. As a result of policy shift, market prices rose by 40-50 percent between 2003 and 2004 to levels well above the protection price. Grain prices were than mostly set in open markets and government procurement prices appeared to be following market prices. Simultaneously, China has been privatizing the domestic grain marketing system, investing heavily in agricultural infrastructure, making efforts to prevent loss of agricultural land to urban uses and encouraging rural financial institutions to provide more loans to farmers. Xiaoping (2004) reported that China was also aiming to improve the livelihoods of agricultural producers through increased investment from US$14.5 billion to $18.1 billion in rural infrastructure in 2003. The major spending included improved irrigation facilities, rural roads, methane production facilities, rural hydroelectric plants, pasture enclosures, research and construction of agricultural high technology parks.

Agricultural policies of India

Indian agricultural sector accounted for 23.6 percent of GDP which was estimated to be US$3.319 trillion for the year 2004 and was among the top three global producers of agricultural commodities such as wheat, rice, pulses, cotton, peanuts, fruits, and vegetables. Agriculture Sector contributed 14 percent i.e. US$69.18 billion in exports during 2004 (Fact Book, 2004 and USDA, 2005d).

According to Dacnet (2005) and USDA (2005d) historically, India’s agricultural policies
revolved around the doctrine of food self-sufficiency particularly of rice and wheat, with import protectionism and highly taxed export control. India's domestic markets were insulated from world markets by various restrictive practices including bans, licensing regimes, state trading and other quantitative restrictions as well as high tariffs. To meet the domestic requirements, the emphasis was laid on high-yielding varieties, expanding irrigation, increasing nutrient-fertilizers use and increasing area under crops. However, since early 1980s, India has started liberalizing its import policy. At the domestic front, India's agricultural policy instruments included a system of minimum support prices for major crops; input subsidies for nutrient-fertilizers, power, and irrigation water; and public investments in surface and to a lesser extent, groundwater irrigation.

Following the WTO rules regarding removal of quantitative trade restrictions, the Indian policy was than replaced by relatively high bound and applied tariff for major commodities. Rice and wheat were procured from domestic market at support prices and supplied for distribution at subsidized prices through the Public Distribution System (PDS) and other food distribution programs. The cost of rice and wheat operations i.e. food subsidy along with the power subsidy were generally the largest budget subsidy outlays for agriculture. The overall agricultural subsidies during the fiscal year 2002-03 have reached about US$12 billion (Government of India, 2004). The reforms introduced for industrial, trade and exchange-rate by the Indian Government in early 1990s have been creating pressure for change in agricultural policy resulting in removal of quantitative trade restrictions and initiating steps for regulation of domestic markets. In a major policy shift, import licensing for all products, except those on the banned, restricted and state monopoly lists was abolished to free imports. The lists which included mainly agricultural products, consumer goods and textiles, were revised and shortened annually. Maximum tariff rates were brought down in steps from 300 percent to about 40 percent for most products and countervailing duties were reduced. The average trade-weighted tariffs were reduced from 87 percent in 1991 to 27 percent in 1997. Trade restrictions on agricultural products were left mostly untouched in the 1991 reform but subsequent trade policy changes gradually lifted restrictions on agricultural products.

Under the Agreement on Agriculture (AoA), India had agreed to bind agricultural tariffs at ceiling rates ranging from 0 to 100 percent for primary products, 150 percent for processed products and 300 percent for edible oils. In 1997, after India lost the balance-of-payments waiver that allowed it to maintain restrictive trade policies, India accelerated
the process of lifting quantitative import restrictions. In April 2001, India completed the removal of quantitative import restrictions on agricultural imports and nearly all items have been allowed to be imported subject to tariff and sanitary and phytosanitary standards. In fiscal year 2002-03, while the average bound tariff for agricultural goods was relatively high 115 percent, the average applied rate was 33 percent. India's agricultural trade policy also provided incentives for exports which included: (i) reduced import duties for items needed by a processing industry if the processed products were to be exported (ii) firms have been permitted to set up private bonded warehouses in domestic tariff areas to import, stock, and even sell restricted list items to holders of advance licenses (iii) export restrictions on most products have been lifted, and some commodities have been provided subsidies allowed by the World Trade Organization on domestic transport and marketing costs and (iv) agro-processing zones have been planned to set up with government support for infrastructure and finance, as well as duties concession for imported inputs for exported products.
2.4 WTO: Existing Scenario

In the first section, we have introduced various agreements of WTO. In the second and third sections we studied agriculture policy regimes of Pakistan and major players. In the fourth section we are going to discuss latest/existing situation in order to arrive at what we have yet to accomplish. A Committee on Agriculture (CoA) comprising of representatives from member states is working based at Geneva. The Chair of this Committee, in February 2008, submitted modalities for further work on implementation of WTO/AoA. The material in this section has been collected from WTO website (www.wto.org). The modalities can present the best picture (official version of WTO) of what WTO has yet to achieve in the remaining period up to 2014. The main points of modalities are reproduced as follows.

**Domestic support**

**Overall reduction of trade-distorting domestic support: Tiered reduction formula**

Where the base level of Overall Trade-Distorting Domestic Support is greater than US$60 billion, or the equivalent in the monetary terms in which the binding is expressed, the reduction shall be 75-85 percent; Where Domestic Support is greater than US$10 billion and less than or equal to US$60 billion, the reduction shall be 66-73 percent; Where the Domestic Support is less than or equal to US$10 billion, the rate of reduction shall be 50-60 percent.

**Implementation period and staging**

As the first installment of the overall reduction, in the first year the sum of all trade-distorting support shall not exceed 2/3rd of the base level for first and second category and 75 percent for third category of Overall Trade-Distorting Domestic Support (OTDS). The remaining reductions shall be implemented in equal steps over next 5 years.

**Final bound total AMS: Tiered reduction formula; reductions in final bound total AMS**

Where the Final Bound Total AMS is greater than US$40 billion, the reduction shall be 70 percent; Where the AMS is greater than US$15 billion or equal to US$40 billion, the reduction shall be 60 percent; Where the AMS is less than or equal to US$15 billion, the rate of reduction shall be 45 percent.
Implementation period and staging

The reductions in Final Bound Total AMS shall be implemented with 25 percent reduction on day 1 of implementation, and remaining in equal annual installments over 5 years by developed countries for category first and second and over 6 years for remaining developed countries. For developing countries reduction would be $2/3^{rd}$ applicable to developed countries in category third in 9 equal installments over 8 years.

**Product-specific AMS caps: Reductions**

The product-specific AMS limits specified in the Schedules of all developed country Members other than the United States shall be the average of the product-specific AMS during the Uruguay Round implementation period (1995-2000) as notified to the Committee on Agriculture.

For the United States only, the product-specific AMS limits specified in their Schedule shall be the resultant of applying proportionately the average product-specific AMS in the [1995-2004] period to the average product-specific total AMS support for the Uruguay Round implementation period (1995-2000) as notified to the Committee on Agriculture.

**Blue box cap**

The maximum permitted value of support shall not exceed 2.5 percent of the average total value of agricultural production during the base period. This limit will apply from the commencement of the implementation period.

**Cotton: Domestic support: Reductions in support for cotton production**

The AMS Support for cotton shall be reduced by following formula in $1/3^{rd}$ of implementation period.

\[
R_c = R_g + \frac{100 - R_g}{3} \times 100
\]

where:
- $R_c$ = Specific reduction applicable to cotton as a percentage
- $R_g$ = General reduction in AMS as a percentage

**Market access**

**Tiered formula for tariff reductions**

For developed countries, where the bound duty or ad valorem equivalent is greater than 0 and less than or equal to 20 percent the reduction shall be 48-52 percent; where its equivalent is greater than 20 percent and less than or equal to 50 percent, the reduction shall be 55-60 percent; where this equivalent is greater than 50 percent and less than or
equal to 75 percent, the reduction shall be 62-65 percent; and where the bound duty or ad valorem equivalent is greater than 75 percent, the reduction shall be 66-73 percent.

For the developing country Members, where the bound duty or ad valorem equivalent is greater than 0 and less than or equal to 30 percent, the reduction shall be 2/3\textsuperscript{rd} of the cut for developed countries in the bottom band; where this equivalent is greater than 30 percent and less than or equal to 80 percent, the reduction shall be 2/3 of the cut for developed in the second band; where this is greater than 80 percent and less than or equal to 130 percent, the reduction shall be 2/3 of the cut for developed in the third band; and where the bound duty or ad valorem equivalent is greater than 130 percent, the reduction shall be 2/3 of the cut for developed countries in the fourth band, over 8 years.

Sensitive products
Each developed country Member shall have the right to designate up to 4-6 percent of dutiable tariff lines as "Sensitive Products". Where such Members have more than 30 percent of their tariff lines in the top band, there is an option to have the number of Sensitive Products increased to 6-8 percent. Developing country Members shall have the right to designate up to 1/3\textsuperscript{rd} more of their tariff lines.

Treatment - tariff cut
Members may deviate from the otherwise applicable reduction in bound duties on products designated as Sensitive. This deviation may be at a maximum of 1/3\textsuperscript{rd}, 1/2 and 2/3\textsuperscript{rd} of the reduction that would otherwise have been required by the tiered formula.

Tariff quota expansion
Tariff quotas arrived at through use of the sensitive products provision, for developed member countries result in new access opportunities equivalent to no less than 4-6 percent of domestic consumption expressed in terms of physical units where the maximum deviation of two-thirds is used where 1/3\textsuperscript{rd} deviation is used, new access opportunities should be no less than 3-5 percent of domestic consumption. Where 1/2 deviation is used, new access opportunities should be no less than 3.5-5.5 percent. For developing member countries, the tariff quotas shall be two thirds of volume of developed countries.

Tariff simplification
All bound duties on agricultural products shall be expressed as simple ad valorem tariff. In any case, no tariff may be bound in a form more complex than the current binding.
Tariff quotas: Bound in-quota duties

The final reductions of Members' existing final bound in-quota tariffs shall be no less than the default cut (sensitive product cut increased by 20 per cent for developed country Members and by 14 per cent for developing country Members). The implementation period and staging shall be aligned with those applying to reductions in the existing bound out-of-quota tariffs. Bound in-quota tariffs shall be eliminated in equal annual installments over five years for developed country Members. Developing country Members shall not be required to make reductions in their existing bound in-quota tariffs.

In-quota tariffs for new Doha Round tariff quota access opportunities shall be bound at zero. Be bound at a rate equivalent to what would have applied under application of the tiered formula but for the deviation applied as a result of its designation as a sensitive, less 10 ad valorem percentage points for tariffs in the top tier, 7.5 ad valorem percentage points for tariffs in the second highest tier, 5 ad valorem percentage points for tariffs in the third highest tier and 2.5 ad valorem percentage points for tariffs in the bottom tier. Any resulting in-quota duty which would, under this approach, be less than 10 per cent shall be bound at zero, and in no case shall the bound in-quota duty exceed 30 percentage points.

Cotton market access

Developed country Members and developing country Members in a position to do so shall give duty and quota free access for cotton exports from least-developed country Members from the commencement of the implementation period. Developing country Members that are not in a position to give duty- and quota-free access for cotton exports from least-developed country Members from the commencement of the implementation period shall undertake to look positively at possibilities for increased import opportunities for cotton from least-developed country Members.

Export competition

Export subsidy commitments

Developed country Members shall eliminate their export subsidies by the end of 2013. This will be on the basis of budgetary outlay commitments being reduced by 50 percent by end 2010 with the remaining budgetary outlay commitments being eliminated in equal annual installments so that all forms of export subsidies are eliminated by the end of 2013.
Developing country Members shall eliminate their export subsidy entitlements by reducing to zero their scheduled export subsidy budgetary outlay and quantity commitment levels in equal annual installments by the end of 2016.

**Agricultural exporting state trading enterprises (STEs)**

Any governmental or non-governmental enterprise, including a marketing board, which has been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which the enterprise influences through its purchases or export sales the level or direction of agricultural exports will lie in the category of STEs. The member states to eliminate, government financing of exporting state trading enterprises, preferential access to capital or other special privileges with respect to government financing or re-financing facilities, borrowing, lending or government guarantees for commercial borrowing or lending, at below market rates;

**International food aid**

Food aid outside the Safe Box will be actionable where it leads to commercial displacement. In-kind food aid provided which fails to meet its criteria will be deemed to create commercial displacement and thereby circumvent export subsidy commitments.

**Liberalization of trade: Where do we stand**

As is evident from the foregoing scenario that yet we are far away from the fully liberalization of trade. However, the positive point is that all member states are engaged in on-going negations and trying to reach a consensus. If the on-going negotiations, based on just presented modalities are successfully concluded in coming Round than it is expected that duty-free and quota-free market access on a lasting basis, for all products originating from all LDCs by 2008 or no later than the start of the implementation period in a manner that ensures stability, security and predictability. Members facing difficulties at this time to provide market access shall provide duty-free and quota-free market access for at least 97 percent of products originating from LDCs, defined at the tariff line level, by 2008 or no later than the start of the implementation period. In addition, these Members shall take steps to progressively achieve compliance with the obligations, taking into account the impact on other developing country Members at similar levels of development and as appropriate, by incrementally building on the initial list of covered products.
Annex-2.1

Definition of terms and concepts used

Aggregate measurement of support (AMS): An index that measures the monetary value of the extent of government support to a sector. The AMS, as defined in the Agreement on Agriculture, includes both budgetary outlays as well as revenue transfers from consumers to producers as a result of policies that distort market prices. The AMS includes actual or calculated amounts of direct payments to producers (such as deficiency payments), input subsidies (on irrigation water, for example), the estimated value of revenue transferred from consumers to producers as a result of policies that distort market prices (market price supports), and interest subsidies on commodity loan programs.

Base acreage (or crop acreage base): A farm's crop-specific acreage of wheat, feed grains, upland cotton, rice, oilseeds, or peanuts eligible to participate in commodity programs under the 2002 Farm Act. Base acreage includes land that would have been eligible to receive production flexibility contract payments in 2002 and producers of other covered commodities (oilseed and peanut producers). Producers had the option to choose base acres to reflect contract acreage that would otherwise have been used for 2002 PFC payments or to update base acres to reflect the 4-year average of planted plus prevented from planting for the commodity during the 1998-2001 crop years. Producers must select one of the two options for all covered commodities, including oilseeds.

Commodity Credit Corporation (CCC): A federally owned and operated corporation within the USDA, created to stabilize and support agricultural prices and farm income by making loans and payments to producers, purchasing commodities, and engaging in various other operations. The CCC handles all money transactions for agricultural price and income support and related programs.

Counter-cyclical payments: Counter-cyclical payments are available to eligible commodities under the 2002 Farm Act whenever the effective commodity price is less than the target price. The effective price is equal to the sum of 1) the higher of the national average farm price for the marketing year, or the commodity national loan rate and 2) the direct payment rate for the commodity. The payment amount for a farmer equals the product of the payment rate, the payment acres, and the payment yield. Payments are considered counter-cyclical since they vary inversely with market prices. In

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6 The definitions have been collected from the websites www.usda.gov and www.europa.eu.int
this way, farmers kept flexibility to plant a range of crops. Thus they were not necessarily growing the crops for which they receive fixed and counter-cyclical payments. If the base crop was produced, counter-cyclical payments reduced revenue variability because the drop in revenue when market prices fell was made up by variable payments on a fixed part of the output. This insurance effect could stimulate production, similarly to the insurance effect of loan rates.

**Decoupled payments:** Government program payments to farmers that are not linked to the current levels of production, prices, or resource use. When payments are decoupled, farmers make production decisions based on expected market returns rather than expected government payments.

**Deficiency payments:** Direct government payments made prior to 1996 to farmers who participated in an annual commodity program for wheat, feed grains, rice, or cotton. The crop-specific payment rate for a particular crop year was based on the difference between an established target price and the higher of the commodity loan rate or the national average market price for the commodity during a specified time period. A deficiency payment to the farmer was calculated as the product of the payment rate, the farm’s eligible payment acreage, and the farm’s established program payment yield.

**De minimis rule:** The total aggregate measurement of support (AMS) includes a specific commodity support only if it equals more than 5 percent of its value of production for developed countries such as the United States. The non-commodity-specific support component of the AMS is included in the AMS total only if it exceeds 5 percent of the value of total agricultural output.

**Direct payments:** Fixed payments provided under the 2002 Farm Act for eligible producers of wheat, corn, barley, grain sorghum, oats, upland cotton, rice, soybeans, other oilseeds, and peanuts. Producers enroll annually in the program to receive payments based on payment rates specified in the 2002 Farm Act and their historic program payment acres and yields.

**Green box policies:** Domestic or trade policies that are deemed to be minimally trade distorting and that are excluded from domestic support reduction commitments in the Uruguay Round’s Agreement on Agriculture. Examples are domestic policies dealing with research, extension, inspection and grading, environmental and conservation programs, disaster relief, crop insurance, domestic food assistance, food security stocks, structural adjustment programs, and direct payments not linked to production. Trade
measures or policies, such as export market promotion, are also exempt (but not export subsidies or foreign food aid).

**Loan deficiency payments:** A provision initiated in the Food Security Act of 1985, giving the Secretary of Agriculture the discretion to provide direct payments to wheat, feed grain, upland cotton, rice, or oilseed producers who agree not to obtain a commodity loan on their production for a particular crop year. Loan deficiency payments (LDP) continue to be available for all loan commodities except extra-long staple cotton. The LDP provision is applicable only if a marketing loan provision has been implemented; in which case a commodity loan may be repaid at a price less than the original loan rate (the repayment rate). The intent of these two provisions is to minimize the accumulation of stocks by the government, minimize the costs of government storage, and allow US commodities to be marketed freely and competitively. The LDP payment amount is determined by multiplying the local marketing loan payment rate by the amount of the commodity eligible for a loan. The marketing loan payment rate at a point in time is the announced local commodity loan rate minus the then current local repayment rate for marketing loans.

**Non-recourse loan program:** Provides commodity-secured loans to producers for a specified period of time (typically 9 months), after which producers may either repay the loan and accrued interest or transfer ownership of the commodity pledged as collateral to the Commodity Credit Corporation (CCC) as full settlement of the loan, without penalty. These loans are available on a crop year basis for wheat, feed grains, cotton, peanuts, tobacco, rice, and oilseeds. Sugar processors are also eligible for nonrecourse loans. Participants in commodity loan programs agree to store and maintain a certain quantity of a commodity as loan collateral, for which they receive loan funds from the CCC based on the announced commodity-specific, per-unit loan rate. The loans are called non-recourse because, at the producer's option, the CCC has no recourse but to accept the commodity as full settlement of the loan. For those commodities eligible for marketing loan benefits, producers may repay the loan at the world price (rice and upland cotton) or posted county price (wheat, feed grains, and oilseeds). Some commodity loans are recourse loans, meaning producers must pay back the loans in cash.

**Production flexibility contract (AMTA) payments:** Payments to farmers during 1996-2002 who enrolled "contract acreage," under Title I, Subtitle B of the 1996 Farm Act. The annual total amount was first determined for all contract crops combined (wheat, rice,
feed grains, and upland cotton) and then allocated to specific crops based on percentage allocation factors established in the 1996 Act. Each participating producer of a contract crop received payments equal to the product of their production flexibility contract payment quantity and the national average production flexibility contract payment rate.

**Three-entity rule:** Limits the number of farms from which a person can receive program payments. Under the rule, an individual can receive a full payment directly and up to a half payment from two additional entities.

**A unified market:** this meant free movement of agricultural products within the area of the Member States.

**Agenda 2000:** the name given to the CAP reforms agreed in 1999.

**Border measures:** The CAP maintains domestic agricultural prices above world prices for most commodities. In preferential trade agreements, such as those with former colonies and neighboring countries, the EU satisfies consumer demand while protecting high domestic prices through import quotas and minimum import price requirements. The CAP also applies tariffs at EU borders so that imports cannot be sold domestically below the internal market prices set by the CAP. Thus market access to the EU remains highly restricted in practice. In addition, the EU subsidizes agricultural exports to make domestic agricultural products competitive in world markets.

**Common Market Organizations (CMOs):** used to define the main agricultural commodity sectors e.g. dairy, arable, beef, goat & sheep, olive oil, etc.

**Domestic price support:** Domestic price supports are the historical backbone of CAP farm support. Prices for major commodities such as grains, oilseeds, dairy products, beef and veal, and sugar depend on the EU price support system. The major method of maintaining domestic agricultural prices is through price intervention and high external tariffs. Farmers are guaranteed intervention prices for unlimited quantities of eligible agricultural products. The EU authorities purchase, at the intervention price, unlimited excess products meeting minimum quality requirements that cannot be sold on the market. The surplus commodities are then put into EU storage facilities or exported with subsidy. Other mechanisms, such as subsidies to assist with surplus storage and consumer subsidies paid to encourage domestic consumption of products like butter and skimmed milk powder, also support domestic prices.

**Intervention buying:** Intervention buying is a method used by the EU to support market prices for certain agricultural commodities. When the world market price for cereals,
skimmed milk powder, butter and beef falls below the EU price, the commodity is bought (by the Member States but funded by the EU) and put it into storage. The commodity is then either put back onto the same or alternative markets at a later date. Intervention buying therefore acts as a price support mechanism.
CHAPTER III

METHODOLOGY

This chapter presents methodological and analytic framework applied to carry out the research under hand. There are in all four sections. The first section specifies the general supply and demand model, which was used to estimate supply and demand functions of various crops. The second section presents the methodological framework for arriving at welfare effects associated with the existing protection policies and government interventions. The third section provides explanation as to how changes in producers and consumers surpluses would occur if WTO's trade liberalization is fully implemented. The fourth and last section describes the type of data needed and its sources.

Specification and estimation of supply and demand functions

Supply and demand functions of seven major crops were econometrically estimated, and each one had its own specification of supply and demand as would be clear in the forthcoming Chapter IV. However, in general, the following model of supply and demand was originally tried and subsequently adjusted according to the nature of the crop/commodity involved.

For exporting commodity:

\[ A = a_0 + a_{11}A_{t-1} + a_2P_d \]  
\[ S_d = \beta_0 + \beta_1 \hat{A} + \beta_2 FNT + \beta_3 PPT + \beta_4 WAT \]  
\[ D_d = \gamma_0 - \gamma_1 P_d + \gamma_2 GDPP + \gamma_3 POPP \]  
\[ E_s = S_d - D_d \]  
\[ E_d = \theta_0 - \theta_1 P_c + \theta_2 P_w + \theta_3 GDPW + \theta_4 POPW \]

For importing commodity:

\[ A = a_0 + a_{11}A_{t-1} + a_2P_d \]  
\[ S_d = \beta_0 + \beta_1 \hat{A} + \beta_2 FNT + \beta_3 PPT + \beta_4 WAT \]  
\[ D_d = \gamma_0 - \gamma_1 P_d + \gamma_2 GDPP + \gamma_3 POPP \]  
\[ I_d = D_d - S_d \]  
\[ I_s = \theta_0 + \theta_1 P_1 - \theta_2 P_w + \theta_3 S_w \]

Where \( A \) = area under commodity in '000' hectares

\( A_{t-1} \) = lagged area under commodity in '000' hectares
\( A \) = area predicted (in equation 3.1a) under commodity in ‘000’ hectares

\( S_d \) = domestic supply of respective commodity in Pakistan in ‘000’ M. tons

\( D_d \) = domestic demand of respective commodity in ‘000’ M. tons

\( E_S \) = net export supply in ‘000’ M. tons

\( E_d \) = net export demand in ‘000’ M. tons

\( I_d \) = net import demand

\( I_s \) = net import supply in ‘000’ M. tons

\( S_w \) = world supply in ‘000’ M. tons

\( P_d \) = Pakistan’s domestic wholesale price in Pak. Rupees per M. ton.

\( P_e \) = export price per M. ton in US$

\( P_i \) = import price per M. ton in US$

\( P_w \) = world trade price per M. ton in US$

\( FNT \) = total nutrient-fertilizers in ‘000’ M. tons used

\( PPT \) = total pesticides used in ‘000’ M. tons

\( WAT \) = availability of water in million acre feet

\( POPP \) = population of Pakistan in millions

\( POPW \) = World population

\( GDPP \) = GDP of Pakistan

\( GDPW \) = GDP of world

The aforementioned model of supply and demand is a simultaneous-equations recursive model (Gujarati 2003, pp.764-766; Maddala 2002, p.373), wherein area sown \((A)\) under crop is assumed to be determined by lagged area \((A_{t-1})\) and domestic price \((P_d)\). The so determined area \((A)\), along with nutrient-fertilizers used, plant protection measures \((PPT)\) applied and water availability \((WAT)\), further determines commodity supply \((S_d)\).

The domestic demand \((D_d)\) is assumed to be influenced by commodity’s own price \((P_d)\), Pakistan’s national income \((GDPP)\) and size of Pakistan’s population \((POPP)\). Export supply \((E_d)\) is an identity equation equal to \(S_d - D_d\) and, in the same token, import demand \((I_d)\) is identity equation, equal to \(D_d - S_d\).

Export demand \((E_d)\) is assumed to be determined by Pakistan’s export price \((P_e)\), world trade price of the commodity involved \((P_w)\), world GDP \((GDPW)\) and world population \((POPW)\). While Import supply \((I_s)\) is determined by Pakistan’s import price \((P_i)\), world trade price \((P_w)\) and world supply \((S_w)\) of the commodity involved.

The seven crops selected for the analysis are the major crops produced in Pakistan in
terms of total cropped area as reflects from table 1.1 provided in the first chapter. In the same token, these crops produce large outputs and account for sizeable shares in their respective trade. We have, therefore, made use of large country assumption for estimation of supply and demand functions.

A number of specifications for each of the commodities were used and final estimated model (given in 4.1, 4.18, 4.26, 4.34, 4.42, 4.51 & 4.58 in Chapter IV) was selected on the basis of economic theory and statistical/econometric diagnostics using $R^2$, F-test, t-test, Jarque-Bera (JB) Normality Test, DW test and Durban h tests. These estimated models needed to go through, at least, three more major modifications to come up to a final useable form. First, the equation (3.1a) and (3.2a) are Autoregressive functions, which yield short-run results; it needed to be converted in to its long-run version. Second, equations (3.1b) and (3.2b) contain predicted value of area ($\hat{A}$), which is already estimated in equation (3.1a) and (3.2a); hence, $\hat{A}$ in equation (3.1b) and (3.2b) would have to be replaced with their estimated values. Third, the model 3.1 contains export demand function ($E_d$) but does not have export supply function ($E_s$), which would be computed using Identity equation $E_s = S_d - D_d$. Similarly model 3.2 contains import supply ($I_d$) function but lacks import demand ($I_d$) function, which would be computed as per identity equation $I_d = D_d - S_d$.

As already mentioned, equation 3.1a (and 3.2a) includes lagged dependent variables ($A_{t-1}$), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment ($\lambda$), and then adjust short run equation to its long run version. For computation of ($\lambda$), we know that coefficient of lagged variable is equal to ‘1- $\lambda$’ (Gujarati 2003, pp.673-78). Hence in case of equation (3.1a), $\alpha_1$ is:

$$1 - \lambda = \alpha_1 \quad (3.3a)$$

Solving for $\lambda$

$$\lambda = 1 - \alpha_1 \quad (3.3b)$$

To convert equation (3.1a) into its long run version, we would divide all coefficients attached with explanatory variables (with the exception of lagged variable) and constant by the value of ($\lambda$) and omit lagged variable from the equation. By doing so we would get the long run version of equation.

Since equation (3.1b) includes predicted value of variable ‘A’, hence we would replace its value with the long run version of equation (3.1a). Similarly, we replaced predicted
values in other equations wherever needed.

**Computation of welfare effects associated with existing policies**

Objectives set in the introductory chapter require identification of existing protection measures and government interventions and the welfare effects thereof in terms of changes in producers and consumers surpluses. We used Pakistan's domestic wholesale price \( (P_d) \) and compared it with Pakistan's export or import trade price \( (P_e \text{ or } P_i) \) and world average trade price \( (P_w) \) to arrive at protection policies and types of interventions practiced during 20 years 1985-86 to 2004-05.

For welfare effects, we used the following measures to compute changes in producers and consumers surpluses \((\Delta PS \text{ & } \Delta CS)\).

\[
\Delta PS = \int_{P_d}^{P_f} S(P)\,dp \\
\text{or}
\Delta PS = -\int_{P_d}^{P_f} S(P)\,dp
\]

\[
\Delta CS = -\int_{P_d}^{P_f} D(P)\,dp \\
\text{or}
\Delta CS = \int_{P_d}^{P_f} D(P)\,dp
\]

Where \( S(P) \) and \( D(P) \), respectively, represent estimated supply and demand functions and \( P_d \) and \( P_f \) domestic price and estimated free trade price. In case \( P_d > P_f \), change in producers surplus would be positive, and negative if \( P_f > P_d \). While in the former case change in consumers surplus would be negative and positive in the later case. Free trade price \( (P_f) \) would be estimated by equating export demand \( (E_d) \) and export supply \( (E_e) \) or import demand \( (I_d) \) and import supply \( (I_e) \).

In addition to changes in producers and consumers surplus \((\Delta PS \text{ & } \Delta CS)\), some of the interventions have been found associated with import subsidy \( (IS) \) or taxes \( (IT) \) or export subsidy \( (ES) \) or taxes \( (ET) \) or cost of the policy in practice. All such taxes or subsidies would be adjusted for arriving at net social welfare gain or cost \((SWG/C)\) as follows.

\[
SWG/C = \Delta PS + \Delta CS + IS \text{ or } IT \text{ or } ET \text{ or } ES
\]
Welfare effects of WTO’s trade liberalization

WTO’s Agreement on Agriculture aims at gradually reduce ‘domestic support’, ‘import tariffs’ and ‘export subsidies’ and eliminate/abolish all such protections policies over a specified period. Besides Agreement on Agriculture, WTO has several other agreements particularly GATT 1994\(^7\), which advocate reduction of protection and introduction of liberalization. This means that WTO in general aims at introducing and implementing free trade. In preceding section, we showed that we would estimate the welfare effects of existing policy regimes comparing it with free trade scenarios. Hence, all the welfare effects estimated for existing domestic policies would be having reverse effects for free trade scenario introduced under WTO’s trade liberalization in the domestic economy.

In addition, Pakistan’s domestic economy would also be affected by trade liberalization exercised in foreign economies. As a consequence of reducing domestic support, domestic prices in foreign countries would go up. The higher domestic prices would help international prices to rise. In addition to this, reduction of export subsidies would also increase international prices, especially the export prices. WTO’s agreements also encourage market access, which means reduction of taxes and tariffs on imports. Consequently, prices would decrease. This decrease in prices is expected to offset, up to some extent, the increase in prices caused by reduction in domestic support and export subsidies. There is still sufficient ground to assume that even after offsetting the increase in prices caused by market access, world prices (\(P_w\)) would in general rise, as also argued in a number of studies including Minot, et al. (2007), Bouet (2006), Tokarick (2005), El-Obeid and Beghin (2005), Vocke, Allen and Ali (2005), Wailes (2004), Poonyth and Sharma (2003), Sumner (2003), FAPRI (2002), Oxfam 2002) and ICAC (2002).

The above discussion and details of the estimates of increase in world prices of the referred studies provided in Chapter VI, help understand that trade liberalization would change world prices of food grains/food commodities less than that of commercial crops like cotton, sugar, etc. We, therefore, assume a range from 2.5 to 10 percent rise in world price for wheat, rice, onion and potato and 5 to 20 percent increase in that of cotton, sugarcane/sugar and rapeseed, and examine their welfare effects on Pakistan’s domestic economy.

\(^7\) GATT 1994, in addition to import and export trade, also asks for disciplining State Trading Enterprises, which play great role in trade of agricultural commodities.
Data and data sources

The models for determining supply and demand functions given in 3.1 and 3.2 in the first section contain a number of variables for each of the functions specified. These variables include area and lagged area under each commodity, domestic wholesale price for the commodity, quantities supplied and demanded, quantities exported and imported, export and import prices, world average trade prices, major inputs like nutrient-fertilizers, pesticides and water used, Gross Domestic Product of Pakistan and Pakistan’s population. In case of some of the commodities, we also required data on world GDP, world population, world supply and world import and export.

The data on most of the listed variables were downloaded from FAO’s website (www.fao.org; statistical databases). In addition, data were also obtained from Government of Pakistan’s publications (Agricultural Statistics of Pakistan, Statistical Year Book and Pakistan Economic Surveys) and UN databases ‘comtrade’.

For estimation of supply and demand functions, data for period 1979-80 to 2004-05 were used. However, for other purposes, the study period was subdivided as per requirement of the analysis.
CHAPTER IV

PAKISTAN’S MAJOR CROPS: SUPPLY & DEMAND FUNCTIONS

This chapter mainly concerns with estimation of supply and demand functions of major crops and discussions thereon. There are in all 7 sub-sections, each devoted to a major crop included.

4.1 Wheat Crop: Supply & Demand Functions

Empirical results

Amongst a number of models tried, the following model of supply and demand functions of wheat has turned out with reasonably good results relative to other specifications tried.

\[ A = 3695.163 + 0.48947A_{t-1} + 24.985TR \]  
\[ (3.093) (2.864) (2.223) \]  
\[ R^2 = 0.8473 \quad F = 63.829 \quad DW = 2.3969 \quad \text{Durban h} = -2.0996 \quad N = 26 \]  

\[ S_d = -8458.219 + 2.4879\hat{A} + 0.41528P_d + 2.4625FNTWT \]  
\[ (-1.162) (2.357) (2.308) (1.310) \]  
\[ (0.2580) (0.028) (0.031) (0.204) \]  
\[ R^2 = 0.9252 \quad F = 90.685 \quad DW = 2.5064 \quad N = 26 \]  

\[ D_d = 750.129 - 0.046974P_d + 136.07POP \]  
\[ (0.188) (-0.1349) (2.905) \]  
\[ (0.853) (0.8940) (0.008) \]  
\[ R^2 = 0.7737 \quad F = 39.313 \quad DW = 1.1857 \quad N = 26 \]  

\[ P_t = 23.1559 + 0.91124P_w \]  
\[ (0.8080) (5.170) \]  
\[ (0.4270) (0.000) \]  
\[ R^2 = 0.5269 \quad F = 26.734 \quad DW = 1.6565 \quad N = 26 \]  

\[ I_s = -5642.2 + 5.2191P_t - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w \]  
\[ (-2.483) (0.7298) (-6.174) (5.109) (3.130) \]  
\[ (0.022) (0.4740) (0.000) (0.000) (0.005) \]  
\[ R^2 = 0.6666 \quad F = 10.498 \quad DW = 2.2496 \quad N = 26 \]  

(Figures in the 1st & 2nd parenthesis are t-ratios and p-values, respectively)

Where \( A \) = area under wheat in ‘000’ hectares

\( A_{t-1} \) = lagged area under wheat in ‘000’ hectares

\( \hat{A} \) = area predicted (in equation 4.1a) under wheat in ‘000’ hectares

\( S_d \) = domestic supply of wheat in Pakistan in ‘000’ M. tons

\( S_{dt-1} \) = lagged domestic supply of wheat in Pakistan in ‘000’ M. tons
\( D_d = \) domestic demand of wheat in ‘000’ M. tons  
\( D_{dt-1} = \) lagged domestic demand of wheat in ‘000’ M. tons  
\( I_t = \) net import supply (import-export) of wheat in Pakistan in ‘000’ M. tons  
\( S_w = \) world supply of wheat in ‘000’ M. tons  
\( P_d = \) domestic price in Pak. Rupees per M. ton.  
\( P_i = \) import price of wheat per M. ton in US$  
\( P_i^* = \) predicted import price of wheat per M. ton in US$  
\( P_w = \) world level price of wheat per M. ton in US$  
\( FNTWT = \) total nutrient-fertilizers in ‘000’ M. tons used in wheat  
\( POP = \) population of Pakistan in millions  
\( TR = \) trend variable, having values 1, 2, 3, 4..., for the years of observations included.

**Diagnostic evaluation**

The aforementioned estimated model of supply and demand functions of Pakistan wheat crop is a simultaneous-equations recursive model (Gujarati 2003, pp.764-766; Maddala 2002, p.373), wherein area sown under wheat is estimated in equation (4.1a) and used as one of the determinants of wheat supply in equation (4.1b). Similarly, Pakistan’s wheat import price \( (P_i) \) is considered influenced by world export price \( (P_w) \) in equation (4.1d), and its estimated value is then used as determinant in the next equation (4.1e).

The estimated model fulfills the economic theory requirements, and all of its explanatory variables carry correct signs. The lagged area \( (A_{t-1}) \) positively determine present area under wheat \( (A) \), which along with wheat’s own price \( (P_d) \) and nutrient-fertilizers used \( (FNTWT) \) determine supply of wheat \( (S_d) \) positively. The domestic demand of wheat \( (D_d) \) is negatively influenced by wheat’s own price \( (P_d) \) and positively by the size of Pakistan’s population \( (POP) \). Pakistan’s import price \( (P_i) \) is positively determined by world export price of wheat \( (P_w) \). The wheat import supply \( (I_t) \) to Pakistan positively responds to Pakistan’s import price \( (P_i) \) and is also positively influenced by total world supply \( (S_w) \); it is also determined negatively by Pakistan’s previous years’ total supply \( (S_{dt-1}) \) and positively by Pakistan’s previous years’ total consumption \( (D_{dt-1}) \). Hence, all variables included in the model appear to be behaving according to economic theory.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated wheat supply and demand functions fulfill such requirements more satisfactorily than the other specifications tried. In case of equation (4.1a), the value of \( R^2 \)
\(= 0.8473\) indicates that 84.73% variations in the dependent variable has been explained by variations in explanatory variables included. The value of \(F_{\text{estimated}} = 63.829\) is much high, relative to \(F_{\text{tabulated}}(2, 23; 0.05) = 3.40\), suggesting that data yield a good fit. The value of Jarque-Bera (JB) Normality Test is 0.2672 with p-value = 0.875; since p-value turns out to be quite high, the null hypothesis of the assumption of normality of residual may not be rejected. Both explanatory variables (\(A_{t-1}\) & TR) included in equation (4.1a) are statistically significant on the basis of respective t-ratios and p-values. The equation, however, seems to be somewhat suffering from the problem of Autocorrelation; being an Autoregressive equation, here DW is not valid and Durban h is -2.0996, which for no-autocorrelation should fall in interval ±1.96.

In the same token, the values of \(R^2\) (0.9252, 0.7737, 0.5269 & 0.6666) and F statistic (90.685, 39.313, 26.734 & 10.498) for the other four equations (4.1b, c, d & e) included in the model are in acceptable range. JB test values are 0.7295 with p-value = 0.694, 1.4781 with p-value = 0.478, 0.2637 with p-value = 0.876 and 0.6276 with p-value = 0.731, suggesting normality of residuals in almost all cases. DW statistic of equation 4.1b is 2.5064, which falls in no-decisive zone at 0.05 level of significance (\(d_l = 1.143 \& d_u = 1.652\)); however, at 0.01 level of significance, it falls in no-autocorrelation zone (\(d_l = 0.928 \& d_u = 1.411\)). The runs test (runs = 16; positive = 14 \& negative = 12) reinforces that 16 runs fall within critical region (10, 22) and therefore there may be no autocorrelation problem. The DW of equation (4.1c) is 1.1857, which falls below the lower bound (\(d_l = 1.224\)) at 0.05 level of significance, suggesting possibility of existence of autocorrelation problem; however, at 0.01 level of significance, it falls within no-decisive zone (\(d_l = 1.001 \& d_u = 1.312\)). The 10 runs (positive = 12 \& negative = 14) fall within the critical region (8, 20), suggesting no autocorrelation problem. The DW of Equation (4.1d) is estimated at 1.6565 and falls within the critical region, suggesting no-autocorrelation at both 0.01 and 0.05 levels of significance (\(d_l = 1.072, d_u = 1.222 \& d_l = 1.302, d_u = 1.461\)). The DW of the last equation (4.1e) is 2.2496, which falls within the critical region at 0.01 level of significance (\(d_l = 0.855, d_u = 1.518\)), suggesting no-autocorrelation and within no-decisive zone at 0.05 level of significance (\(d_l = 1.062, d_u = 1.759\)). The runs test (runs = 14; positive = 14 \& negative = 12) reinforces that 14 runs fall within critical region (8, 20) and therefore there may be no autocorrelation problem.

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8 JB test of normality of residual, however, is a large sample test (Gujarati 2003, pp.148-149).
to this particular equation.

As already mentioned, both explanatory variables (A_{t-1} & TR) included in equation (4.1a) are statistically significant at 0.05 level of significance. Variables $\hat{A}$ and $P_d$ of equation (4.1b) are statistically significant at 0.05 level of significance while variable FNTWT is significant at 0.204 level of significance. Equation (4.1c) includes variable POP statistically significant at 5 percent level and variable $P_d$ statistically insignificant but with correct sign. Equation (4.1d) includes one variable $P_w$, which is statistically significant at 0.01 level of significance. Of the four explanatory variables included in equation (4.1e), only one variable $P_I$ has turned out statistically insignificant while other three variables are statistically significant at 0.01 level of significance.

**Further improvements/modifications**

In light of the discussions made in previous sections, the estimated Model 4.1 (a – e) appears to be a good model in spite of some of its weaknesses explained; it performed best amongst several specifications tried, in terms of usual diagnostic statistics and economic theory. However, this estimated model is still incomplete and it needs to go through, at least, three major modifications to come up to a final useable form. First, its equation (4.1a) is an Autoregressive function, which yields short-run results; it needs to be converted in to its long-run version. Second, its equation (4.1b) contains predicted value of area ($\hat{A}$), which is estimated in equation (4.1a); hence, $\hat{A}$ in equation (4.1b) would have to be replaced with its estimated value in equation (4.1a). Third, this model contains import supply ($I_d$) function but lacks import demand ($I_d$) function, which is to be computed as per identity equation $I_d = D_d - S_d$.

As already mentioned, equation (4.1a) includes lagged dependent variables (A_{t-1}), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment ($\lambda$), and then adjust short run equation to its long run version. For computation of ($\lambda$), we know that coefficient of lagged variable is equal to ‘1 - $\lambda$’ (Gujarati 2003, pp.673-78). Hence in case of equation (4.1a), $1 - \lambda$ is:

$$1 - \lambda = 0.48947$$  \hspace{1cm} (4.2a)

Solving for $\lambda$,

$$\lambda = 1 - 0.48947$$  \hspace{1cm} (4.2b)

$$= 0.51053$$  \hspace{1cm} (4.2c)
To convert equation (4.1a) into its long run version, we divide all coefficients attached with explanatory variables (with the exception of lagged variable) and constant by the value of \(\lambda\) and omit lagged variable from the equation. By doing so we get the long run version of equation (4.1a), as follows.

\[
A = 7176.9189 + 48.93934TR
\]

(4.3)

Since equation (4.1b) includes predicted value of variable ‘A’, which is nothing but equation (4.3), hence substituting the value of ‘A’ in equation (4.3) in to equation (4.1b), the later equation adopts the following form.

\[
S_d = -8458.219 + 2.4879(7176.919 + 48.9393TR) + 0.41528P_d + 2.4625FNTW
\]

(4.4a)

\[
= 9397.238 + 0.41528P_d + 2.4625FNTWT + 121.7562TR
\]

(4.4b)

Putting average values of variables FNTWT and TR (from Annexure Table 4.1) and including in the intercept, we can further shorten domestic supply equation (4.4b), as follows.

\[
S_d = 13485.77 + 0.41528P_d
\]

(4.4c)

Similarly, domestic demand \(D_d\) function, earlier estimated as equation (4.1c), can be further shortened, as follows.

\[
D_d = 750.129 - 0.046974P_d + 136.07POP
\]

(4.5a)

\[
= 16896.20 - 0.046974P_d
\]

(4.5b)

Since the estimated model 4.1 (a - e) lacks import demand \(I_d\) function, which is to be computed as an identity equation (difference between \(D_d\) and \(S_d\)); hence:

\[
I_d = D_d - S_d
\]

(4.6a)

\[
= (16896.20 - 0.046974P_d) - (13485.77 + 0.41528P_d)
\]

(4.6b)

\[
= 3410.43 - 0.462254P_d
\]

(4.6c)

Equations (4.1d) and (4.1e), respectively, represent the effect of world wheat trade price \(P_w\) on Pakistan’s wheat import/trade price \(P_i\) and how Pakistan’s wheat import supply \(I_s\) is affected by its various determinants. These two are, in fact, Recursive equations as the predicted value of \(P_i\), estimated in 4.1d, is used in the estimation of 4.1e. One can use these two as separate equations to have different effects or can merge the two for the sake of simplicity of the model. For the latter case, we take equation (4.1d) and replace it in equation (4.1e), as follows.

\[
I_s = -5642.2 + 5.2191(P_i^t = 23.1559 + 0.91124P_w) - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w
\]

(4.7a)

\[
= -5521.1413 + 4.7556P_w - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w
\]

(4.7b)
Replacing average values of variables $S_{dt-1}$, $D_{dt-1}$ and $S_w$ and adding with the intercept, we get shortened version like:

$$I_s = 389.5862 + 4.7556P_w$$  \hspace{1cm} (4.7c)

However, in case $P_i$ is kept as explanatory variables, then the shortened version would be:

$$I_s = 268.6924 + 5.2191P_i$$  \hspace{1cm} (4.7d)

What has been provided in equations (4.4) through (4.7) represents a full model of Pakistan’s wheat crop sector, namely:

$$S_d = 9397.238 + 0.41528P_d + 2.4625FNTWT + 121.7562TR$$  \hspace{1cm} (4.8a)

$$= 13485.77 + 0.41528P_d$$  \hspace{1cm} (4.8b)

$$D_d = 750.129 - 0.046974P_d + 136.07POP$$  \hspace{1cm} (4.9a)

$$= 16896.20 - 0.046974P_d$$  \hspace{1cm} (4.9b)

$$I_d = 3410.43 - 0.462254P_d$$  \hspace{1cm} (4.10)

$$P_i = 23.1559 + 0.91124P_w$$  \hspace{1cm} (4.11)

$$I_s = -5642 + 5.2191P_i - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w$$  \hspace{1cm} (4.12a)

$$= 268.6924 + 5.2191P_i$$  \hspace{1cm} (4.12b)

$$= -5521.1413 + 4.7556P_w - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w$$  \hspace{1cm} (4.12c)

$$= 389.5862 + 4.7556P_w$$  \hspace{1cm} (4.12d)

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model (equations 4.8 through 4.12), keeping all important choice variables in tact and removing all other (irrelevant) variables from the equations. These other (irrelevant) variables are TR, $S_{dt-1}$ and $D_{dt-1}$; replacing their values and adding with respective intercepts:

$$S_d = 11040.9577 + 0.41528P_d + 2.4625FNTWT$$  \hspace{1cm} (4.13a)

$$= 13485.77 + 0.41528P_d$$  \hspace{1cm} (4.13b)

$$D_d = 750.34 - 0.046974P_d + 136.07POP$$  \hspace{1cm} (4.14a)

$$= 16896.20 - 0.046974P_d$$  \hspace{1cm} (4.14b)

$$I_d = 3410.43 - 0.462254P_d$$  \hspace{1cm} (4.15)

$$P_i = 23.1559 + 0.91124P_w$$  \hspace{1cm} (4.16)

$$I_s = -9043.3944 + 5.2191P_i + 0.017019S_w$$  \hspace{1cm} (4.17a)

$$= 268.6924 + 5.2191P_i$$  \hspace{1cm} (4.17b)

$$= -8922.5358 + 4.7556P_w + 0.017019S_w$$  \hspace{1cm} (4.17c)

$$= 389.5862 + 4.7556P_w$$  \hspace{1cm} (4.17d)
4.2 Basmati Rice: Supply & Demand Functions

Empirical results

The following model of supply and demand functions of Basmati rice has turned out with reasonably good results relative to other options tried.

\[
A = 201.95 + 0.7375A_{t-1} + 0.0085P_d \\
(1.831) (4.854) (1.865) \\
(0.080) (0.000) (0.075) \\
R^2 = 0.9127 \quad F = 120.236 \quad DW = 2.0581 \quad Durbin H = -0.3560 \quad N = 26
\]

\[
S_d = -848.18 + 1.6226\hat{A} + 0.3761FNT - 21.1720TR \\
(-2.038) (2.692) (1.195) (-0.7234) \\
(0.054) (0.013) (0.245) (0.477) \\
R^2 = 0.8801 \quad F = 53.812 \quad DW = 1.1255 \quad N = 26
\]

\[
D_d = 565.31 - 0.0084P_d + 0.0117PWIR + 0.2002GDPPR \\
(7.653) (-0.4186) (0.3680) (2.763) \\
(0.000) (0.680) (0.716) (0.011) \\
R^2 = 0.8409 \quad F = 38.760 \quad DW = 1.5681 \quad N = 26
\]

\[
E_d = -526.29 - 0.23247P_e + 1.1063P_w + 0.028086GDPWD \\
(-1.635) (-0.9639) (2.424) (5.448) \\
(0.116) (0.346) (0.024) (0.000) \\
R^2 = 0.7514 \quad F = 22.169 \quad DW = 1.5985 \quad N = 26
\]

Where

- \( A \) = area under Basmati rice in ‘000’ hectares
- \( A_{t-1} \) = lagged area under Basmati rice in ‘000’ hectares
- \( \hat{A} \) = area predicted under Basmati rice in ‘000’ hectares
- \( S_d \) = domestic supply of Basmati rice in ‘000’ M. tons
- \( D_d \) = domestic demand of Basmati rice in ‘000’ M. tons
- \( E_d \) = export of Basmati rice in ‘000’ M. tons
- \( P_d \) = domestic price in Rupees per M. ton.
- \( FNT \) = total nutrient-fertilizers used in ‘000’ M. tons
- \( PWIR \) = domestic price of IRRI in Rupees per M. ton.
- \( P_e \) = export price of Basmati rice per M. ton in US$
- \( P_w \) = world level price of Basmati rice per M. ton in US$
- \( GDPWD \) = GDP of the world in billion US$
- \( GDPWD \) = GDP of Pakistan in billion Rupees

Diagnostic evaluation

Like wheat, aforementioned estimated model of supply and demand functions of Pakistan Basmati rice crop is a simultaneous-equations recursive model, wherein area sown under Basmati rice (A) is estimated in equation (4.18a) and used as one of the determinants of
Basmoti rice supply in equation (4.18b). The estimated model fulfills all economic theory requirements, as all of its explanatory variables carry correct signs. The lagged area (A_{t-1}) and Basmoti rice's own price (P_d) positively determine the present area under Basmoti rice (A), which along with nutrient-fertilizers (FNT) determines supply of Basmoti rice (S_d). The domestic demand of Basmoti rice (D_d) is negatively influenced by Basmoti rice's own price (P_d) and positively by the size of Pakistan's GDP (GDPPPR) and price of Irri rice as substitute in consumption. The Basmoti rice export demand (E_d) is negatively influenced by Pakistan's export price (P_e) and positively by world rice trade price (P_w as substitute) and world's GDP (GDPWWD). Hence, all variables included in the model appear to be behaving in accordance with the economic theory.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated Basmoti rice supply and demand functions fulfill such requirements more satisfactorily than all other specifications tried. In case of equation (4.18a), the value of R^2 = 0.9127 indicates that 91.27% variations in the dependent variable has been explained by variations in explanatory variables included. The value of F_{estimated} = 120.236 is much higher, relative to F_{tabulated; (2, 23; 0.05)} = 3.40, suggesting that data yield a good fit. The value of Jarque-Bera (JB) Normality Test is 0.0743 with p-value = 0.964; since p-value turns out to be quite high, the null hypothesis of the assumption of normality of residual may not be rejected. The explanatory variables (A_{t-1}) included in equation (4.18a) is statistically significant on the basis of t-ratio and p-value where as variable (P_d) is significant at p-value = 0.075. The equation has no problem of Autocorrelation; being an Autoregressive equation, here DW is not valid and Durban h is -0.3560, which is well within no-autocorrelation interval of ±1.96.

In the same token, the values of R^2 (0.8801, 0.8409 & 0.7514) and F statistic (53.812, 38.760 & 22.169) for the other three equations (4.18b, c & d) included in the model are in acceptable range. JB test values are 0.1918 with p-value = 0.909, 0.9704 with p-value = 0.616 and 1.0192 with p-value = 0.601, suggesting normality of residuals in almost all cases. DW statistic of equation (4.18b) is 1.1255, which falls in autocorrelation zone at 0.05 level of significance (d_1 = 1.143 & d_0 = 1.652); however, at 0.01 level of significance, it falls in indecisive zone (d_1 = 0.928 & d_0 = 1.411). The runs test (runs = 8; positive = 12 & negative = 14) reinforces that 8 runs fall at the boundary of critical region (8, 20) and therefore there may be no autocorrelation problem. The DW of equation (4.18c) is 1.5684, which falls in indecisive zone at 0.05 level of significance (d_1 = 1.143
& \( d_u = 1.652 \)). The 12 runs (positive = 12 & negative = 14) fall within the critical region (8, 20), suggesting no autocorrelation problem. The DW of Equation (4.18d) is estimated at 1.5985 which falls in indecisive zone at 0.05 level of significance \( (d_l = 1.143 \& d_u = 1.652) \), The 11 runs (positive = 15 & negative = 11) fall within the critical region (8, 19), suggesting no autocorrelation problem.

As already mentioned, both explanatory variables \((A_{t-1} \& P_d)\) included in equation (4.2a) are statistically significant at 0.000 & 0.075 level of significance, respectively. Variables \( \hat{A} \), FNT and TR of equation (4.18b) are statistically significant at 0.013, 0.245 & 0.477 level of significance, respectively. Equation (4.18c) includes variable \( P_d \), PWIR & GDPPR, which are significant at 0.68, 0.716 & 0.011 level of significant, respectively. Equation (4.18d) includes variables \( P_y, P_w \& GDPWD; \) of these the first variable is statistically insignificant (significant level = 0.346) while the remaining two variables are highly significant at 0.024 and 0.000 levels of significance.

**Further improvements and discussion**

In light of the discussions made in previous sections, the estimated Model 4.18 (a – d) appears to be a good model in spite of some of its weaknesses explained; it performed best amongst several specifications tried, in terms of usual diagnostic statistics and economic theory. However like wheat, this estimated model is still incomplete and needs to go through, at least, three major modifications to come up to a final useable form. First, its equation (4.18a) is an Autoregressive function, which yields short-run results; it needs to be converted in to its long-run version. Second, its equation (4.18b) contains predicted value of area \( \hat{A} \), which is estimated in equation (4.18a); hence, \( \hat{A} \) in equation (4.18b) would have to be replaced with its estimated value in equation (4.18a). Third, this model contains export demand \( (E_d) \) function but lacks export supply \( (E_s) \) function, which is to be computed as per identity equation \( E_s = S_d - D_d \).

As already mentioned, equation (4.18a) includes lagged dependent variables \( (A_{t-1}) \), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment \( (\lambda) \), and then adjust short run equation to its long run version. Hence in case of equation (4.18a), the long run converted equation becomes, as follows\(^9\).

\[
A = 674.0786 + 0.032406P_d \tag{4.19}
\]

\(^9\) We have already shown how a short-run function is converted to long-run function; see the case of wheat explained in equation 4.2 (a-c) above.
Since equation (4.18b) includes predicted value of variable ‘A’, which is nothing but equation 4.19, hence substituting the value of ‘A’ in equation (4.19) in to equation (4.18b), the later equation adopts the following form.

\[ S_d = 245.5799 + 0.052582P_d + 0.37609FNT - 21.172TR \]  \hspace{1cm} (4.20a)

Putting mean values of variables FNT and TR (from Annex Table 4.2) and including in the intercept, we can further shorten domestic supply equation (4.19), as follows.

\[ S_d = -40.2421 + 0.052582P_d + 0.37609FNT \]  \hspace{1cm} (4.20b)

\[ S_d = 750.5248 + 0.052582P_d \]  \hspace{1cm} (4.20c)

Similarly, domestic demand (D_d) and export demand (E_d) functions (earlier estimated as equation 4.18c and 4.18d) can be further shortened, as follows.

\[ D_d = 565.31 - 0.008451P_d + 0.011751PWIR + 0.2002GDPR \]  \hspace{1cm} (4.21a)

\[ = 1043.901 - 0.008451P_d \]  \hspace{1cm} (4.21b)

\[ E_d = -526.29 - 0.23247P_e + 1.1063P_w + 0.028086GDWP \]  \hspace{1cm} (4.22a)

\[ = 574.5015 - 0.23247P_e \]  \hspace{1cm} (4.22b)

Since the estimated model 4.18 (a - d) lacks export supply (E_s) function, which is to be computed as an identity equation (difference between S_d and D_d); hence:

\[ E_s = S_d - D_d \]  \hspace{1cm} (4.23a)

\[ = -293.3762 + 0.061033P_d \]  \hspace{1cm} (4.23b)

The adjustments made through equations (4.19) through (4.23) represent a full model of Pakistan’s Basmati rice crop sector, namely:

\[ S_d = 245.5799 + 0.052582P_d + 0.37609FNT - 21.172TR \]  \hspace{1cm} (4.24a)

\[ = -40.2421 + 0.052582P_d + 0.37609FNT \]  \hspace{1cm} (4.24b)

\[ = 750.5248 + 0.052582P_d \]  \hspace{1cm} (4.24c)

\[ D_d = 565.31 - 0.008451P_d + 0.011751PWIR + 0.2002GDPR \]  \hspace{1cm} (4.24d)

\[ = 1043.901 - 0.008451P_d \]  \hspace{1cm} (4.24e)

\[ E_s = -293.3762 + 0.061033P_d \]  \hspace{1cm} (4.24f)

\[ E_d = -26.29 - 0.23247P_e + 1.1063P_w + 0.028086GDWP \]  \hspace{1cm} (4.24g)

\[ = 574.5015 - 0.23247P_e \]  \hspace{1cm} (4.24h)

\[ = 121.1217 + 1.1063P_w \]  \hspace{1cm} (4.24i)

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model 4.24 (a – i), keeping all important choice variables in tact and removing all other variables from the equations; we get the
shortened version of the model as follows:

\[ S_d = 750.5248 + 0.052582P_d \]  \hspace{1cm} (4.25a)

\[ D_d = 1043.901 - 0.008451P_d \]  \hspace{1cm} (4.25b)

\[ E_s = -293.3762 + 0.061033P_d \]  \hspace{1cm} (4.25c)

\[ E_d = 574.5015 - 0.23247P_e \]  \hspace{1cm} (4.25d)

\[ = 121.1217 + 1.1063P_w \]  \hspace{1cm} (4.25e)
4.3 Cotton Crop: Supply & Demand Functions

Empirical results

The data on production of cotton are available as seed cotton while that of import and export trade and respective prices as cotton lint. For estimation of the desired functions, we had to convert cotton import and export trade and respective prices from cotton lint to its seed cotton equivalent. For this, we computed a ratio between cotton lint and seed cotton, using the actual data on cotton production available in seed cotton and cotton lint forms for the study period 1980-2005. Annex Table 4.2 works out the desired ratio between seed cotton and cotton lint as 3.17:1. We used this ratio to convert Pakistan’s lint export and import trade and their respective price into Seed Cotton equivalent. Similarly, we converted world trade price of cotton lint into seed cotton for estimation of supply and demand functions of Pakistan’s seed cotton.

Amongst a number of models tried, the following model of supply and demand functions of seed cotton crop has turned out with reasonably good results relative to the other models.

\[
A = 544.11 + 0.78569A_{t-1} + 0.007116P_d
\]
\[
(2.055) \quad (6.605) \quad (0.9991) \quad (0.3280)
\]
\[R^2 = 0.8518 \quad F = 66.105 \quad DW = 2.2051 \quad Durbin = -1.0391 \quad N = 26\] (4.26a)

\[
S_d = 1131.6 + 0.48805\hat{A} + 4.8092FNTSN + 0.002246CAT
\]
\[
(0.3967) \quad (0.3570) \quad (2.203) \quad (0.2142) \quad (0.695) \quad (0.724) \quad (0.038) \quad (0.832)
\]
\[R^2 = 0.6880 \quad F = 16.172 \quad DW = 1.1903 \quad N = 26\] (4.26b)

\[
D_d = 2014.8 - 0.12361P_d + 0.16801GDPR + 236.14TR
\]
\[
(4.471) \quad (-1.542) \quad (0.4190) \quad (3.638) \quad (0.000) \quad (0.1370) \quad (0.6790) \quad (0.001)
\]
\[R^2 = 0.8093 \quad F = 31.131 \quad DW = 1.9666 \quad N = 26\] (4.26c)

\[
E_d = -142.35 - 3.8984P_e + 4.1879P_w
\]
\[
(-0.6702) \quad (-7.452) \quad (6.216) \quad (0.5090) \quad (0.000) \quad (0.000)
\]
\[R^2 = 0.7112 \quad F = 28.317 \quad DW = 1.3965 \quad N = 26\] (4.26d)

Where

\[A = \text{area under cotton in '000' hectares}\]
\[A_{t-1} = \text{lagged area under seed cotton in '000' hectares}\]
\[\hat{A} = \text{area predicted under seed cotton in '000' hectares}\]
\[S_d = \text{domestic supply of seed cotton in '000' M. tons}\]
\[D_d = \text{domestic demand of seed cotton in '000' M. tons}\]
\[E_d = \text{net export of seed cotton in '000' M. tons}\]
\[P_d = \text{domestic procurement (support) price in rupees per M. ton}\]
\[ P_e = \text{export price of seed cotton per M. ton in US$} \]
\[ P_w = \text{world trade price of seed cotton per M. ton in US$} \]
\[ \text{GDPPR} = \text{GDP of Pakistan in billion Rupees.} \]
\[ \text{FNTSN} = \text{total nutrient-fertilizers in '000' M. tons used in cotton crop} \]
\[ \text{CAT} = \text{credit availability in million rupees} \]
\[ \text{TR} = \text{trend variable, having values 1, 2, 3, 4..., for the years of observations included} \]

**Diagnostic evaluation**

The estimated model (4.26) fulfills the economic theory requirements as all of its explanatory variables carry correct signs. The lagged area and cotton’s own price \((A_{t-1} \& P_d)\) positively determine present area under cotton \((A)\), which along with nutrient-fertilizers \((\text{FNTSN})\) used in cotton crop and credit availability \((\text{CAT})\), used as proxy for various other high yielding inputs) determine supply of cotton \((S_d)\) positively. The domestic demand of cotton \((D_d)\) is negatively influenced by cotton's own price \((P_d)\) and positively by Pakistan’s GDP \((\text{GDPPR})\) and trend variable \((\text{TR})\). The cotton export demand \((E_d)\) negatively responds to Pakistan’s export price \((P_e)\) and is positively influenced by the world cotton trade price \((P_w)\). Hence, all variables included in the model carry correct signs as per economic theory requirements.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated cotton supply and demand functions fulfill such requirements more satisfactorily than the other specifications tried. In case of equation (4.26a), the value of \(R^2 = 0.8518\) indicates that 85.18% variations in the dependent variable has been explained by variations in explanatory variables included. The value of \(F_{\text{estimated}} = 66.105\) is much high, relative to \(F_{\text{tabulated}}; (2, 23; 0.05) = 3.40\), suggesting that data yield a good fit. The value of Jarque-Bera (JB) Normality Test is 0.7130 with p-value = 0.700; since p-value turns out to be quite high, the null hypothesis of the assumption of normality of residual may not be rejected. The explanatory variable \((A_{t-1})\) included in equation (4.26a) is statistically significant on the basis of t-ratio and p-value. However, variable \(P_d\) is insignificant \((p = 0.328)\). The equation is an Autoregressive equation, hence DW statistic is not valid; the valid statistic Durban h is -1.0391, which is within no-autocorrelation interval of ±1.96.

Similarly, the values of \(R^2 (0.6880, 0.8093 \& 0.7112)\) and \(F\) statistic \((16.172, 31.131 \& 80.93)\) of the other three equations (4.26b, c & d) included in the model are in acceptable range. JB test values of the three equations are 2.4455 with p-value = 0.294, 5.5770 with p-value = 0.101, and 0.4979 with p-value = 0.78, suggesting normality of residuals in
most of the cases. DW statistic of equation (4.23b) is 1.1903, which falls in no-decisive zone at 0.05 level of significance ($d_l = 1.143$ & $d_u = 1.652$). The alternative runs test (runs $= 9$; positive $= 11$ & negative $= 15$) reinforces that 9 runs fall within critical region (8, 19) and therefore there may be no autocorrelation problem. The DW of equation (4.26c) is 1.966, which falls in no auto-correlation zone ($d_u = 1.652$) at 0.05 level of significance. The DW of equation (4.26d) is estimated at 1.3965 and falls in no-decision zone ($d_l = 1.224$ & $d_u = 1.553$). The runs test (runs $= 11$; positive $= 14$ & negative $= 12$) reinforces that 11 runs fall within critical region (8, 20) and therefore there may be no autocorrelation problem to this particular equation.

As already mentioned, both explanatory variables ($A_{t-1}$ & $P_d$) included in equation (4.26a) are statistically significant at 0.000 & 0.328 level of significance. Variables $\hat{A}$, FNTSN and CAT of equation (4.26b) are statistically significant at 0.724, 0.038 & 0.832 level of significance, respectively. Equation (4.26c) includes variable $P_d$, GDPPR and TR, which are statistically significant at 0.137, 0.679 and 0.001 level of significance, respectively. Equation (4.26d) includes variables $P_c$ & $P_w$, which are highly significant that is at 0.00 significance level.

Further improvements and discussion

In light of the aforementioned discussion, the estimated Model 4.26 (a – d) appears to be a good model in spite of some of its weaknesses explained; it performed best amongst many specifications tried, in terms of usual diagnostic statistics and economic theory. However, this estimated model is still incomplete and it needs to go through adjustments and modifications.

The equation (4.26a) of the model includes lagged dependent variables ($A_{t-1}$), used as one of the explanatory variables included and therefore needs to be converted in to long-run equation. To convert this equation into long run, we first compute coefficient of adjustment ($\lambda$), and then adjust short run equation to its long run version, as we did in case of wheat crop (applying equation 4.2a – c). By doing so, equation (4.26a) transforms to its long-run version, as follows.

\[ A = 2355.459 + 0.033204P_d \]  \hspace{1cm} (4.27)

Since equation (4.26b) includes predicted value of variable ‘$A$’, which is nothing but equation (4.27), hence substituting the value of ‘$A$’ in equation (4.27) in to equation (4.26b), the later equation adopts the following form.
\[ S_d = 2281.182 + 0.016205P_d + 4.8092FNTSN + 0.002246CAT \] (4.28a)

Putting average values of variables FNTSN and CAT (from Annex Table 4.1) and including in the intercept, we can further shorten domestic supply equation (4.28a), as follows.

\[ S_d = 4363.309 + 0.016205P_d \] (4.28b)

Similarly, domestic demand \((D_d)\) and export demand \((E_d)\) functions (estimated as equation 4.26c & 4.26d) can be further shortened, as follows.

\[ D_d = 2014.8 - 0.12361P_d + 0.16801GDPPR + 236.14TR \] (4.29)
\[ = 5202.69 - 0.12361P_d + 0.16801GDPPR \] (4.29a)
\[ = 5547.909 - 0.12361P_d \] (4.29b)

\[ E_d = -142.35 - 3.8984P_e + 4.1879P_w \] (4.30a)
\[ = 1791.517 - 3.8984P_e \] (4.30b)

Since the estimated model 4.28 - 4.30 lacks export supply \((E_s)\) function, which is to be computed as an identity equation (difference between \(S_d\) and \(D_d\)); hence:

\[ E_s = S_d - D_d \] (4.31a)
\[ = -1184.600 + 0.139815P_d \] (4.31b)

The adjustments made in equations (4.27) through (4.31) represent a full model of Pakistan’s cotton crop economy, namely:

\[ S_d = 2281.182 + 0.016205P_d + 4.8092FNTSN + 0.002246CAT \] (4.32a)
\[ = 4363.309 + 0.016205P_d \] (4.32b)

\[ D_d = 2014.8 - 0.12361P_d + 0.16801GDPPR + 236.14TR \] (4.32c)
\[ = 5547.909 - 0.12361P_d \] (4.32d)

\[ E_s = -1184.600 + 0.139815P_d \] (4.32e)

\[ E_d = -142.35 - 3.8984P_e + 4.1879P_w \] (4.32f)
\[ = 1791.517 - 3.8984P_e \] (4.32g)
\[ = -1763.972 + 4.1879P_w \] (4.32h)

Final model

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model 4.32(a - h), keeping all important choice variables in tact and adding the effects of all other variables in the intercepts.

\[ S_d = 4363.309 + 0.016205P_d \] (4.33a)

\[ D_d = 5547.909 - 0.12361P_d \] (4.33b)

\[ E_s = -1184.600 + 0.139815P_d \] (4.33c)

\[ E_d = 1791.517 - 3.8984P_e \] (4.33d)
\[ = -1763.972 + 4.1879P_w \] (4.33e)
4.4 Sugarcane Crop: Supply & Demand Functions

Empirical results

Unlike other crops, sugarcane is not imported into or exported from Pakistan. Hence, we can not develop a full model of domestic supply and demand and external trade of sugarcane. We have therefore, converted white sugar imports into its cane equivalent, using the prevailing sugar recovery rate (8.7%, average for study period). Consequently, we have a cane import supply \( l_{isc} \) function in our following estimated model.

Our model assumes that, instead of price of cane, sugar price \( P_{dsr} \) determines sugarcane and sugar economy of Pakistan. Hence, sugar prices have been taken as determinants of sugarcane area, supply of sugarcane \( S_{dsc} \) as a consequence and demand of sugarcane \( D_{dsc} \).

Amongst a number of models, the following model of supply and demand functions of sugarcane has turned out with reasonably good results relative to all other models tried.

\[
A = 352.41 + 0.55917A_{t-1} + 0.0041876P_{dsr} \quad (4.34a)
\]
\[
(2.685) \quad (3.178) \quad (1.236)
(0.013) \quad (0.004) \quad (0.229)
\]
\[
R^2 = 0.6184 \quad F = 18.635 \quad DW = 1.6268 \quad Durban h = 1.1773 \quad N = 26
\]

\[
S_{dsc} = -2072.4 + 10.192\hat{A} + 4.3560FNT + 0.20343WAT \quad (4.34b)
\]
\[
(-0.0989) \quad (0.4467) \quad (1.154) \quad (1.206)
(0.922) \quad (0.659) \quad (0.261) \quad (0.241)
\]
\[
R^2 = 0.7171 \quad F = 18.586 \quad DW = 1.9740 \quad N = 26
\]

\[
D_{dsc} = 34442.00 - 0.11033P_{dsr} + 4.6073GDPP \quad (4.34c)
\]
\[
(8.841) \quad (-0.2526) \quad (3.161)
(0.000) \quad (0.803) \quad (0.004)
\]
\[
R^2 = 0.7186 \quad F = 29.368 \quad DW = 2.1087 \quad N = 26
\]

\[
P_{isr} = -18.407 + 0.93649P_{wsr} \quad (4.34d)
\]
\[
(-0.2151) \quad (4.000)
(0.832) \quad (0.001)
\]
\[
R^2 = 0.4000 \quad F = 15.999 \quad DW = 0.8189 \quad N = 26
\]

\[
l_{isc} = -13681.00 + 20.049P_{isr} + 0.46585S_{d} + 0.65814D_{d} \quad (4.34e)
\]
\[
(-1.260) \quad (1.334) \quad (-1.630) \quad (3.334)
(0.221) \quad (0.196) \quad (0.1170) \quad (0.003)
\]
\[
R^2 = 0.4009 \quad F = 4.908 \quad DW = 1.6320 \quad N = 26
\]

Where \( A = \) area under sugarcane in '000' hectares

\( A_{t-1} = \) lagged area under sugarcane in '000' hectares

\( \hat{A} = \) area predicted under sugarcane in '000' hectares

\( S_{dsc} = \) domestic supply of sugarcane in Pakistan in '000' M. tons
\( S'_{dsc} \) = predicted domestic supply of sugarcane in Pakistan in '000' M. tons \\
\( D_{dsc} \) = domestic demand of sugarcane in '000' M. tons \\
\( I_{ssc} \) = import of sugarcane (converted from sugar) in '000' M. tons \\
\( P_{dsc} \) = domestic price of sugar in Pak. Rupees per m. M. ton. \\
\( P_{irs} \) = import price of sugar per M. ton in US$ \\
\( P_{wrs} \) = world level price of sugar per M. ton in US$ \\
\( GDPP \) = GDP of Pakistan in billion Rupees \\
\( FNT \) = total nutrient-fertilizers in M. tons \\
\( WAT \) = availability of water in '000' acre feet

**Diagnostic evaluation**

The first equation of this model assumes that sugarcane producers' cane planting behavior is determined by sugarcane lagged area \((A_{t-1})\) and domestic price of sugar \((P_{dsc})\). Total supply of sugarcane \((S_{dsc})\) depends upon predicted area \((\hat{A})\), nutrient-fertilizers used \((FNT)\) and water availability \((WAT)\). Demand of sugarcane \((D_{dsc})\) depends on sugar price \((P_{irs})\) and Pakistan's GDP. Equation (4.34e) represent import supply \((I_{t})\) of sugarcane; which depends on predicted import price of sugar \((P_{irs})\), predicted domestic supply of sugarcane \((S_{dsc})\), and predicted domestic consumption of sugarcane \((D_{dsc})\).

The estimated model fulfills the economic theory requirements as all of its explanatory variables carry correct signs. As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated sugarcane supply and demand functions fulfill all such requirements more satisfactorily than a number of all other specifications tried. In case of equation (4.34a), the value of \( R^2 = 0.6184 \) indicates that 61.84\% variations in the dependent variable has been explained by variations in explanatory variables included. The value of \( F_{\text{estimated}} = 18.635 \) is high enough, relative to \( F_{\text{tabulated}}: (2, 23; 0.05) = 3.40 \), suggesting that data yield a good fit. DW statistic is 1.6268, which falls in indecisive zone at 0.05 level of significance \((d_l = 1.143 \& d_u = 1.652)\), but being an autoregressive equation, DW is not of much relevance while the model calculated Durban h = 1.1773 is valid and shows there is no auto correlation as it falls within critical region \((\pm 1.96)\). The explanatory variable \((A_{t-1})\) included in equation is statistically significant on the basis of t-ratios and p-value = 0.004 while variable \((P_{irs})\) is statistically significant at p-value = 0.229.

On the same pattern, the values of \( R^2 (0.7171, 0.7186, 0.4000, \& 0.4009) \) and F statistic \((18.586, 29.368, 15.999 \& 4.908)\) for the other four equations (4.34b-c) included in the
model are in acceptable range. DW statistics of equation (4.34b) is 1.9740, which falls in no autocorrelation zone (d_1 = 0.928 & d_u = 1.411). DW statistic of equation (4.34c) is 2.1087, which falls in no autocorrelation zone at 0.05 level of significance (d_1 = 1.22 & d_u = 1.55). The DW of equation (4.34d) is 0.8189 (d_1 = 1.30 & d_u = 1.46), shows auto correlation problem. The DW of equation (4.34e) is estimated at 1.6320 and falls within no autocorrelation zone (d_1 = 0.928 & d_u = 1.411), suggesting no-autocorrelation problem. The JB test values of equations (4.34a-e) are respectively 0.3067 with p-value = 0.858, 1.5780 with p-value = 0.454, 22.0092 with p-value = 0.000, 9.5308 with p-value = 0.009 and 1.8372 with p-value = 0.399, which show that two of the equations (namely 4.34c & d) do not meet the normality of residuals assumption.

**Further improvements and discussion**

As already mentioned, equation (4.34a) includes lagged dependent variable (A_{t-1}), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment (λ), and then adjust short run equation to its long run version. By doing so we get the following short run version of equation (4.34a).

\[ A = 790.732 + 0.009499353P_{dfr} \]  

(4.35)

Since equation (4.34b) includes predicted value of variable ‘A’, hence substituting the value of ‘A’ from equation (4.34a) in to equation (4.34b), the later equation adopts the following form.

\[ S_{dsc} = 5987.70 + 0.0968173P_{dfr} + 4.356FNT + 0.20343WAT \]  

(4.36)

Putting average values of variables FNT, TW and WAT (from Annex Table 4.1) and including in the intercept, we can further shorten domestic supply of canes equation (4.36), as follows.

\[ S_{dsc} = 39421.93 + 0.096817P_{dfr} \]  

(4.37)

Similarly, domestic canes demand (D_d) function (earlier estimated as equation 4.34c) can be further shortened, as follows.

\[ D_{dsc} = 34442.31 - 0.11033P_{dfr} + 4.6073GDP \]  

(4.38a)

\[ = 43909.85 - 0.11033P_{dfr} \]  

(4.38b)

The import supply of sugarcane equivalent (I_{sec}) function, estimated as equation 4.34e can be further shortened, as follows.

\[ I_{sec} = -13681.00 + 20.049P_{tcr} - 0.46585S_{d} + 0.65814D_{d} \]  

(4.39a)

\[ = -4865.193 + 20.049P_{tcr} \]  

(4.39b)
The adjustments made in equations (4.36) through (4.39) represent a combined model of Pakistan’s sugarcane and white sugar demand and supply functions, namely:

\[
S_{dsc} = 5987.70 + 0.0968173P_{dtr} + 4.356FNT + 0.20343WAT \quad (4.40a)
\]
\[
= 39421.93 + 0.096817P_{dtr} \quad (4.40b)
\]
\[
D_{dsc} = 34442.31 - 0.11033P_{dtr} + 4.6073GDPP \quad (4.40c)
\]
\[
= 43909.85 - 0.11033P_{dtr} \quad (4.40d)
\]
\[
P_{irs} = -18.407 + 0.93649P_{wsr} \quad (4.40e)
\]
\[
I_{ssc} = -13681.00 + 20.049P_{irs} - 0.46585S_{d} + 0.65814D_{d} \quad (4.40f)
\]
\[
= -4865.193 + 20.049P_{irs} \quad (4.40g)
\]

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model (equations 4.40a - g), keeping all important choice variables in tact and removing all other (irrelevant) variables from the equations and adding with respective intercepts, we get the shorter version of the model, as follows:

\[
S_{dsc} = 39421.93 + 0.096817P_{dtr} \quad (4.41a)
\]
\[
D_{dsc} = 43909.85 - 0.11033P_{dtr} \quad (4.41b)
\]
\[
P_{irs} = -18.407 + 0.93649P_{wsr} \quad (4.41c)
\]
\[
I_{ssc} = -4865.193 + 20.049P_{irs} \quad (4.41d)
\]
4.5 Onion Crop: Supply & Demand Functions

Empirical results

The following model of supply and demand functions of onion has turned out with reasonably good results relative to all other specification of the model tried.

\[ A = 0.77832 + 0.99514A_{t-1} + 0.000644P_d \]
\[ (0.2071) \quad (11.96) \quad (0.8914) \]
\[ (0.838) \quad (0.000) \quad (0.382) \]
\[ R^2 = 0.9525 \quad F = 230.591 \quad DW = 2.1870 \quad Durbin h = -1.3131 \quad N = 26 \]  

\[ S_d = -186.81 + 13.329\hat{A} + 8.0593FNTON \]
\[ (-2.374) \quad (5.688) \quad (1.308) \]
\[ (0.026) \quad (0.000) \quad (0.204) \]
\[ R^2 = 0.9342 \quad F = 163.254 \quad DW = 1.8088 \quad N = 26 \]  

\[ D_d = -153.24 - 0.01224P_d + 0.029129PCI + 5.3718POT \]
\[ (-0.5245) \quad (-0.9488) \quad (3.680) \quad (1.550) \]
\[ (0.605) \quad (0.3530) \quad (0.001) \quad (0.135) \]
\[ R^2 = 0.9535 \quad F = 150.384 \quad DW = 1.7666 \quad N = 26 \]  

\[ P_e = 47.671 + 0.31415P_w \]
\[ (0.5582) \quad (0.956) \]
\[ (0.582) \quad (0.349) \]
\[ R^2 = 0.0367 \quad F = 0.914 \quad DW = 1.4676 \quad N = 26 \]  

\[ E_d = -116.89 - 0.08959P_e^* + 0.0089GDPWD + 0.1470S_d^* - 14.094TR \]
\[ (-0.7156) \quad (-0.2187) \quad (0.8762) \quad (2.481) \quad (-2.192) \]
\[ (0.4820) \quad (0.8290) \quad (0.3910) \quad (0.022) \quad (0.040) \]
\[ R^2 = 0.4388 \quad F = 4.105 \quad DW = 2.0370 \quad N = 26 \]  

Where

\( A = \) area under onion in ‘000’ hectares
\( A_{t-1} = \) lagged area under onion in ‘000’ hectares
\( \hat{A} = \) area predicted under onion in ‘000’ hectares
\( S_d = \) domestic supply of onion in Pakistan in ‘000’ M. tons
\( S_d^* = \) predicted domestic supply of onion in Pakistan in ‘000’ M. tons
\( D_d = \) domestic demand of onion in ‘000’ M. tons
\( E_d = \) net export supply of onion in Pakistan in ‘000’ M. tons
\( P_d = \) domestic price in Pak. Rupees per m. ton.
\( P_e = \) Export price of onion per M. ton in US$
\( P_e^* = \) predicted export price of onion per M. ton in US$
\( P_w = \) world level price of onion per M. ton in US$
\( GDPWD = \) GDP of the world in billion US$

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PCI = per capita income in Pakistan
POT = population of Pakistan in millions
FNTON = total nutrient-fertilizers in thousand M. tons used in onion
TR = trend variable, having values 1, 2, 3, 4..., for the years of observations included

**Diagnostic evaluation**

The coefficients of all variables included in the estimated model 4.42 carry expected signs and the model therefore fulfills the economic theory requirements. As per its first equation, the lagged area \((A_{t-1})\) and onion’s own price \((P_d)\) positively determine present area under onion \((A)\), which along with nutrient-fertilizers used on onion \((FNTON)\) determines supply of onion \((S_d)\) positively. The domestic demand of onion \((D_d)\) is negatively influenced by onion’s own price \((P_d)\) and positively by per capita income \((PCI)\) and the size of Pakistan’s population \((POT)\). Pakistan’s export price \((P_e)\) is positively determined by world price of onion \((P_w)\). The onion export demand \((E_d)\) is negatively influenced by the predicted export price \((P_e^*)\) of Pakistan but responds positively to world’s GDP \((GDPWD)\), Pakistan’s supply of onion \((S_d)\) and trend variable \((TR)\). Hence, all variables included in the model appear to be behaving in accordance with economic theory.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated onion supply and demand functions fulfill such requirements more satisfactorily than the other specifications tried. In case of equation \((42a)\), the value of \(R^2 = 0.9525\) indicates that 95.25% variations in the dependent variable has been explained by variations in explanatory variables included. The value of \(F_{\text{estimated}} = 230.591\) is much higher, relative to \(F_{\text{tabulated}}; (2, 23; 0.05) = 3.40\), suggesting that data yield a good fit. The explanatory variables \((A_{t-1})\) included in equation \((4.42a)\) is statistically significant on the basis of t-ratio and p-value where as variable \((P_d)\) is significant only at p-value = 0.382. The equation seems to having no problem of Autocorrelation; being an Autoregressive equation, here DW is not valid and Durban h is -1.3131, which lies within no-autocorrelation interval of ±1.96.

With the exception of equation \((4.42d)\), the values of \(R^2\) of all remaining equations \((0.9342, 0.9535 & 0.4388)\) and F statistic \((163.254, 150.384 & 4.105)\) are in acceptable range. DW statistics of equations \((4.42b)\) and \((4.42c)\), respectively, are 1.8088 and 1.7668; both values fall in no autocorrelation zones at 0.05 level of significance.
(d_l = 1.224 & d_u = 1.553 and d_l = 1.143 & d_u = 1.652). The DW of equation (4.42d) is estimated at 1.4676 which falls in no autocorrelation at 0.05 level of significance (d_l = 1.302 & d_u = 1.461). The DW of Equation (4.42e) is estimated at 2.0370, which also falls in no decision zone at 0.05 level of significance (d_l = 1.062 & d_u = 1.759).

The explanatory variable (A_{l-1}) included in equation (4.42a) is statistically significant at p-value = 0.000 whereas variable (P_d) is significant at p-value = 0.38. Variables A and FNTON of equation (4.42b) are significant at p-values equal to 0.000 and 0.204, respectively. Equation (4.42c) includes variable P_d, PCI and POT, which respectively are significant at 0.353, 0.001 & 0.135 level of p-values, respectively. Equation (4.42d) includes variables P_e, which is significant at p-value = 0.345. Equation (4.42e) includes P_e, GDPWD, S^*_d and TR. These variables are respectively significant at 0.8290, 0.3910, 0.022 & 0.040 levels of p-values.

**Further improvements and discussion**

In light of the aforementioned discussions, the estimated Model 4.42 (a – e) seems to be a good model in spite of some of its weaknesses explained; it performed best amongst several specifications tried, in terms of usual diagnostic statistics and economic theory. However, this estimated model is still incomplete and it needs to go through some adjustments and modifications to come up to a final useable form.

As already mentioned, equation (4.44a) includes lagged dependent variables (A_{l-1}), used as one of the explanatory variables included; hence this equation needs to be converted to a long-run equation. To convert this equation into long run, we first compute coefficient of adjustment (\lambda), and then adjust short run equation to its long run version. Applying the procedure already explained, the long run converted equation becomes, as follows.

\[ A = -541.032 + 0.132558P_d \]  \hspace{1cm} (4.43)

Since equation (4.42b) includes predicted value of variable ‘A’, which is nothing but equation (4.43), hence substituting the value of ‘A’ in equation (4.43) in to equation (4.42b), the later equation adopts the following form.

\[ S_d = -7398.232 + 1.766686P_d + 8.0593FNTON \]  \hspace{1cm} (4.44a)

Putting mean values of variables FNTON (from Annex Table 4.1) and including in the intercept, we can further shorten domestic supply equation (4.46a), as follows.

\[ S_d = -7246.984 + 1.766686P_d \]  \hspace{1cm} (4.44b)

Similarly, domestic demand (D_d), export price (P_e) and export demand (E_d) functions (estimated as equation 4.42c – e) can be further shortened, as follows.
\[ D_d = -153.24 - 0.012243P_d + 0.029129PCI + 5.3718POT \quad (4.45a) \]
\[ = 931.346 - 0.01224P_d \quad (4.45b) \]
\[ P_e = 47.671 + 0.31415P_w \quad (4.46) \]
\[ E_d = -116.89 - 0.08959P_e + 0.0089GDPWD + 0.1470S_d - 14.094TR \quad (4.47a) \]
\[ = 57.956 - 0.08959P_e \quad (4.47b) \]

Since the estimated model 4.44 through 4.47 lacks export supply \( (E_s) \) function, which is to be computed as an identity equation (difference between \( S_d \) and \( D_d \)); hence:

\[ E_s = S_d - D_d \quad (4.48a) \]
\[ = -8178.329 + 1.77910P_d \quad (4.48b) \]

What has been provided in equations (4.44) through (4.48) represents a full model of Pakistan's onion crop sector, namely:

\[ S_d = -7398.232 + 1.76686P_d + 8.0593FNTON \quad (4.49a) \]
\[ = -7246.984 + 1.76686P_d \quad (4.49b) \]
\[ D_d = -153 - 0.012243P_d + 0.029129PCI + 5.3718POT \quad (4.49c) \]
\[ = 931.346 - 0.01224P_d \quad (4.49d) \]
\[ P_e = 47.671 + 0.31415P_w \quad (4.49e) \]
\[ E_s = -8178.329 + 1.77910P_d \quad (4.49f) \]
\[ E_d = -307.159 - 0.08959P_e + 0.0089GDPWD + 0.1470S_d \quad (4.49g) \]
\[ = 57.956 - 0.08959P_e \quad (4.49h) \]

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model, keeping all important choice variables intact and removing the effect of all other (irrelevant) variables and adding in the intercepts.

\[ S_d = -7246.984 + 1.76686P_d \quad (4.50a) \]
\[ D_d = 931.346 - 0.01224P_d \quad (4.50b) \]
\[ E_s = -8178.329 + 1.77910P_d \quad (4.50c) \]
\[ P_e = 47.671 + 0.31415P_w \quad (4.50d) \]
\[ E_d = 57.956 - 0.08959P_e \quad (4.50e) \]
4.6 Potato Crop: Supply & Demand Functions

Empirical results

Amongst a number of models, the following model of supply and demand functions of potato has turned out with reasonably good results relative to all other specifications tried.

\[
A = 18.46 + 0.50123A_{t-1} + 0.001301P_d + 1.1955TR \\
(1.954) (1.826) (1.021) (1.069)
(0.064) (0.081) (0.318) (0.297)
R^2 = 0.9533 \quad F = 149.800 \quad DW = 1.9431 \quad Durban h^{10} \quad N = 26
\]

\[
S_d = -485.39 + 15.349\hat{A} + 11.435FNTPO + 0.000002CAT \\
(-3.524) (4.379) (2.048) (1.365)
(0.002) (0.000) (0.053) (0.186)
R^2 = 0.9374 \quad F = 109.732 \quad DW = 1.2831 \quad N = 26
\]

\[
D_d = -2.6662 - 0.048992P_d + 0.052187PCI + 3.7324POT \\
(-0.01021) (-3.692) (7.075) (1.213)
(0.99200) (0.001) (0.000) (0.238)
R^2 = 0.9775 \quad F = 318.664 \quad DW = 1.5269 \quad N = 26
\]

\[
E_d = 83.453 - 0.000213P_e + 0.008997GDPWD - 0.000614S_w - 0.0168E_w \\
(0.6367) (-0.0518) (1.903) (-1.017) (-1.303)
(0.5310) (0.9590) (0.071) (0.3210) (0.207)
R^2 = 0.3284 \quad F = 2.567 \quad DW = 1.1891 \quad N = 26
\]

Where

- \( A \) = area under potato in ‘000’ hectares
- \( A_{t-1} \) = lagged area under potato in ‘000’ hectares
- \( \hat{A} \) = area predicted under potato in ‘000’ hectares
- \( S_d \) = domestic supply of potato in Pakistan in ‘000’ tons
- \( D_d \) = domestic demand of potato in ‘000’ tons
- \( E_d \) = net export supply of potato in Pakistan in ‘000’ tons
- \( S_w \) = world level supply of potato in ‘000’ tons
- \( E_w \) = world level export of potato in ‘000’ tons
- \( P_d \) = domestic price in Pak. Rupees per m. ton.
- \( P_e \) = Export price of potato per ton in US$
- \( P_w \) = world level price of potato per ton in US$
- \( GDPWD \) = GDP of the world in billion US$
- \( PCI \) = per capita income in Pakistan
- \( POT \) = population of Pakistan in millions

\(^{10}\) Durban h could not be computed.
FNTPO = total nutrient-fertilizers in tons used in potato
CAT = availability of credit in '000' Rupees
TR = trend variable, having values 1, 2, 3, 4..., for the years of observations included

Diagnostic evaluation
The estimated model fulfills the economic theory requirements as all of its explanatory variables carry correct signs. The lagged area (A_{t-1}) and potato's own price (P_d) positively determine present area under potato (A), which along with nutrient-fertilizers used (FNTPO) in potato and credit availability (CAT) determine supply of potato (S_d) positively. The domestic demand of potato (D_d) is negatively influenced by potato's own price (P_d) and positively by per capita income (PCI) and the size of country's population (POT). The potato export demand (E_d) is inversely affected by Pakistan's export price (P_e), total world output of potato (S_w) and volume of world export trade of potato but positively affected by world's GDP (GDPWD). Hence, all variables included in the model, seem to be behaving according to economic theory.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated potato supply and demand functions fulfill such requirements. In case of equation (4.51a), the value of $R^2 = 0.9533$ indicates that 95.33% variations in the dependent variable has been explained by variations in explanatory variables included.

The value of $F_{estimated} = 149.80$ is much higher, relative to $F_{tabulated; (2, 23; 0.05)} = 3.40$, suggesting that data yield a good fit. The value of JB test of Normality is 2.8946 with p-value = 0.235; since p-value is nearer but not too close to zero, one cannot say for sure about normality of residuals. The explanatory variables (A_{t-1}) included in equation (4.51a) is statistically significant on the basis of t-ratio and p-value = 0.081 where as variable (P_d) is significant only at p-value = 0.318. The DW is 1.9431, which is within critical region, reflecting no problem of Autocorrelation. The equation is autoregressive equation, but model did not compute Durban h. The 14 runs (positive = 11 & negative = 15) fall within the critical region (8, 19), again suggesting no autocorrelation problem.

In the same token, the values of $R^2 (0.9374 & 0.9775)$ and F statistic (109.732 & 318.664) for the next two equations (4.53b & c) quiet high. $R^2 (0.3284)$ and F statistic (2.567) of last equation (4.51d) are not reasonably high; however, F statistic is significant at 0.068 significance level.

The values of JB tests of the three equations (4.51b, c & d), respectively, are 1.6775 with
p-value = 0.432, 0.3068 with p-value = 0.858 and 1.3324 with p-value = 0.514, suggesting normality of residuals in almost all cases. DW statistic of equation (4.51b) is 1.2831, which falls in no decisive zone at 0.05 level of significance (d$_{l}$ = 1.143 & d$_{u}$ = 1.652). The runs test (runs = 12; positive = 12 & negative = 14) reinforces that 12 runs fall in critical region (8, 20) and therefore there may not be any autocorrelation problem. The DW of equation (4.51c) is 1.5269, which falls in no decision zone at 0.05 level of significance (d$_{l}$ = 1.143 & d$_{u}$ = 1.652); however, at 0.01 level of significance (d$_{l}$ = 0.026 & d$_{u}$ = 1.411) it falls within critical region, suggesting no autocorrelation problem. The 12 runs (positive = 14 & negative = 12) fall within the critical region (8, 20), suggesting no autocorrelation. The DW of equation (4.51d) is estimated at 1.1891, which falls in indecisive zone at 0.05 level of significance (d$_{l}$ = 1.062 & d$_{u}$ = 1.759), The 14 runs (positive = 12 & negative = 14) fall within the critical region (8, 20), suggesting no autocorrelation problem.

The explanatory variables (A$_{t-1}$ & P$_d$) included in equation (4.51a) are statistically significant at 0.081 & 0.318 significance levels, respectively. Variables $\hat{A}$, FNTPO and CAT of equation (4.51b) are statistically significant at p-values = 0.000, 0.053 & 0.186, respectively. Equation (4.51c) includes variable P$_d$, PCI & POT, which are significant at p-values = 0.001, 0.000 & 0.238, respectively. Equation (4.51d) includes variables P$_c$, GDPWD, S$_w$ & E$_w$, the first variable is highly insignificant while others are significant at p-values 0.071, 0.321 and 0.207, respectively.

**Further improvements/modifications**

In light of the discussions made in previous section, the estimated Model 4.51 (a – d) appears to be a good model in spite of some of its weaknesses explained; it performed best amongst several specifications tried, in terms of usual diagnostic statistics and economic theory. However, this estimated model is still incomplete and it needs certain adjustments.

As already mentioned, equation (4.51a) includes lagged dependent variables (A$_{t-1}$), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment ($\lambda$), and then adjust short run equation to its long run version. By doing so, we got:

\[
A = 34.1454 + 0.002609P_d + 2.396896TR
\]

\[
= 66.5035 + 0.002609P_d
\]

Since equation (4.51b) includes predicted value of variable ‘A’, which is nothing but
equation (4.52b), hence substituting the value of ‘A’ in equation (4.52b) in to equation (4.51b), the later equation adopts the following form.

\[ S_d = 535.3725 + 0.04004 P_d + 11.435FNTPO + 0.00000205CAT \]  \hspace{1cm} (4.52c)

Putting average values of variables FNTPO and CAT (from Annex Table 4.1) and including in the intercept, we can further shorten domestic supply equation (4.52c), as follows.

\[ S_d = 875.657 + 0.04004P_d \]  \hspace{1cm} (4.52d)

Similarly, domestic demand (Dd) and export demand (Ed) functions (estimated as equation 4.51c & d) can be further shortened, as follows.

\[ D_d = -2.6662 - 0.048992P_d + 0.052187PCI + 3.7324POT \]  \hspace{1cm} (4.53a)
\[ = 1241.395 - 0.048992P_d \]  \hspace{1cm} (4.53b)
\[ E_d = 83.453 - 000213P_e + 0.008997GDPWD-0.000614S_w - 0.0168E_w \]  \hspace{1cm} (4.54a)
\[ = 19.87223 - 0.000213P_e \]  \hspace{1cm} (4.54b)

Since the estimated model 4.51 lacks export supply (Es) function, which is to be computed as an identity equation (difference between \( S_d \) and \( D_d \)); hence:

\[ E_s = S_d - D_d \]  \hspace{1cm} (4.55a)
\[ = -8178.341 + 1.779103P_d \]  \hspace{1cm} (4.55b)

The adjustments made in equations (4.52) through (4.55) represent a full model of Pakistan’s potato crop sector, namely:

\[ S_d = 535.3725 + 0.04004 P_d + 11.435FNTPO + 0.00000205CAT \]  \hspace{1cm} (4.56a)
\[ = 875.657 + 0.04004P_d \]  \hspace{1cm} (4.56b)
\[ D_d = -2.6662 - 0.048992P_d + 0.052187PCI + 3.7324POT \]  \hspace{1cm} (4.56c)
\[ = 1241.395 - 0.048992P_d \]  \hspace{1cm} (4.56d)
\[ E_d = 83.453 - 000213P_e + 0.008997GDPWD-0.000614S_w - 0.0168E_w \]  \hspace{1cm} (4.56e)
\[ = 19.87223 - 0.000213P_e \]  \hspace{1cm} (4.56f)
\[ E_s = -8178.341 + 1.779103P_d \]  \hspace{1cm} (4.56g)

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model (equations 4.53a - g), keeping all important choice variables in tact and removing all other (irrelevant) variables from the equations and replacing their values and adding with respective intercepts:
\[ S_d = 875.657 + 0.04004P_d \] (4.57a)
\[ D_d = 1241.395 - 0.048992P_d \] (4.57b)
\[ E_d = 19.87223 - 0.000213P_e \] (4.57c)
\[ E_s = -8178.341 + 1.779103P_d \] (4.57d)
4.7 Rapeseed Crop: Supply & Demand Functions

Empirical results

Amongst a number of options tried, the following model of supply and demand functions of rapeseed has turned out with reasonably good results relative to other models.

\[
A = 104.67 + 0.67338 A_{t-1} + 0.000152 P_d \\
(2.178) (4.795) (0.6394) \\
(0.040) (0.000) (0.529) \\
R^2 = 0.5010 \quad F = 11.544 \quad DW = 1.9863 \quad DURBIN h = -0.02162 \quad N = 26
\]

\[
S_d = -50.98 + 0.68686 \hat{A} + 5.7996 FNTRD \\
(-0.5037) (2.424) (4.875) \\
(0.619) (0.024) (0.000) \\
R^2 = 0.5183 \quad F = 12.372 \quad DW = 1.0481 \quad N = 26
\]

\[
D_d = 254.89 - 0.000373 P_d + 0.27467 GDPPR - 32.234 TR \\
(6.638) (-0.664) (9.243) (0.000) \\
(0.000) (0.514) (0.000) (-4.789) \\
R^2 = 0.9229 \quad F = 87.840 \quad DW = 1.5937 \quad N = 26
\]

\[
P_i = -12.299 + 0.87303 P_w \\
(-0.0185) (0.4029) \\
(0.9850) (0.651) \\
R^2 = 0.0067 \quad F = 0.162 \quad DW = 1.2408 \quad N \approx 26
\]

\[
I_s = -63.097 + 0.14371 P^*_d - 0.8321 S^*_d + 0.95306 D^*_d \\
(-0.2571) (0.2925) (-1.157) (8.266) \\
(0.800) (0.773) (0.260) (0.000) \\
R^2 = 0.9063 \quad F = 70.943 \quad DW = 1.9054 \quad N = 26
\]

Where 

- \( A \) = area under rapeseed in ‘000’ hectares
- \( A_{t-1} \) = lagged area under rapeseed in ‘000’ hectares
- \( \hat{A} \) = area predicted under rapeseed in ‘000’ hectares
- \( S_d \) = domestic supply of rapeseed in Pakistan in ‘000’ tons
- \( S^*_d \) = predicted domestic supply of rapeseed in Pakistan in ‘000’ tons
- \( D_d \) = domestic demand of rapeseed in ‘000’ tons
- \( D^*_d \) = predicted domestic demand of rapeseed in ‘000’ tons
- \( P_i \) = net import supply of rapeseed in Pakistan in ‘000’ tons
- \( P_d \) = domestic price in Pak. Rupees per m. ton.
- \( P_i \) = import price of rapeseed per ton in US$
- \( P^*_i \) = predicted import price of rapeseed per ton in US$
- \( P_w \) = world level price of rapeseed per ton in US$
- \( FNTRD \) = total nutrient-fertilizers in tons used in rapeseed
TR = trend variable, having values 1, 2, 3, 4..., for the years of observations

Diagnostic evaluation

The aforementioned estimated model fulfills the economic theory requirements and all of its explanatory variables carry correct signs. The lagged area (A_{t-1}) and rapeseed's own price (P_d) positively determine present area under rapeseed (A), which along with nutrient-fertilizers used (FNTRD) determine supply of rapeseed (S_d). The domestic demand of rapeseed (D_d) is negatively influenced by rapeseed's own price (P_d) and positively by the GDP of Pakistan (GDPDPR) and trend (TR). Pakistan's import price (P_i) is positively influenced by world trade price of rapeseed (P_w). The rapeseed import supply (I_i) to Pakistan positively responds to Pakistan's import price (P_i) and is also positively influenced by Pakistan's total domestic demand (D_d) and negatively by Pakistan's total domestic supply (S_d). Hence, all variables included in the model appear to be behaving according to the economic theory.

As far as statistical and econometric diagnostic statistics requirements are concerned, the estimated rapeseed supply and demand functions fulfill such requirements more satisfactorily than the other specifications tried. In case of equation (4.58a), the value of $R^2 = 0.5010$ indicates that 50.10% variations in the dependent variable has been explained by variations in explanatory variables included. The value of $F_{estimated} = 11.544$ is high, relative to $F_{tabulated; (2, 23; 0.05)} = 3.40$, suggesting that data give a good fit. The value of JB Normality Test statistic is 0.0795 with p-value = 0.583; since p-value turns out to be quite high, the null hypothesis of the assumption of normality of residual may not be rejected. The explanatory variable (A_{t-1}) included in equation (4.58a) is statistically significant on the basis of respective t-ratio (4.795) and p-values = 0.000. However, the other variable (P_d) is insignificant (p-value = 0.529). The DW is 1.9863 which is well within no autocorrelation zone, but being an Autoregressive equation, DW is not valid and Durban h therefore taken, which is -0.02172 and falls within no-autocorrelation interval of ±1.96.

In the same token, the values of $R^2$ (0.5183, 0.9229 & 0.9063) and F statistic (12.372, 87.84 & 70.943) for equations (4.58b, c & e) are in acceptable range. JB test values of equations (4.58b & c) are 0.1835 with p-value = 0.912 and 2.3387 with p-value = 0.311, indicating normality of residuals. DW statistic of equation 4.58b is 1.0481, which falls in autocorrelation zone at 0.05 level of significance ($d_i = 1.224$ & $d_u = 1.553$) and indecisive
zone at 0.01 level of significance \((d_l = 1.001 \& d_u = 1.312)\). The runs test \((\text{runs} = 16; \text{positive} = 13 \& \text{negative} = 13)\) reinforces that 16 runs fall within critical region \((8, 20)\) and therefore there may be no autocorrelation problem. The DW of equation \((4.58c)\) is 1.5937, which falls in the no decision zone at 0.05 level of significance \((d_l = 1.143 \& d_u = 1.652)\); however, at 0.01 level of significance, it falls within no autocorrelation zone \((d_l = 0.926 \& d_u = 1.411)\). The 10 runs \((\text{positive} = 13 \& \text{negative} = 13)\) fall within the critical region \((8, 20)\), suggesting no autocorrelation problem. The DW of equation \((4.58e)\) is 1.9054, which falls within the critical region at 0.05 level of significance \((d_l = 1.143, d_u = 1.652)\), suggesting no-autocorrelation. In spite of the fact that equation \((4.58d)\) lacks several necessary requirements in terms of diagnostic statistics, we have retained this equation in the model because it represents relationship between Pakistan's import trade price \((P_i)\) and rapeseeds world trade price \((P_w)\). This equation shows a statistically weak but positive relationship between the two prices mentioned.

**Further improvements and discussion**

In light of the discussions made in previous sections, the estimated Model 4.58 \((a - e)\) appears to be a good model in spite of some of its weaknesses explained; it performed best amongst several specifications tried, in terms of usual diagnostic statistics and economic theory.

As already mentioned, equation \((4.58a)\) includes lagged dependent variables \((A_{t-1})\), used as one of the explanatory variables included; hence this equation provides short-run effects. To convert this equation into long run, we first compute coefficient of adjustment \((\lambda)\), and then adjust short run equation to its long run version. By doing so, we get:

\[
A = 324.1902 + 0.000465P_d \tag{4.59}
\]

Since equation \((4.58b)\) includes predicted value of variable 'A', which is nothing but equation 4.59, hence substituting the value of 'A' in equation \((4.59)\) in to equation \((4.58b)\), the later equation adopts the following form.

\[
S_{d} = -50.98 + 0.68686P_d + 5.7996\text{FNTRD} \tag{4.60a}
\]

Putting average values of variables FNTRD and TR (from Annex Table 4.1) and including in the intercept, we can further shorten domestic supply equation \((4.60a)\), as follows.

\[
S_{d} = 260.0826 + 0.000319P_d \tag{4.60b}
\]

Similarly, domestic demand \((D_{d})\) function, earlier estimated as equation \(4.58c\), can be further shortened, as follows.
\[ D_d = 254.89 - 0.000373P_d + 0.27467GDPPR - 32.234TR \]  
\[ = -180.2871 - 0.000373P_d + 0.27467GDPPR \]  
\[ = 384.1446 - 0.000373P_d \]  

Since the estimated model 4.58 (a - e) lacks import demand \((I_d)\) function, which is to be computed as an identity equation (difference between \(D_d\) and \(S_d\)); hence:

\[ I_d = D_d - S_d \]  
\[ = 124.062 - 0.000692P_d \]  

Equations (4.58d) and (4.58e), respectively, represent the effect of world rapeseed price \((P_w)\) on Pakistan’s rapeseed import/trade price \((P_t)\) and how Pakistan’s rapeseed import supply \((I_s)\) is affected by its various determinants. These two are, in fact, Recursive equations as the predicted value of \(P_t\), estimated in (4.58d), is used in the estimation of (4.58e). One can use these two as separate equations to have different effects or can merge the two for the sake of simplicity of the model. For the latter case, we take equation (4.58d), replace it in equation (4.58e), replace average values of variables \(S_d\) and \(D_d\hat{H}_d\), and consequently get the following equation:

\[ I_s = 75.45176 + 0.125463P_w \]  

What has been provided in equations (4.60 through 4.63) represents a full model of Pakistan’s rapeseed crop sector, namely:

\[ S_d = -50.98 + 0.68686 P_d + 5.7996FNTRD \]  
\[ = 260.0826 + 0.000319P_d \]  

\[ D_d = 254.89 - 0.000373P_d + 0.27467GDPPR + -32.234TR \]  
\[ = 384.1446 - 0.000373P_d \]  

\[ I_d = 124.062 - 0.000692P_d \]  

\[ P_t = -2.209 + 0.87303P_w \]  

\[ I_s = -63.097 + 0.14371P^*_t - 0.8321S^*_d + 0.95306D^*_d \]  
\[ = 77.21784 + 0.14371P^*_t \]  
\[ = 75.45176 + 0.125463P_w \]  

**Final model**

Since we are interested in the analysis of various policy scenarios effective under WTO regime, we further simplify the above model (equations 4.64a - i), keeping all important choice variables in tact and removing all other (irrelevant) variables from the equations. Replacing their values and adding with respective intercepts, we get the shorter version of the model, as follows.
\[ S_d = 260.0826 + 0.000319P_d \]  
\[ D_d = 384.1446 - 0.000373P_d \]  
\[ I_d = 124.062 - 0.000692P_d \]  
\[ P_i = -12.209 + 0.87303P_w \]  
\[ I_s = 77.21784 + 0.14371P^* \]  
\[ = 75.45176 + 0.125463P_w \]  

(4.65a)  
(4.65b)  
(4.65c)  
(4.65d)  
(4.65e)  
(4.65f)
Annex Table 4.1 Mean values of variables involved

<table>
<thead>
<tr>
<th>Name of variable</th>
<th>Mean value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheat</strong></td>
<td></td>
</tr>
<tr>
<td>A = area under wheat in ‘000’ hectares</td>
<td>7837.60</td>
</tr>
<tr>
<td>A̅ = area predicted in ‘000’ hectares</td>
<td>7837.60</td>
</tr>
<tr>
<td>A_t-1 = lagged area in ‘000’ hectares</td>
<td>7774.00</td>
</tr>
<tr>
<td>S_d = domestic supply in ‘000’ tons</td>
<td>15512.00</td>
</tr>
<tr>
<td>S_d_t-1 = lagged domestic supply in ‘000’ tons</td>
<td>15099.00</td>
</tr>
<tr>
<td>D_d = domestic demand in ‘000’ tons</td>
<td>16667.00</td>
</tr>
<tr>
<td>D_d_t-1 = lagged domestic demand in ‘000’ tons</td>
<td>16269.00</td>
</tr>
<tr>
<td>S_w = world supply of wheat in ‘000’ tons</td>
<td>547170.00</td>
</tr>
<tr>
<td>I_5 = Net import in ‘000’ tons</td>
<td>1154.60</td>
</tr>
<tr>
<td>P_d = domestic price in Pak. Rupees per m. ton.</td>
<td>4879.20</td>
</tr>
<tr>
<td>P_e = Pakistan level trade price per ton in US$</td>
<td>169.82</td>
</tr>
<tr>
<td>P_w = world level trade price per ton in US$</td>
<td>160.95</td>
</tr>
<tr>
<td>FNTWT, nutrient-fertilizers used in wheat in ‘000’ tons</td>
<td>992.82</td>
</tr>
<tr>
<td>POT = population of Pakistan in millions</td>
<td>118.66</td>
</tr>
<tr>
<td>TR = trend variable for the years of observations included</td>
<td>13.50</td>
</tr>
<tr>
<td><strong>Basmati Rice</strong></td>
<td></td>
</tr>
<tr>
<td>A = area under Basmati rice in ‘000’ hectares</td>
<td>1067.20</td>
</tr>
<tr>
<td>A̅ = predicted area in ‘000’ hectares</td>
<td>1067.20</td>
</tr>
<tr>
<td>A_t-1 = lagged area in ‘000’ hectares</td>
<td>1033.40</td>
</tr>
<tr>
<td>S_d = domestic supply in ‘000’ tons</td>
<td>1388.40</td>
</tr>
<tr>
<td>D_d = domestic demand in ‘000’ tons</td>
<td>941.37</td>
</tr>
<tr>
<td>E_s = net export in ‘000’ tons</td>
<td>447.03</td>
</tr>
<tr>
<td>P_d = domestic price in Rupees per ton</td>
<td>12133.00</td>
</tr>
<tr>
<td>PWIR, domestic price of IRRI rice in Rupees per ton</td>
<td>5723.90</td>
</tr>
<tr>
<td>P_e = Pakistan level trade price per ton in US$</td>
<td>548.07</td>
</tr>
<tr>
<td>P_w = world level trade price per ton in US$</td>
<td>340.92</td>
</tr>
<tr>
<td>GDPWD, GDP of the world in billion US$</td>
<td>25763.00</td>
</tr>
<tr>
<td>GDPPPR, GDP of the Pakistan in billion Rupees</td>
<td>2054.90</td>
</tr>
<tr>
<td><strong>FNT</strong>, nutrient-fertilizers used in ‘000’ tons</td>
<td>2102.60</td>
</tr>
<tr>
<td>TR = trend variable for the years of observations included</td>
<td>13.50</td>
</tr>
</tbody>
</table>

**Cotton**

| **A** = area under cotton in ‘000’ hectares | 2677.10 |
| **A** = area predicted in ‘000’ hectares | 2677.10 |
| **A_{t-1}** = lagged area in ‘000’ hectares | 2627.10 |
| **S_d** = domestic supply in ‘000’ tons | 4520.30 |
| **D_d** = domestic demand in ‘000’ tons | 4350.40 |
| **E_s** = Net export in ‘000’ tons | 169.96 |
| **P_d** = support price in Pak. Rupees per ton | 9687.80 |
| **P_c** = Pakistan seed cotton trade price per ton in US$ | 415.97 |
| **P_w** = world seed cotton trade price per ton in US$ | 461.80 |
| **GDPPR**, GDP of the Pakistan in billion Rupees | 2054.90 |
| **FNTSN**, nutrient-fertilizers used in cotton in ‘000’ tons | 430.98 |
| **CAT**, credit availability in million rupees | 4204.60 |
| TR = trend variable for the years of observations included | 13.50 |

**Sugarcane**

<p>| <strong>A</strong> = area under sugar cane in ‘000’ hectares | 929.38 |
| <strong>A</strong> = area predicted in ‘000’ hectares | 929.38 |
| <strong>A_{t-1}</strong> = lagged area in ‘000’ hectares | 922.53 |
| <strong>S_{dsc}</strong> = domestic supply of sugar cane in ‘000’ tons | 40835.05 |
| <strong>S_{dsc}^</strong>* = predicted domestic supply of sugar cane in ‘000’ tons | 40835.00 |
| <strong>D_{dsc}</strong> = domestic demand of sugar cane in ‘000’ tons | 42299.50 |
| <strong>I_{dsc}</strong> = import demand of sugarcane | 1464.45 |
| <strong>I_{ssc}</strong> = import supply of sugarcane | 1464.45 |
| <strong>P_{dsc}</strong> = domestic price of sugar in Pak. Rupees per m. ton. | 14595.77 |
| <strong>P_{isc}</strong> = Pakistan level trade price of sugar per ton in US$ | 315.70 |
| <strong>P_{isc}^</strong>* = Pakistan level predicted trade price of sugar per ton in US$ | 315.70 |
| <strong>P_{wsc}</strong> = world level trade price of sugar per ton in US$ | 356.76 |
| <strong>GDPPP</strong>, GDP of Pakistan in billion Rupees | 2054.90 |</p>
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNT, nutrient-fertilizers in ‘000’ tons</td>
<td>2102.60</td>
</tr>
<tr>
<td>WAT, water availability in ‘000’ acre feet</td>
<td>119330.00</td>
</tr>
<tr>
<td><strong>Onion</strong></td>
<td></td>
</tr>
<tr>
<td>$A$ = area under onion in ‘000’ hectares</td>
<td>71.78</td>
</tr>
<tr>
<td>$\hat{A}$ = area predicted in ‘000’ hectares</td>
<td>71.78</td>
</tr>
<tr>
<td>$A_{t-1}$ = lagged area in ‘000’ hectares</td>
<td>68.36</td>
</tr>
<tr>
<td>$S_d$ = domestic supply in ‘000’ tons</td>
<td>921.21</td>
</tr>
<tr>
<td>$S'_d$ = predicted domestic supply in ‘000’ tons</td>
<td>921.21</td>
</tr>
<tr>
<td>$D_d$ = domestic demand in ‘000’ tons</td>
<td>874.76</td>
</tr>
<tr>
<td>$E_x$ = net export in ‘000’ tons</td>
<td>46.45</td>
</tr>
<tr>
<td>$P_d$ = domestic price in Pak. Rupees per m. ton.</td>
<td>4623.00</td>
</tr>
<tr>
<td>$P_e$ = Pakistan level trade price per ton in US$</td>
<td>128.43</td>
</tr>
<tr>
<td>$P_w$ = world level trade price per ton in US$</td>
<td>257.07</td>
</tr>
<tr>
<td>$P'_e$ = predicted Pakistan level trade price per ton in US$</td>
<td>128.43</td>
</tr>
<tr>
<td>GDPWD, GDP of the world in billion $</td>
<td>25763.00</td>
</tr>
<tr>
<td>PCI, Per capita income of Pakistan</td>
<td>15352.00</td>
</tr>
<tr>
<td>POT, population of Pakistan in millions</td>
<td>118.66</td>
</tr>
<tr>
<td>FNTON, nutrient-fertilizers used in onion in ‘000’ tons</td>
<td>18.77</td>
</tr>
<tr>
<td>TR = trend variable for the years of observations included</td>
<td>13.50</td>
</tr>
<tr>
<td><strong>Potato</strong></td>
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</tr>
<tr>
<td>$A$ = area under potato in ‘000’ hectares</td>
<td>77.80</td>
</tr>
<tr>
<td>$\hat{A}$ = area predicted in ‘000’ hectares</td>
<td>77.80</td>
</tr>
<tr>
<td>$A_{t-1}$ = lagged area in ‘000’ hectares</td>
<td>74.95</td>
</tr>
<tr>
<td>$S_d$ = domestic supply in ‘000’ tons</td>
<td>1049.00</td>
</tr>
<tr>
<td>$D_d$ = domestic demand in ‘000’ tons</td>
<td>1029.30</td>
</tr>
<tr>
<td>$E_d$ = net export in ‘000’ tons</td>
<td>19.80</td>
</tr>
<tr>
<td>$P_d$ = domestic price in Pak. Rupees per m. ton.</td>
<td>4329.90</td>
</tr>
<tr>
<td>$P_e$ = Pakistan level trade price per ton in US$</td>
<td>485.19</td>
</tr>
<tr>
<td>$S_w$ = world supply in ‘000’ tons</td>
<td>289610.00</td>
</tr>
<tr>
<td>$E_w$ = world export in ‘000’ tons</td>
<td>7004.60</td>
</tr>
<tr>
<td>GDPWD = GDP of the world in billion $</td>
<td>25763.00</td>
</tr>
<tr>
<td>Variable</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PCI</td>
<td>Per capita income of Pakistan</td>
</tr>
<tr>
<td>POT</td>
<td>Population of Pakistan in millions</td>
</tr>
<tr>
<td>FNTPO</td>
<td>Nutrient-fertilizers used in potato in ‘000’ tons</td>
</tr>
<tr>
<td>CAT</td>
<td>Credit availability in ‘000’ rupees</td>
</tr>
<tr>
<td>TR</td>
<td>Trend variable for the years of observations included</td>
</tr>
<tr>
<td>A</td>
<td>Area under rapeseed in ‘000’ hectares</td>
</tr>
<tr>
<td>Â</td>
<td>Area predicted in ‘000’ hectares</td>
</tr>
<tr>
<td>A_{t-1}</td>
<td>Lagged area in ‘000’ hectares</td>
</tr>
<tr>
<td>S_d</td>
<td>Domestic supply in ‘000’ tons</td>
</tr>
<tr>
<td>Ŝ_d</td>
<td>Predicted domestic supply in ‘000’ tons</td>
</tr>
<tr>
<td>D_d</td>
<td>Domestic demand in ‘000’ tons</td>
</tr>
<tr>
<td>D̂_d</td>
<td>Predicted domestic demand in ‘000’ tons</td>
</tr>
<tr>
<td>I_s</td>
<td>Net import in ‘000’ tons</td>
</tr>
<tr>
<td>P_d</td>
<td>Domestic price in Pak. Rupees per m. ton.</td>
</tr>
<tr>
<td>P_s</td>
<td>Pakistan level trade price per ton in US$</td>
</tr>
<tr>
<td>P_w</td>
<td>World level trade price per ton in US$</td>
</tr>
<tr>
<td>P̂_s</td>
<td>Predicted Pakistan level trade price per ton in US$</td>
</tr>
<tr>
<td>GDPPR</td>
<td>GDP of Pakistan in billion Rupees</td>
</tr>
<tr>
<td>FNTRD</td>
<td>Nutrient-fertilizers used in rapeseed in ‘000’ tons</td>
</tr>
<tr>
<td>TR</td>
<td>Trend variable for the years of observations included</td>
</tr>
</tbody>
</table>
## Annex Table 4.2 Pakistan’s cotton: seed cotton & lint conversion ratio

<table>
<thead>
<tr>
<th>Year</th>
<th>Production</th>
<th>Cotton-Lint Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed Cotton (M. ton)</td>
<td>Lint Cotton (M. ton)</td>
</tr>
<tr>
<td>1980</td>
<td>2143500</td>
<td>739684.40</td>
</tr>
<tr>
<td>1981</td>
<td>2244000</td>
<td>726475.75</td>
</tr>
<tr>
<td>1982</td>
<td>2471700</td>
<td>760005.40</td>
</tr>
<tr>
<td>1983</td>
<td>1483767</td>
<td>837225.20</td>
</tr>
<tr>
<td>1984</td>
<td>3025713</td>
<td>502944.75</td>
</tr>
<tr>
<td>1985</td>
<td>3650000</td>
<td>1024178.40</td>
</tr>
<tr>
<td>1986</td>
<td>3958800</td>
<td>1227388.40</td>
</tr>
<tr>
<td>1987</td>
<td>4404541</td>
<td>1330009.45</td>
</tr>
<tr>
<td>1988</td>
<td>4278112</td>
<td>1491561.40</td>
</tr>
<tr>
<td>1989</td>
<td>4367245</td>
<td>1448887.30</td>
</tr>
<tr>
<td>1990</td>
<td>4912740</td>
<td>1479368.80</td>
</tr>
<tr>
<td>1991</td>
<td>6542790</td>
<td>1663273.85</td>
</tr>
<tr>
<td>1992</td>
<td>4619880</td>
<td>2216005.05</td>
</tr>
<tr>
<td>1993</td>
<td>4103130</td>
<td>1564717.00</td>
</tr>
<tr>
<td>1994</td>
<td>4437869</td>
<td>1389956.40</td>
</tr>
<tr>
<td>1995</td>
<td>5406260</td>
<td>1502737.95</td>
</tr>
<tr>
<td>1996</td>
<td>4783373</td>
<td>1830922.10</td>
</tr>
<tr>
<td>1997</td>
<td>4686218</td>
<td>1619583.70</td>
</tr>
<tr>
<td>1998</td>
<td>4485375</td>
<td>1580707.10</td>
</tr>
<tr>
<td>1999</td>
<td>5735435</td>
<td>1518994.75</td>
</tr>
<tr>
<td>2000</td>
<td>5476167</td>
<td>1942687.60</td>
</tr>
<tr>
<td>2001</td>
<td>5415600</td>
<td>1855307.30</td>
</tr>
<tr>
<td>2002</td>
<td>5210400</td>
<td>1833970.25</td>
</tr>
<tr>
<td>2003</td>
<td>5127200</td>
<td>1764878.85</td>
</tr>
<tr>
<td>2004</td>
<td>7279400</td>
<td>1736429.45</td>
</tr>
<tr>
<td>2005</td>
<td>7279400</td>
<td>2464937.30</td>
</tr>
</tbody>
</table>

**Source:** For Seed Cotton production (FAO Databases: [www.fao.org](http://www.fao.org))

For Cotton Lint, Government of Pakistan’s Agricultural Statistics of Pakistan, various issues
CHAPTER V
PAKISTAN'S CROP SECTOR: PROTECTION POLICIES AND ASSOCIATED WELFARE EFFECTS

A review of various agricultural policies and protection measures practiced in Pakistan has already been presented in the second chapter on literature review. In this chapter, we use secondary data on prices to identify various protection measures adopted for different agricultural commodities and measure welfare effects of each of such policies. This chapter consists of seven sections, each devoted to a major crop, its present status of protection and estimation of welfare effects associated with such protection.

5.1 Wheat Crop: Protection Status & Welfare Effects

Protection status

Table 5.1 provides data on Pakistan's domestic wholesale price ($P_d$), Pakistan's wheat import trade price ($P_i$) and world average wheat trade price ($P_w$) for 20 years, covering 10 years of pre-WTO (1985-95) and 10 years of post-WTO (1995-05) periods.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan Domestic Wholesale Price</th>
<th>World Price (US$)</th>
<th>Pakistan Import Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pak Rs.</td>
<td>US$</td>
<td></td>
</tr>
<tr>
<td>1985-86</td>
<td>2089.75</td>
<td>129.48</td>
<td>140.85</td>
</tr>
<tr>
<td>1986-87</td>
<td>2107.25</td>
<td>122.66</td>
<td>120.24</td>
</tr>
<tr>
<td>1987-88</td>
<td>2109.00</td>
<td>119.83</td>
<td>144.40</td>
</tr>
<tr>
<td>1988-89</td>
<td>2527.75</td>
<td>131.55</td>
<td>176.83</td>
</tr>
<tr>
<td>1989-90</td>
<td>2706.25</td>
<td>126.19</td>
<td>170.59</td>
</tr>
<tr>
<td>1990-91</td>
<td>2991.75</td>
<td>133.42</td>
<td>137.51</td>
</tr>
<tr>
<td>1991-92</td>
<td>3866.75</td>
<td>155.64</td>
<td>159.04</td>
</tr>
<tr>
<td>1992-93</td>
<td>4006.25</td>
<td>154.33</td>
<td>150.34</td>
</tr>
<tr>
<td>1993-94</td>
<td>4193.75</td>
<td>139.03</td>
<td>144.82</td>
</tr>
<tr>
<td>1994-95</td>
<td>4412.75</td>
<td>143.03</td>
<td>178.22</td>
</tr>
<tr>
<td>1995-96</td>
<td>4954.25</td>
<td>147.59</td>
<td>207.61</td>
</tr>
<tr>
<td>1996-97</td>
<td>7166.75</td>
<td>183.79</td>
<td>173.56</td>
</tr>
<tr>
<td>1997-98</td>
<td>8127.00</td>
<td>188.14</td>
<td>149.59</td>
</tr>
<tr>
<td>1998-99</td>
<td>8125.25</td>
<td>173.65</td>
<td>134.48</td>
</tr>
<tr>
<td>1999-00</td>
<td>8640.00</td>
<td>166.89</td>
<td>132.03</td>
</tr>
<tr>
<td>2000-01</td>
<td>8575.25</td>
<td>146.74</td>
<td>136.90</td>
</tr>
<tr>
<td>2001-02</td>
<td>8218.75</td>
<td>133.80</td>
<td>134.12</td>
</tr>
<tr>
<td>2002-03</td>
<td>8827.00</td>
<td>150.89</td>
<td>154.26</td>
</tr>
<tr>
<td>2003-04</td>
<td>10888.00</td>
<td>189.11</td>
<td>173.07</td>
</tr>
<tr>
<td>2004-05</td>
<td>11530.83</td>
<td>192.73</td>
<td>191.58</td>
</tr>
<tr>
<td>Average</td>
<td>5803.22</td>
<td>151.43</td>
<td>155.50</td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical database)
It appears that Pakistan's domestic price ($P_d$) has remained at US$151.43 per M. ton against the world average trade price ($P_w$) of Rs.155.50 per M. ton, suggesting that, against the popular claim of price-support, Pakistan has been taxing its wheat output. In addition, Pakistan has imported wheat at an annual average import price ($P_i$) of US$162.80 per M. ton during 1985-2005 and sold at Rs.151.43 per M. ton in domestic market, subsidizing import at US$11.37 per M. ton. Hence, an analysis of data for 1985-2005 period reflects that, on an overall basis, Pakistan wheat has been subjected by 'price tax-cum-import subsidy' regime instead of Government of Pakistan's claim of supporting wheat prices.

Since, we would be interested to analyze the effects of WTO trade liberalization, we therefore further divide the study period of 1985-2005 into pre-WTO (1985-1995) and post-WTO (1995-2005) sub-periods. The average prices computed for the two sub-periods are provided, as follows.

<table>
<thead>
<tr>
<th></th>
<th>Pre-WTO period</th>
<th>Post-WTO period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan's wholesale price ($P_d$)</td>
<td>US$135.52</td>
<td>US$167.33</td>
</tr>
<tr>
<td>World average price ($P_w$)</td>
<td>US$152.24</td>
<td>US$158.69</td>
</tr>
<tr>
<td>Pakistan's import price ($P_i$)</td>
<td>US$163.54</td>
<td>US$162.06</td>
</tr>
</tbody>
</table>

Since average $P_d$ remained at US$135.52 per M. ton against average $P_w$ at US$152.24 and average $P_i$ at US$163.54 during the pre-WTO period, the same 'price tax-cum-import subsidy' regime (Figure 5.1) seems to have been in practice during the pre-WTO period. However, situation during post-WTO period appears entirely different as average $P_d$ has remained higher (US$167.33) than $P_w$ (US$158.69), suggesting practicing of price-support. In addition, $P_i$ has remained lower than $P_d$, which means import has been taxed during post-WTO period. Hence, a regime of 'price support-cum-import tax' (Figures 5.2) has been exercised in Pakistan during post-WTO period.

**Welfare effects**

Welfare effects of the existing situations (pre- and post-WTO) versus a free trade WTO scenario would be measured in terms of changes in producers and consumers surpluses ($\Delta PS$ & $\Delta CS$), which along with import subsidy (IS) or import tax (IT) would make social welfare gains/costs (SWG/C).

**Pre-WTO scenario**

As already discussed and depicted in Figure 5.1, the interventions practiced in wheat crop
economy during pre-WTO period may best be termed as ‘price tax-cum-import subsidy’ regime.

**Figure 5.1 Price tax-cum-import subsidy regime during pre-WTO 10 Years**

The welfare effects of the regime in practice are estimated in terms of changes in producers and consumers surpluses are captured using the following model.

\[
\Delta PS = - (abef) = - \int_{pd}^{pdf} S(P)dp
\]

\[
\Delta CS = (acdf) = \int_{pd} S(P)dp
\]

\[
IS = - (ghij) = - (P_i - P_d)Is
\]

\[
SWG/C = \Delta PS + \Delta PS + IS
\]

The functions, \(S(P)\) and \(D(P)\), respectively are wheat supply and demand functions already estimated in model 4.13 – 4.17 in previous Chapter IV. Taking the shortened version of the estimated functions:

\[
S_d = 13485.77 + 0.41528P_d
\]

\[
D_d = 16896.20 - 0.046974P_d
\]

\[
I_d = 3410.43 - 0.462254P_d
\]

\[
P_i = 23.1559 + 0.91124P_w
\]

\[
I_s = 268.6924 + 5.2191P_i
\]

\[
= 389.5862 + 4.7556P_w
\]

These functions were estimated using data for years 1979-80 to 2004-05, and therefore are valid only for average values of the related variables for period 1980-2005; for all
other periods, we would need to adjust intercept values, using average values of the dependent variables and respective explanatory variables. Our pre-WTO study period relates to period 1985-95, we therefore use mean values of dependent and explanatory variables for 1985-95 to re-adjust intercept values, as follows.

\[
\begin{align*}
S_d &= 13309.145 + 0.41528P_d \\
D_d &= 16492.400 - 0.046974P_d \\
I_d &= 3183.975 - 0.462254P_d \\
P_i &= 24.814 + 0.91124P_w \\
I_s &= 896.911 + 5.2191P_i \\
&= 1025.737 + 4.7556P_w
\end{align*}
\]

(5.3a) (5.3b) (5.3c) (5.3d) (5.3e) (5.3f)

For estimation of free market price \(P_d\), we equate import supply with import demand, as follows.

\[
I_s = I_d
\]

\[
3183.975 - 0.462254(P_d) = 896.911 + 5.2191P_i
\]

(5.4a) (5.4b)

Since \(P_d/EXR = P_i\) or \(P_d = P_i*EXR\), replacing \(P_d\) in above equation (5.4b) we get:

\[
3183.975 - 0.462254(P_i)(EXR=22.8036) = 896.910 + 5.2191P_i
\]

\[
(3183.975 - 896.911) = (5.2191 + (0.462254*22.8836))P_i
\]

\[
2287.064 = (5.2191 + (10.5780))P_i = 15.79713P_i
\]

\[
P_{df} = 144.78
\]

(5.4c)

Substituting value of \(P_{df} = 144.78\) given in (5.4c) in \(I_s\) (5.3e)

\[
I_{sf} = 896.911 + 5.2191(P_i = 144.78)
\]

\[
= 1652.52
\]

(5.5a) (5.5b)

Equating \(I_{sf} = I_{df}\)

\[
1652.52 = 3183.975 - 0.462254P_d
\]

\[
0.462254P_d = (3183.975 - 1651.52)
\]

\[
P_{df} = 3313.02
\]

(5.6a) (5.6b) (5.6c)

After estimating \(P_{df}\) and \(P_{df}\) in equations (5.4c) and (5.6c), we are in a position to estimate pre-WTO scenario's welfare effects specified in model 5.1; mean values of all other variables (namely \(P_d, P_i, I_s\) ) for period (1985-95) have been used. For estimation of SWG/C specified in model 5.1, we estimate various components of SWG/C, as follows.

\[
\Delta PS = - \left\{ \int_{P_d=3101.13}^{P_d=3313.02} (13309.145 + 0.41528P_d) dp \right\}
\]

(5.7)
\[
= - \left\{ 13309.145 P_d + \left( \frac{0.41528}{2} \right) P_d^2 \right\} \frac{3313.02}{3101.13}
\]

\[
= - \left\{ 13309.145(3313.02) + \left( \frac{0.41528}{2} \right)(3313.02)^2 \right\} - \left\{ 13309.145(3101.13) + \left( \frac{0.41528}{2} \right)(3101.13)^2 \right\}
\]

\[
= - \{(46372565) - (43270191)}\]

\[
= -\text{Rs.}3102375 \text{ thousand}^{11}
\]

\[
= -\text{Rs.}3102.38 \text{ million}
\]

\[
\Delta CS = \int_{pd=3101.13}^{pd=3313.02} 16492.400 - 0.04697 P_d dp
\]

\[
= \text{Rs.}3462763 \text{ thousand}
\]

\[
= \text{Rs.}3462.76 \text{ million}
\]

\[
\text{IS} = - (P_d - P_d) I_d
\]

\[
= - (\$163.545 - \$135.517) \times 1749.75
\]

\[
= - \text{US$}49041 \text{ thousand}
\]

\[
= - \text{Rs.}1122235 \text{ thousand}
\]

\[
= - \text{Rs.}1122.24 \text{ million}
\]

\[
\text{SWG/C} = \Delta PS + \Delta CS + IS
\]

\[
= - \text{Rs.}761847 \text{ thousand}
\]

\[
= - \text{Rs.}761.85 \text{ million}
\]

It appears that the Government of Pakistan intervention in wheat crop economy referred to above as 'price tax-cum-import subsidy' has resulted, on average, in an overall social welfare cost of Rs.761.85 million per year to the society during the study period 1985-95. However, it is worth noting that producers of wheat have suffered losses worth Rs.3102.38 million per year due to depressed prices (price-tax) while consumers benefited by Rs.3462.76 million per year due to lowered prices. In addition, Government of Pakistan provided subsidy worth Rs.1122.24 million on imported wheat for selling to consumers at lower domestic prices.

**Post-WTO scenario**

As previously discussed and depicted in Figure 5.2, the Pakistan’s wheat crop economy has remained subjected to ‘price support-cum-import tax’ regime.

---

11 Since supply and demand functions (S_d & D_d) are in thousand M. tons, \(\Delta PS & \Delta CS\) would therefore result in thousand rupees.
The welfare effects are captured using the following model.

$$\Delta PS = (abef) = \int_{pd}^{pd} S(P)dp$$  \hspace{1cm} (5.11a)

$$\Delta CS = - (acdf) = - \int_{pdf}^{pd} D(P)dp$$  \hspace{1cm} (5.11b)

$$IT = (ghij) = (P_1 - P_d)I_s$$  \hspace{1cm} (5.11c)

$$SWG/C = \Delta PS + \Delta CS + IT$$  \hspace{1cm} (5.11d)

As per previous case, we adjust relevant supply and demand functions for post-WTO period (1995-05); the so adjusted functions are provided, as follows.

$$S_d = 15339.196 + 0.41528P_d$$  \hspace{1cm} (5.12a)

$$D_d = 20266.082 - 0.04697P_d$$  \hspace{1cm} (5.12b)

$$I_d = 4926.886 - 0.46225P_d$$  \hspace{1cm} (5.12c)

$$P_i = 17.45159 + 0.91124P_w$$  \hspace{1cm} (5.12d)

$$I_s = 149.468 + 5.2191P_i$$  \hspace{1cm} (5.12e)

$$= 240.5894 + 4.7556P_w$$  \hspace{1cm} (5.12f)

For estimation of free market price ($P_d$)

$$I_s = I_d$$  \hspace{1cm} (5.13a)

$$4926.886 - 0.46225(P_d) = 149.468 + 5.2191P_i$$  \hspace{1cm} (5.13b)
Since \( P_d/EXR = P_i \) or \( P_d = P_i \times \frac{1}{EXR} \), replacing \( P_d \) in above equation (5.13b) we get:

\[
4926.886 - 0.462254(P_d)(EXR=50.8285) = 149.468 + 5.2191P_i
\]

\[
4926.886 - 149.47 = (5.2191 + (23.4957))P_i
\]

\[
P_{if} = 166.37
\]  

(5.13c)

Putting value of \( P_{if} = 166.37 \) given in (5.12c) in \( I_s \) (5.12e)

\[
I_{sf} = 149.468 + 5.2191(P_{if} = 166.37)
\]

\[
= 1017.80
\]  

(5.14a)

(5.14b)

EQUATING \( I_{sf} = I_{df} \)

\[
1017.80 = 4926.886 - 0.462254P_{df}
\]  

(5.15a)

\[
P_{df} = 8456.59
\]  

(5.15b)

(5.15c)

After estimating \( P_{if} \) and \( P_{df} \) in equations (5.13c) and (5.15c), we are in a position to estimate post-WTO scenario welfare effects specified in model 5.11: the mean values of all other variables (namely \( P_a, P_b, I_s \)) for the specified period (1995-05) have been used. For estimation of SWG/C specified in model 5.11, we estimate various components of SWG/C, as follows.

\[
\Delta PS = (abef) = \int_{P_{df}=8456.59}^{P_d=8505.31} (15339.2 + 0.41528Pd)dp
\]

(5.16)

\[
= Rs.918908.34 \text{ thousand}
\]

\[
= Rs.918.91 \text{ million}
\]  

(5.16a)

\[
CS = -(acdf) = -\left\{ \int_{P_{df}=8456.59}^{P_d=8505.31} (19866.55 - 0.046974Pd)dp \right\}
\]

(5.17)

\[
- \text{ Rs.967946.28 thousand}
\]

\[
= \text{ Rs.967.95 million}
\]  

(5.17a)

\[
IT = (P_i - P_d)I_d
\]

(5.18a)

\[
= \text{US$ 5248.66}
\]

\[
= \text{Rs.266781.90 thousand}
\]

\[
= \text{Rs.266.78 million}
\]  

(5.18b)

\[
SWG/C = \Delta PS + \Delta CS + IS
\]

(5.19a)

\[
= \text{Rs.217743.90 thousand}
\]

\[
= \text{Rs.217.74 million}
\]  

(5.19b)

It seems that the Government of Pakistan's interventions in wheat crop economy referred to above as 'price support-cum-import tax' have resulted, on average, in an overall social
welfare gain of Rs.217.74 million per year to the society during the study period 1995-05. However, it is worth-mentioning that producers of wheat have benefited to the tune of Rs.918.91 million per year due to higher prices (price-support) while consumers have suffered losses of Rs.967.95 million annually. It appears that losses in terms of consumers surplus (Rs.967.95 million) are higher than the gains in producers surplus (918.91 million). Government of Pakistan has gained Rs. 266.78 million in terms of import tax, which changed the losses (of the consumers) to net gains of 217.74 million to the society.
5.2 Basmati rice Crop: Protection Status & Welfare Effects

Protection status:
Table 5.2 provides data on Pakistan’s Domestic wholesale price (Pd), Pakistan’s Basmati rice export trade price (Pe) and world average rice trade price (Pw) for 20 years, covering, 10 years of pre-WTO and 10 years of post-WTO periods.

Table 5.2 Pakistan’s basmati rice prices for 1985-05 (prices per M. ton)

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan’s Domestic Wholesale Price</th>
<th>World Price (US$)</th>
<th>Pakistan’s Export Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985-86</td>
<td>6300.75 390.40</td>
<td>268.23</td>
<td>655.87</td>
</tr>
<tr>
<td>1986-87</td>
<td>6625.75 385.68</td>
<td>280.56</td>
<td>697.68</td>
</tr>
<tr>
<td>1987-88</td>
<td>6843.75 388.86</td>
<td>347.59</td>
<td>713.10</td>
</tr>
<tr>
<td>1988-89</td>
<td>6625.25 344.79</td>
<td>351.99</td>
<td>677.51</td>
</tr>
<tr>
<td>1989-90</td>
<td>7326.00 341.61</td>
<td>356.24</td>
<td>671.57</td>
</tr>
<tr>
<td>1990-91</td>
<td>8314.50 370.81</td>
<td>368.93</td>
<td>466.23</td>
</tr>
<tr>
<td>1991-92</td>
<td>9338.25 375.87</td>
<td>358.03</td>
<td>407.07</td>
</tr>
<tr>
<td>1992-93</td>
<td>10323.00 397.65</td>
<td>332.35</td>
<td>424.34</td>
</tr>
<tr>
<td>1993-94</td>
<td>10650.50 353.09</td>
<td>374.17</td>
<td>405.56</td>
</tr>
<tr>
<td>1994-95</td>
<td>10275.25 333.05</td>
<td>348.97</td>
<td>400.45</td>
</tr>
<tr>
<td>1995-96</td>
<td>14316.75 426.49</td>
<td>403.33</td>
<td>406.71</td>
</tr>
<tr>
<td>1996-97</td>
<td>14729.25 377.74</td>
<td>390.74</td>
<td>440.67</td>
</tr>
<tr>
<td>1997-98</td>
<td>17683.25 409.37</td>
<td>351.67</td>
<td>452.41</td>
</tr>
<tr>
<td>1998-99</td>
<td>20570.75 439.64</td>
<td>329.25</td>
<td>508.14</td>
</tr>
<tr>
<td>1999-00</td>
<td>15902.00 307.16</td>
<td>295.98</td>
<td>501.71</td>
</tr>
<tr>
<td>2000-01</td>
<td>18140.25 310.42</td>
<td>268.52</td>
<td>463.95</td>
</tr>
<tr>
<td>2001-02</td>
<td>21000.50 341.88</td>
<td>252.40</td>
<td>461.93</td>
</tr>
<tr>
<td>2002-03</td>
<td>23327.75 398.77</td>
<td>276.89</td>
<td>494.78</td>
</tr>
<tr>
<td>2003-04</td>
<td>22636.25 393.16</td>
<td>325.24</td>
<td>508.54</td>
</tr>
<tr>
<td>2004-05</td>
<td>24616.00 411.43</td>
<td>378.35</td>
<td>526.34</td>
</tr>
<tr>
<td>Average</td>
<td>13777.29 374.89</td>
<td>332.97</td>
<td>514.23</td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical databases)
Agricultural Statistic of Pakistan (various issues)

The study of Table 5.2 reveals that Pakistan’s Basmati Rice has been exported at a price much higher than the domestic wholesale price as well as the world average trade price. From this analysis, one point is clear that Pakistan has been charging export tax on its Basmati Rice; it exported Basmati Rice at an annual average price of US$514.23 per M. ton against domestic price of US$374.89 and charged export tax worth US$139.34 per M. ton during the study period 1985-2005. To exercise this policy of charging export tax, Pakistan used to export its Basmati Rice through its State Trading Enterprises (STEs) namely Rice Export Corporation of Pakistan (RECP) and Trading Corporation of
Pakistan (TCP) in the earlier years while it has recently allowed private sector Rice Exporters’ Association of Pakistan (REAP) to export Basmati Rice. The REAP is operating as a cartel of a few exporters.

Apparently it seems that Pakistan has kept its Basmati Rice domestic price much lower than that of the world Basmati Rice export market price (free trade price). Basmati is especial quality rice and its export cannot be evaluated on the basis of world average rice price given in Table 5.2. We would have to estimate free trade export price with the domestic price of Basmati Rice and establish whether Pakistan has supported its Basmati Rice in the domestic market. To do so we would use export supply ($E_s$) and export demand ($E_d$) functions already estimated in model 4.24 f & i. We equated equation (4.24 c & d) after adjusting for every year of the study period (1985-2005) and solved for Basmati Rice free trade export price ($P_{ef}$). This free trade export price is provided along with Pakistan’s domestic Basmati Rice price in Table 5.3.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan’s Domestic Wholesale Price (US$)</th>
<th>Basmati Rice Estimated Free Export Trade Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985-86</td>
<td>390.40</td>
<td>441.09</td>
</tr>
<tr>
<td>1986-87</td>
<td>385.68</td>
<td>442.30</td>
</tr>
<tr>
<td>1987-88</td>
<td>388.86</td>
<td>446.55</td>
</tr>
<tr>
<td>1988-89</td>
<td>344.79</td>
<td>399.83</td>
</tr>
<tr>
<td>1989-90</td>
<td>341.61</td>
<td>391.38</td>
</tr>
<tr>
<td>1990-91</td>
<td>370.81</td>
<td>384.66</td>
</tr>
<tr>
<td>1991-92</td>
<td>375.87</td>
<td>380.02</td>
</tr>
<tr>
<td>1992-93</td>
<td>397.65</td>
<td>401.07</td>
</tr>
<tr>
<td>1993-94</td>
<td>353.09</td>
<td>358.97</td>
</tr>
<tr>
<td>1994-95</td>
<td>333.05</td>
<td>340.46</td>
</tr>
<tr>
<td>1995-96</td>
<td>426.49</td>
<td>424.48</td>
</tr>
<tr>
<td>1996-97</td>
<td>377.74</td>
<td>383.34</td>
</tr>
<tr>
<td>1997-98</td>
<td>409.37</td>
<td>412.86</td>
</tr>
<tr>
<td>1998-99</td>
<td>439.64</td>
<td>444.79</td>
</tr>
<tr>
<td>1999-00</td>
<td>307.16</td>
<td>320.49</td>
</tr>
<tr>
<td>2000-01</td>
<td>310.42</td>
<td>319.81</td>
</tr>
<tr>
<td>2001-02</td>
<td>341.88</td>
<td>348.89</td>
</tr>
<tr>
<td>2002-03</td>
<td>398.77</td>
<td>404.64</td>
</tr>
<tr>
<td>2003-04</td>
<td>393.16</td>
<td>400.32</td>
</tr>
<tr>
<td>2004-05</td>
<td>411.43</td>
<td>418.31</td>
</tr>
<tr>
<td>Average</td>
<td><strong>374.89</strong></td>
<td><strong>393.21</strong></td>
</tr>
</tbody>
</table>

Source: Agricultural Statistics of Pakistan (various issues)
A comparison of the two prices ($P_d$ & $P_c$) indicates that Pakistan’s domestic price has been taxed during the 1985-2005, indicating in case of Basmati Rice ‘price tax-cum-export tax’ regime. As far as pre- and post-WTO periods are concerned, a comparison of the average prices for the two periods is provided as follows.

<table>
<thead>
<tr>
<th></th>
<th>Pre-WTO Period</th>
<th>Post-WTO Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan’s wholesale price</td>
<td>US$368.18</td>
<td>US$381.61</td>
</tr>
<tr>
<td>Estimated free trade average price</td>
<td>US$398.63</td>
<td>US$387.79</td>
</tr>
<tr>
<td>Pakistan’s export price</td>
<td>US$551.94</td>
<td>US$476.52</td>
</tr>
</tbody>
</table>

Since, average $P_d$ remained at US$368.18 per M. ton against average estimated free trade average price ($P_c$) at US$398.63 and average $P_e$ at US$551.94 during the pre-WTO period reflecting ‘price tax-and-export tax’. During post WTO period, $P_d$ (US$381.61) remained below estimated free trade average price ($P_c$) (US$327.21), suggesting price-tax. In addition $P_e$ (US$476.52) remained higher than $P_d$ (US$381.61) suggesting tax on export. Hence a regime of ‘price tax-cum-export tax’.

**Welfare effects**

Welfare effects of the existing situations (pre- and post-WTO versus a free trade WTO scenario would be measured in terms of changes in producers and consumers surpluses ($\Delta P_S$ & $\Delta C_S$), along with export tax (ET) and export subsidy (ES) would make social welfare gains/costs (SWG/C).

**Pre-WTO scenario**

As already discussed and depicted in Figure 5.3, interventions made in Basmati rice economy during pre-WTO period may best be termed as ‘price tax-cum-export tax’ regime.

**Figure 5.3 Price tax-cum-export tax regime**

during pre-WTO 10 years
The welfare effects in terms of producers and consumers would be captured using the following model.

\[ \Delta PS = -(acdf) = - \int_{p_d}^{pdf} S(P)dp \]  \hspace{1cm} (5.20a)

\[ \Delta CS = (abef) = \int_{p_d}^{pdf} D(P)dp \]  \hspace{1cm} (5.20b)

\[ ET = (ghij) = (P_e - P_d)E_s \]  \hspace{1cm} (5.20c)

\[ SWG/C = \Delta PS + \Delta CS + T \]  \hspace{1cm} (5.20d)

The functions \( S(P) \) and \( D(P) \), respectively are Basmati rice supply and demand functions already estimated in model 4.25 in previous Chapter IV. Taking shortened version of the estimated functions.

\[ S_d = 750.5248 + 0.052582P_d \]  \hspace{1cm} (5.21a)

\[ D_d = 1043.901 - 0.008451P_d \]  \hspace{1cm} (5.21b)

\[ E_s = -293.3762 + 0.061033P_d \]  \hspace{1cm} (5.21c)

\[ E_d = 574.5015 - 0.23247P_e \]  \hspace{1cm} (5.21d)

\[ = 121.1217 + 1.1063P_w \]  \hspace{1cm} (5.21e)

These functions were estimated using data for years 1980 to 2005, and are therefore, valid only for average values of the related variables for period 1980-2005; for all other periods, we would need to adjust intercept values, using average values of the dependent variables and respective explanatory variables. Our pre-WTO study period relates to period 1985-95, we therefore use mean values of dependent and explanatory variables for 1985-95 to re-adjust intercept values, as follows.

\[ S_d = 676.9517 + 0.052582P_d \]  \hspace{1cm} (5.22a)

\[ D_d = 840.7971 - 0.008451P_d \]  \hspace{1cm} (5.22b)

\[ E_s = -163.845 + 0.061033P_d \]  \hspace{1cm} (5.22c)

\[ E_d = 468.7365 - 0.23247P_e \]  \hspace{1cm} (5.22d)

\[ = 1.360216 + 1.1063P_w \]  \hspace{1cm} (5.22e)

For estimation of free market price \( (P_{ef}) \)

\[ E_s = E_d \]  \hspace{1cm} (5.23a)
Since \( P_d/EXR = P_e \) or \( P_d = P_e \times EXR \), replacing \( P_d \) in above equation we get:

\[
P_{ef} = 398.63
\]  
(5.23b)

Putting values of \( P_{ef} = 398.63 \) given in (5.22b) in Ed (5.21d)

\[
E_{df} = 468.7365 - 0.23247(P_e = 394.85)
\]  
(5.24a)

\[
E_{df} = 376.07
\]  
(5.24b)

Equating \( E_{df} = E_{sf} \)

\[
P_{df} = 8846.24
\]  
(5.25a)

After estimating \( P_{ef} \) and \( P_{df} \) in equation (5.23b) and (5.25b), we are in a position to estimate pre-WTO scenario welfare effects specified in model 5.20; values of all other variables (namely \( P_d, P_e, E_s \) are already available in the form of mean values of these variables for the specified period (1985-95).

For estimation of SWG/C specified in model 5.20, we estimate various components of SWG/C, as follows.

\[
\Delta PS = -(acdf) = - \left\{ \int_{P_d = 8262.30}^{P_d = 8846.24} (676.9517 + 0.052582P_d) dp \right\}
\]  
(5.26a)

\[\begin{align*}
&= - \text{Rs.657953.00 thousand} \\
&= - \text{Rs.657.95 million}
\end{align*}
\]  
(5.26b)

\[
\Delta CS = (abef) = \int_{P_d = 8262.30}^{P_d = 8846.24} (840.7971 - 0.008451P_d) dp
\]  
(5.27a)

\[\begin{align*}
&= \text{Rs.448759.20 thousand} \\
&= \text{Rs.448.76 million}
\end{align*}
\]  
(5.27b)

\[
ET = (ghij) = (P_e - P_d)E_s
\]  
(5.28a)

\[\begin{align*}
&= \text{US$ 62555.42} \\
&= \text{Rs.1403792 thousand} \\
&= \text{Rs.1403.79 million}
\end{align*}
\]  
(5.28b)

\[
SWG/C = \Delta PS + \Delta CS + T
\]  
(5.29a)

\[\begin{align*}
&= \text{Rs.1194598.00 thousand} \\
&= \text{Rs.1194.60 million}
\end{align*}
\]  
(5.29b)

It appears that the Government of Pakistan interventions in Basmati rice economy referred to above as 'price tax-cum-export tax' has resulted, on average, in an overall social welfare gain of Rs.1194.60 million per year to the society during the study period 1985-95. However, it is worth mentioning that producers of Basmati rice have suffered
Rs.657.95 million per year due to depressed prices compared to free market prices while consumers benefited by 448.76 million per annum due to lowered prices. In addition, Government of Pakistan received export tax worth Rs.1403.79 million on export of Basmati rice.

Post-WTO scenario

As already discussed and depicted in Figure 5.4, interventions made in Basmati rice economy during post-WTO period may best be termed as ‘price tax-cum-export tax’ regime.

**Figure 5.4 Price tax-cum-export tax regime during post-WTO 10 years**

The welfare effects in terms of producers and consumers would be estimated using the following model.

\[
\Delta PS = -(acdf) = - \int_{Pd}^{Pd_f} S(P) \, dp \tag{5.30a}
\]

\[
\Delta CS = (abef) = \int_{Pd}^{Pd_f} D(P) \, dp \tag{5.30b}
\]

\[
ET = (ghij) = (P_e - P_d)E_s \tag{5.30c}
\]

\[
SWG/C = \Delta PS + \Delta CS + ET \tag{5.30d}
\]

The functions \( S(P) \) and \( D(P) \), respectively are Basmati rice supply and demand functions already estimated in model 4.25 in previous Chapter IV and reproduced in model 5.21 above. We use mean values of dependent and explanatory variables for 1995-2005 to re-adjust intercept values, as follows.

\[
S_d = 898.4736 + 0.052582P_d \tag{5.31a}
\]
\[ D_d = 1437.392 - 0.008451P_d \] (5.31b)
\[ E_s = -538.919 + 0.061033P_d \] (5.31c)
\[ E_d = 749.3228 - 0.23247P_e \] (5.31d)
\[ = 298.5887 + 1.1063P_w \] (5.31e)

For estimation of free market price \((P_{ef})\)

\[ E_s = E_d \] (5.32a)

Since \(P_d/EXR = P_e\) or \(P_d = P_e*EXR\), replacing \(P_d\) in above equation we get:

\[ P_{ef} = 387.79 \] (5.32b)

Putting values of \(P_{ef} = 387.79\) given in (5.32b) in Ed (5.31c)

\[ E_{dr} = 749.3228 - 0.23247(P_{ef} = 387.79) \] (5.33a)
\[ E_{dr} = 659.17 \] (5.33b)

Equating \(E_{dr} = E_{ef}\) (5.34a)

\[ P_{dr} = 19630.23 \] (5.34b)

After estimating \(P_{ef}\) and \(P_{dr}\) in equation (5.32b) and (5.34b), we are in a position to estimate post-WTO scenario welfare effects specified in model 5.30; values of all other variables (namely \(P_d, P_e, E_s\) are already available in the form of mean values of these variables for the specified period (1995-2005).

For estimation of SWG/C specified in model 5.30, we estimate various components of SWG/C, as follows.

\[ \Delta PS = -\left\{ \int_{P_d = 19292.28}^{P_d = 19630.23} (898.4736 + 0.052582P_d)dp \right\} \] (5.35a)

\[ = -Rs.649480.00 \text{ thousand} \] (5.35b)
\[ = -Rs.649.48 \text{ million} \]

\[ \Delta CS = \int_{P_d = 19292.28}^{P_d = 19630.23} (1437.392 - 0.008451P_d)dp \] (5.36a)

\[ = Rs.430193.50 \text{ thousand} \] (5.36b)
\[ = Rs.430.19 \text{ million} \]

\[ ET = (ghij) = (P_e - P_d)E_s \] (5.37a)

\[ = \text{US$60604.84} \]
\[ = \text{Rs.3063899.00 thousand} \] (5.37b)
\[ = \text{Rs.3063.90 million} \]

\[ \text{SWG/C} = \Delta PS + \Delta CS + T \] (5.38a)
= Rs. 2844612 thousand
= Rs.2844.61 million

It reflects that the Government of Pakistan interventions in Basmati rice economy referred to above as ‘price tax-cum-export tax’ have resulted, on average, in an overall social welfare gain of Rs.2844.61 million per year to the society during the study period 1995-05. However, it is worth mentioning that producers of Basmati rice have suffered losses of Rs.649.48 million per year due to lower prices while consumers gained by Rs.430.19 million per annum due to lower prices compared to free market prices. In addition Government of Pakistan benefited by export tax worth Rs.3063.90 million on export of Basmati rice.
5.3 Cotton Crop: Protection Status & Welfare Effects

Protection status: Domestic support

Table 5.4 provides a comparison of Pakistan's domestic seed cotton procurement prices\(^{12}\) (P\(\text{d}\)), Pakistan export trade prices (P\(\text{e}\)) and world average cotton prices\(^{13}\) (P\(\text{w}\)) for 1985-86 to 2004-05 period.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan Domestic Wholesale Price</th>
<th>World Price</th>
<th>Net Export ('000' M. ton)</th>
<th>Pakistan trade Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pak Rs.</td>
<td>US$</td>
<td>(US$)</td>
<td></td>
</tr>
<tr>
<td>1985-86</td>
<td>4825.25</td>
<td>298.98</td>
<td>365.97</td>
<td>637.35</td>
</tr>
<tr>
<td>1986-87</td>
<td>4825.25</td>
<td>280.88</td>
<td>403.45</td>
<td>640.35</td>
</tr>
<tr>
<td>1987-88</td>
<td>4825.25</td>
<td>274.17</td>
<td>503.18</td>
<td>501.11</td>
</tr>
<tr>
<td>1988-89</td>
<td>4900.25</td>
<td>255.02</td>
<td>470.25</td>
<td>869.16</td>
</tr>
<tr>
<td>1989-90</td>
<td>5275.25</td>
<td>245.99</td>
<td>538.73</td>
<td>290.90</td>
</tr>
<tr>
<td>1990-91</td>
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<td>1991-92</td>
<td>7000.25</td>
<td>281.77</td>
<td>423.70</td>
<td>452.48</td>
</tr>
<tr>
<td>1992-93</td>
<td>7500.25</td>
<td>288.92</td>
<td>382.61</td>
<td>256.44</td>
</tr>
<tr>
<td>1993-94</td>
<td>7875.00</td>
<td>261.07</td>
<td>451.57</td>
<td>26.95</td>
</tr>
<tr>
<td>1994-95</td>
<td>10000.00</td>
<td>324.13</td>
<td>585.67</td>
<td>-124.15</td>
</tr>
<tr>
<td>Average</td>
<td>6315.20</td>
<td>278.41</td>
<td>466.38</td>
<td>383.19</td>
</tr>
<tr>
<td>1995-96</td>
<td>10000.00</td>
<td>297.90</td>
<td>557.07</td>
<td>277.68</td>
</tr>
<tr>
<td>1996-97</td>
<td>12500.00</td>
<td>320.57</td>
<td>535.39</td>
<td>-41.24</td>
</tr>
<tr>
<td>1997-98</td>
<td>15000.00</td>
<td>289.38</td>
<td>479.67</td>
<td>-354.74</td>
</tr>
<tr>
<td>1998-99</td>
<td>12500.00</td>
<td>267.15</td>
<td>413.26</td>
<td>-165.54</td>
</tr>
<tr>
<td>1999-00</td>
<td>20625.00</td>
<td>398.39</td>
<td>378.23</td>
<td>102.43</td>
</tr>
<tr>
<td>2000-01</td>
<td>18125.00</td>
<td>310.16</td>
<td>375.92</td>
<td>-72.07</td>
</tr>
<tr>
<td>2001-02</td>
<td>19500.00</td>
<td>317.46</td>
<td>323.13</td>
<td>-167.34</td>
</tr>
<tr>
<td>2002-03</td>
<td>20000.00</td>
<td>341.88</td>
<td>384.79</td>
<td>-133.40</td>
</tr>
<tr>
<td>2003-04</td>
<td>21250.00</td>
<td>369.09</td>
<td>465.52</td>
<td>-293.17</td>
</tr>
<tr>
<td>2004-05</td>
<td>14781.25</td>
<td>247.05</td>
<td>379.80</td>
<td>-244.77</td>
</tr>
<tr>
<td>Average</td>
<td>16178.13</td>
<td>315.90</td>
<td>429.28</td>
<td>-77.29</td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical databases)

The above Table 5.4 reveals two major points: (i) in the pre-WTO period Pakistan exported cotton more than its imports and its net exports, on average, remained at 383.19 thousand M. ton per year. (ii) in contrast, during post-WTO 10 years period, Pakistan's

\(^{12}\) Government of Pakistan calls this 'support price'.

\(^{13}\) Pakistan's export trade price (P\(\text{e}\)) and world trade price (P\(\text{w}\)) of seed cotton equivalent prices converted from cotton lint, as discusses in section 4.3 and Annex Table 4.2.
imports remained higher than its exports and its net imports remained at 77.29 thousand M. ton per year.

Table 5.4 further reveals that Pakistan's cotton domestic price \( (P_d) \) remained at Rs.6315.20 or US$278.41 per M. ton during pre-WTO period; however its exports were made at US$388.58 per M. ton reflecting a tax on exports worth US$110.17 per M. ton. Hence, pre-WTO period needs to be evaluated as an 'export-tax' regime (Figure 5.5).

During post-WTO period, average domestic price remained at Rs.16178.13 or US$315.90 per M. ton per year. And quality cotton was imported at a premium price of US$441.77 per M. ton per year (Figure 5.6).

**Welfare effects**

**Pre-WTO scenario**

As already discussed and depicted in Figure 5.5, interventions made in cotton economy during pre-WTO period may best be termed as 'export-tax' regime.

**Figure 5.5 export-tax regime during pre-WTO 10 years**

The welfare effects in terms of producers and consumers would be captured using the following model.

\[
\Delta PS = -(acdf) = - \int_{PD}^{Pd} S(p) \, dp \\
\Delta CS = (abef) = \int_{PD}^{Pd} D(p) \, dp \\
ET = (ghij) = (P_e - P_d)E_t
\]  

(5.39a)  

(5.39b)  

(5.39c)
SWG/C = ΔPS + ΔCS + ET \hspace{1cm} (5.39d)

The functions, S(P) and D(P), respectively are supply and demand functions already estimated in model 4.33 in previous Chapter IV. Taking the shortened version of the estimated functions:

\begin{align*}
S_d &= 4363.309 + 0.016205P_d \hspace{1cm} (5.40a) \\
D_d &= 5547.909 - 0.12361P_d \hspace{1cm} (5.40b) \\
E_s &= -1184.600 + 0.139815P_d \hspace{1cm} (5.40c) \\
E_d &= 1791.517 - 3.8984P_e \hspace{1cm} (5.40d) \\
&= -1763.972 + 4.1879P_w \hspace{1cm} (5.40e)
\end{align*}

These functions were estimated using data for years 1979-80 to 2004-05, and therefore are valid only for average values of the related variables for period 1980-2005; for all other periods, we would need to adjust intercept values, using average values of the dependent variables and respective explanatory variables.

Our pre-WTO study period relates to period 1985-95, we therefore use mean values of dependent and explanatory variables for 1985-95 to re-adjust intercept values, as follows.

\begin{align*}
S_d &= 4600.7989 + 0.016205P_d \hspace{1cm} (5.41a) \\
D_d &= 5100.5649 - 0.12361P_d \hspace{1cm} (5.41b) \\
E_s &= -499.76599 + 0.139815P_d \hspace{1cm} (5.41c) \\
E_d &= 1898.0223 - 3.8984P_e \hspace{1cm} (5.41d) \\
&= -1569.972 + 4.1879P_w \hspace{1cm} (5.41e)
\end{align*}

For estimation of free market price ($P_{ef}$)

$$E_s = E_d \hspace{1cm} (5.42a)$$

Since $P_{d}/EXR = P_e$ or $P_d = P_e * EXR$, replacing $P_d$ in above equation we get:

$$P_{ef} = 339.16 \hspace{1cm} (5.42b)$$

Putting values of $P_{ef} = 339.16$ given in (5.42b) in $E_d$ (5.41d)

$$E_{dr} = 1898.0223 - 3.8984(P_e = 339.16) \hspace{1cm} (5.43a)$$

$$E_{dr} = 575.85 \hspace{1cm} (5.43b)$$

Equating $E_{dr} = E_{sf}$

$$P_{df} = 7693.16 \hspace{1cm} (5.44)$$

After estimating $P_{ef}$ and $P_{df}$ in equation (5.42b) and (5.45), we are in a position to estimate pre-WTO scenario welfare effects specified in model 5.39; values of all other variables (namely $P_d$, $P_e$, $E_s$ are already available in the form of mean values of these variables for the specified period (1985-95).
For estimation of SWG/C specified in model 5.39, we estimate various components of SWG/C, as follows.

\[
\Delta PS = - \left\{ \frac{4600.7989 + 0.016205P_d}{pd = 6315.20} \right\} 
= - \text{Rs.}6496100.73 \text{ thousand} 
= - \text{Rs.}6496.10 \text{ million} \tag{5.46a}
\]

\[
\Delta CS = \int_{pd = 6315.20}^{pd = 7693.16} (5100.565 - 0.12361)dp 
= \text{Rs.}5835338.84 \text{ thousand} 
= \text{Rs.}5835.34 \text{ million} \tag{5.47a}
\]

\[
ET = (ghij) = (P_c - P_d)E_d 
= \text{US}\$ \, 42215.66 
= \text{Rs.}957585.1 \text{ thousand} 
= \text{Rs.}957.59 \text{ million} \tag{5.48a}
\]

\[
\text{SWG/C = } \Delta PS + \Delta CS + T 
= 296823.3 \text{ thousand} 
= \text{Rs.}296.82 \text{ million} \tag{5.49a}
\]

On average, an overall social welfare gain of Rs.296.82 million per year received by the society during the study period 1985-95. However, producers of cotton have suffered Rs.6496.10 million per year due to depressed domestic prices while consumers benefited by Rs.5835.34 million per annum due to lowered prices. In addition Government of Pakistan received export tax worth Rs.957.59 million per annum on export of cotton.

**Post-WTO scenario**

As already reported while analyzing data of Table 5.4, Pakistan was an exporter of cotton during pre-WTO period and became an importer during post-WTO period.

To analyze post-WTO situation, we reproduce supply and demand functions already estimated after adjusting their intercepts for the post-WTO period.

\[
S_d = 5285.6903 + 0.016205P_d \tag{5.50a}
\]

\[
D_d = 7624.924 - 0.12361P_d \tag{5.50b}
\]

For import demand \((I_d)\) function:

\[
I_d = D_d - S_d 
= 2339.234 - 0.139815P_d \tag{5.50c}
\]

For \(I_s\), we adjust the intercept of original \(E_d\) function and take inverse values, as follows.
\[ I_s = -1644.906 + 3.8984P_i \]  
\[ = -1720.49 + 4.1879P_w \]  
\[ (5.50d) \]

\[ (5.50e) \]

Equations (5.50a-d) represent Pakistan's cotton supply and demand functions for post-WTO period. When these functions are further analyzed, they can best be represented through Figure 5.6.

**Figure 5.6 Depressed price regime during pre-WTO 10 years**

![Diagram of Pakistan's Domestic Market and World Market](image)

This Figure 5.6, represents a very interesting phenomenon through which Pakistan's cotton economy has undergone. It reflects that if domestic price (\( P_d \)) is kept at Rs.16178.13 per M. ton, Pakistan demand for cotton (\( D_d \)) enhances than its supply (\( S_d \)) and consequently it imports cotton equal to 'ed' or 'ji'; mathematically:

\[ I_d = 2339.234 - 0.139815P_d \]  
\[ (5.50f) \]

Putting domestic price (\( P_d \)) equal to Rs.16178.13:

\[ I_d = 2339.234 - 0.139815(P_d = 16178.13) \]  
\[ = 77.29 \text{ thousand M. ton}^{14} \]  
\[ (5.50g) \]

(5.50h)

Since Pakistan is demanding more import of cotton because of lower domestic price, hence cotton exporters would demand high price; mathematically, equating \( I_d = 77.29 \) with \( I_s \):

\[ I_s = 77.29 = -1644.906 + 3.8984P_i \]  
\[ (5.50i) \]

Solving for \( P_i \):

\[ P_i = \text{US}\$441.77 \text{ per M. ton} \]

Hence, Pakistan has imported, on average, 77.29 thousand M. ton of cotton per year but it

---

\[ ^{14} \text{Functions are in thousands figure, hence quantity has been taken in thousand M. tons.} \]
had to pay a difference of US$441.77 against the domestic price of US$315.90 per M. ton due to import of higher quality cotton coupled with higher domestic demand induced by depressed domestic prices. Please note that for post-WTO scenario, relevant import demand ($I_d$) and import supply ($I_s$) are represented, respectively, by $I_d$ and $I_s$ in the 'World Market' penal of Figure 5.6.

However, when we calculate autarky (no import/no export) situation by equating $S_a = D_a$ and subsequently compute free market situation represented through free market price ($P_{df}$), we arrived at the fact that: (i) Pakistan’s autarky price ($P_a$) estimates at Rs.16730.92 per M. ton and (ii) its free trade price ($P_{df}$) estimates at Rs.18450.46 per M. ton, which reflect the fact that Pakistan would have been an exporter of cotton, if trade was liberalized and domestic price was not kept at depressed level of Rs.16178.13 per M. ton.

The arrow shown in the Domestic Market panel of Figure 5.6, passes through the intersection point of $S_a$ and $D_a$ and bifurcates the penal into two parts; lower part along with $I_d$ and $I_s$ functions represents the cotton import scenario and upper portion represents the export scenario of cotton economy. From the level of autarky price ($P_a = Rs.16730.92$), $I_d$ originates representing import demand and $E_s$ originates representing export supply, which along with export demand ($E_d$) function relate to cotton export market.

As far as welfare effects are concerned, because of depressed domestic price ($P_d = 16178.13$) against the free trade price ($P_{df} = Rs.18450.46$), producers hurt, facing a loss of producers surplus measuring area equal to ‘acef’ while consumers benefited by enhanced consumers surplus equal to area ‘abdf’ (Figure 5.6). It has already been mentioned that imports were made at higher prices for better quality of cotton coupled with higher domestic consumption induced by lower domestic prices. One can argue that cotton prices were kept at lower than the free trade level to benefit cotton textile producers. Hence the extra cost paid by textile producers for import of cotton is actually the cost to the society (CS). The welfare effects are therefore, summarized, as follows.

\[
\Delta PS = -(acef) = - \int_{P_d}^{P_{df}} S(P) \, dp \tag{5.51a}
\]

\[
\Delta CS = (abdf) = \int_{P_d}^{P_{df}} D(P) \, dp \tag{5.51b}
\]
\[ CS = - (ghij) = -(P_i - P_d)I_d \]  \hspace{1cm} (5.51c)

\[ SWG/C = \Delta PS + \Delta CS + CS \]  \hspace{1cm} (5.51d)

Estimating the effects:

\[ \Delta PS = - \left\{ \int_{P_d=16178.13}^{P_d=18450.46} (5285.6903 + 0.016205P_d)dp \right\} \]  \hspace{1cm} (5.52a)

\[ = - Rs.12648440 \text{ thousand} \]

\[ = - Rs.12648.44 \text{ million} \]  \hspace{1cm} (5.52b)

\[ \Delta CS = \int_{P_d=16178.13}^{P_d=18450.46} (7624.924 - 0.12361P_d)dp \]  \hspace{1cm} (5.52c)

\[ = Rs.12463098 \text{ thousand} \]

\[ = Rs.12463.10 \text{ million} \]  \hspace{1cm} (5.52d)

\[ CS = -(ghij) = -(P_i - P_d)I_d \]  \hspace{1cm} (5.52e)

\[ = - Rs.498209 \text{ thousand} \]

\[ = - Rs.498.21 \text{ million} \]  \hspace{1cm} (5.52f)

\[ SWG/C = \Delta PS + \Delta CS + CS \]  \hspace{1cm} (5.52g)

\[ = - Rs.683551 \text{ thousand} \]

\[ = - Rs.683.55 \text{ million} \]  \hspace{1cm} (5.52i)

It appears that the Government of Pakistan interventions in cotton economy referred to above have resulted, on average, in an overall social welfare cost of Rs.683.55 million per year to the society during the study period 1995-05. However, producers of cotton have suffered Rs.12648.44 million per year due to depressed prices (lowered price) while consumers benefited by Rs.12463.10 million per annum due to depressed prices. In addition importers incurred cost to the society worth Rs.498.21 million on import of cotton.
5.4 Sugar cane Crop: Protection Status & Welfare Effects

Protection Status

Table 5.5 provides data on Pakistan’s domestic sugar price ($P_{ds}$), Pakistan’s sugar import trade price ($P_{ir}$) and world average sugar trade price ($P_{wtr}$) for 20 years, covering 10 years of pre-WTO and 10 years of post-WTO periods.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan’s Domestic Price</th>
<th>World Price</th>
<th>Pakistan Import Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pak Rs.</td>
<td>US$</td>
<td>(US$)</td>
</tr>
<tr>
<td>1985-86</td>
<td>8920</td>
<td>552.70</td>
<td>364.17</td>
</tr>
<tr>
<td>1986-87</td>
<td>9570</td>
<td>557.07</td>
<td>359.03</td>
</tr>
<tr>
<td>1987-88</td>
<td>9700</td>
<td>551.16</td>
<td>393.83</td>
</tr>
<tr>
<td>1988-89</td>
<td>9690</td>
<td>504.28</td>
<td>420.10</td>
</tr>
<tr>
<td>1989-90</td>
<td>11360</td>
<td>529.72</td>
<td>484.80</td>
</tr>
<tr>
<td>1990-91</td>
<td>11260</td>
<td>502.17</td>
<td>378.97</td>
</tr>
<tr>
<td>1991-92</td>
<td>11620</td>
<td>467.72</td>
<td>323.19</td>
</tr>
<tr>
<td>1992-93</td>
<td>12290</td>
<td>473.42</td>
<td>321.19</td>
</tr>
<tr>
<td>1993-94</td>
<td>12910</td>
<td>428.00</td>
<td>344.39</td>
</tr>
<tr>
<td>1994-95</td>
<td>13740</td>
<td>445.36</td>
<td>392.16</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>11106.00</strong></td>
<td><strong>501.16</strong></td>
<td><strong>378.18</strong></td>
</tr>
<tr>
<td>1995-96</td>
<td>16760</td>
<td>499.28</td>
<td>375.43</td>
</tr>
<tr>
<td>1996-97</td>
<td>21260</td>
<td>545.22</td>
<td>344.25</td>
</tr>
<tr>
<td>1997-98</td>
<td>19540</td>
<td>452.36</td>
<td>319.31</td>
</tr>
<tr>
<td>1998-99</td>
<td>19090</td>
<td>407.99</td>
<td>253.80</td>
</tr>
<tr>
<td>1999-00</td>
<td>21110</td>
<td>407.76</td>
<td>235.49</td>
</tr>
<tr>
<td>2000-01</td>
<td>27110</td>
<td>463.91</td>
<td>263.69</td>
</tr>
<tr>
<td>2001-02</td>
<td>22870</td>
<td>372.32</td>
<td>237.81</td>
</tr>
<tr>
<td>2002-03</td>
<td>20770</td>
<td>355.05</td>
<td>259.95</td>
</tr>
<tr>
<td>2003-04</td>
<td>19010</td>
<td>330.18</td>
<td>270.59</td>
</tr>
<tr>
<td>2004-05</td>
<td>23450</td>
<td>391.94</td>
<td>383.76</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>21097.00</strong></td>
<td><strong>422.60</strong></td>
<td><strong>294.41</strong></td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical database)

The averages for pre-WTO period provided in the above table reveal that against the world average trade price of US$378.18 per M. ton, Pakistan kept its domestic price at US$501.16 per M. ton reflecting ‘price support-cum-import tax’ regime in practice. The same seems true for the post-WTO scenario.

Welfare Effects

Pre-WTO Scenario

For estimation of the needed welfare effects, the supply and demand functions estimated
in earlier Chapter IV are reproduced with adjusted constant values (for pre-WTO 10 years).

\[
\begin{align*}
S_{dsc} &= 37071.7800 + 0.096817P_{dsc} \\
D_{dsc} &= 4139.1856 - 0.110330P_{dsc} \\
I_{dsc} &= 4237.4056 - 0.207147P_{dsc} \\
I_{sfr} &= -4865.193 + 20.049P_{sfr} \\
&= 2317.268 + 0.93649P_{wfr} 
\end{align*}
\]

(5.53a) (5.53b) (5.53c) (5.53d) (5.53e)

For arriving at free trade scenario,

\[
I_{dsc} = I_{sfr}
\]

(5.54a)

4237.4056 - 0.207147P_d = -4865.193 + 20.049P_i

Replacing \( P_d \) with \( P_i \) and computing value for \( P_i \)

\[
P_{sfr} = US$341.13 \text{ per M. ton}
\]

(5.54b)

Putting value of \( P_i = 341.13 \) into \( I_r \) function

\[
I_{sfr} = -4865.193 + 20.049 \ (P_i = 443.71) \\
= 2671.43 \text{ thousand M. ton}
\]

(5.55a)

EQUATING \( I_{sfr} = 2671.43 \) with \( I_{dsc} \) and solving for \( P_{dsc} \)

\[
I_{dsc} = 2200.56 = 4237.4056 - 0.207147P_{dsc} \\
P_{dsc} = Rs.7559.72 \text{ per M. ton}
\]

(5.55b) (5.56)

Hence, Pakistan kept its domestic sugar price at Rs.11106.00 per M. ton against the free market estimated price of Rs.7559.72 Consequently both, producers of sugar and sugarcane benefited equal to area measuring ‘abef’ and consumers suffered equal to area measured ‘acdf’ (Figure 5.7). In addition government received import tax equal to area ‘ghij’.

**Figure 5.7 Price support-cum-import tax regime during pre-WTO 10 years**
These welfare effects are measured, using the following formulae.

\[
\Delta PS = \int_{pd = 11106}^{pd = 7559.72} (37071.7800 + 0.096817pd)dp
\]

\[
= Rs.134671184.30 \text{ thousands}
\]

\[
= Rs.134671.18 \text{ million}
\]

\[
\Delta CS = - \int_{pd = 11106}^{pd = 7559.72} (41309.1856 - 0.110330pd)dp
\]

\[
= -Rs.142842275.10 \text{ thousands}
\]

\[
= -Rs.142842.28 \text{ million}
\]

\[
IT = (ghij) = (P_d - P_l)I_s
\]

\[
= \text{US$ 380908.8 thousands}
\]

\[
= \text{Rs. 8441196 thousands}
\]

\[
= \text{Rs.8441.20 millions}
\]

\[
SWG/C = \Delta PS + \Delta CS + IT
\]

\[
= \text{Rs.270105.5 thousands}
\]

\[
= \text{Rs.270.11 million}
\]

Though the net social welfare effect has turned out into gains to the society as a whole, consumers seems to have been suffered more than the producers' gain\(^{15}\).

**Post-WTO Scenario**

Same policy of 'price support-cum-import tax' has been in vogue during post-WTO scenario. Hence, we used the similar procedure, using model 4.41 adjusted for post-WTO period, for arriving at free market prices (Figure 4.8) and welfare effect, as follows.

\[
\Delta PS = \int_{pd = 21097.00}^{pd = 16954.79} (46441.8318 + 0.096817pd)dp
\]

\[
= \text{Rs.199521213.9 thousands}
\]

\[
= \text{Rs.199521.21 million}
\]

\[
\Delta CS = - \int_{pd = 21097.00}^{pd = 16954.79} (52538.6672 - 0.110330pd)dp
\]

\[
= -\text{Rs.208424658.10 thousands}
\]

\[
= -\text{Rs.208424.66 million}
\]

\(^{15}\) For these calculations we had to use supply and demand of sugarcane as price of sugar. We can say that producers of cane and sugar have gained but can not say how much fraction belonged to each of these two stakeholders. However, total losses in consumer surplus can be attributed to the general sugar consumers of the country.
\[ IT = (ghij) = (P_d - P_i)l_s \]  
\[ = \text{US$ 216639.60 thousands} \]  
\[ = \text{Rs.10815053 thousands} \]  
\[ = \text{Rs.10815.05 millions} \]  

\[ SWG/C = \Delta PS + \Delta CS + IT \]  
\[ = \text{Rs.1911609 thousands} \]  
\[ = \text{Rs.1911.61 million} \]  

Though the net social welfare has turned out into gains to the society as a whole, consumers seems to have been suffered more than the producers' gain.

**Figure 5.8 Price support-cum-import tax regime during post-WTO 10 years**

Pakistan's Domestic Market  
World Market
### 5.5 Onion Crop: Protection Status & Welfare Effects

#### Protection Status

Table 5.6 provides data on Pakistan’s domestic wholesale price \((P_d)\), Pakistan’s onion export trade price \((P_e)\) and world average onion trade price \((P_w)\) for 20 years, covering 10 years of pre-WTO and 10 years of post-WTO periods.

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan's Domestic Wholesale Price (Pak Rs.)</th>
<th>World Price (US$)</th>
<th>Pakistan's Export Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985-86</td>
<td>2323.75</td>
<td>143.98</td>
<td>191.82</td>
</tr>
<tr>
<td>1986-87</td>
<td>3102.25</td>
<td>180.58</td>
<td>250.85</td>
</tr>
<tr>
<td>1987-88</td>
<td>2712.50</td>
<td>154.13</td>
<td>243.36</td>
</tr>
<tr>
<td>1988-89</td>
<td>2179.25</td>
<td>113.41</td>
<td>246.12</td>
</tr>
<tr>
<td>1989-90</td>
<td>5183.25</td>
<td>241.70</td>
<td>281.11</td>
</tr>
<tr>
<td>1990-91</td>
<td>2962.50</td>
<td>132.12</td>
<td>276.21</td>
</tr>
<tr>
<td>1991-92</td>
<td>3329.00</td>
<td>133.99</td>
<td>271.17</td>
</tr>
<tr>
<td>1992-93</td>
<td>4814.50</td>
<td>185.46</td>
<td>274.30</td>
</tr>
<tr>
<td>1993-94</td>
<td>4506.25</td>
<td>149.39</td>
<td>308.46</td>
</tr>
<tr>
<td>1994-95</td>
<td>5650.00</td>
<td>183.13</td>
<td>352.33</td>
</tr>
<tr>
<td>1995-96</td>
<td>5125.00</td>
<td>152.67</td>
<td>266.33</td>
</tr>
<tr>
<td>1996-97</td>
<td>5550.00</td>
<td>142.33</td>
<td>281.18</td>
</tr>
<tr>
<td>1997-98</td>
<td>11693.75</td>
<td>270.72</td>
<td>318.10</td>
</tr>
<tr>
<td>1998-99</td>
<td>5918.75</td>
<td>126.49</td>
<td>253.01</td>
</tr>
<tr>
<td>1999-00</td>
<td>6237.50</td>
<td>120.48</td>
<td>225.76</td>
</tr>
<tr>
<td>2000-01</td>
<td>4810.50</td>
<td>82.32</td>
<td>244.63</td>
</tr>
<tr>
<td>2001-02</td>
<td>8373.00</td>
<td>136.31</td>
<td>232.19</td>
</tr>
<tr>
<td>2002-03</td>
<td>5777.25</td>
<td>98.76</td>
<td>254.69</td>
</tr>
<tr>
<td>2003-04</td>
<td>8210.50</td>
<td>142.61</td>
<td>277.17</td>
</tr>
<tr>
<td>2004-05</td>
<td>10166.67</td>
<td>169.93</td>
<td>252.50</td>
</tr>
<tr>
<td>Average</td>
<td>5431.31</td>
<td>153.03</td>
<td>265.06</td>
</tr>
</tbody>
</table>

Source: FAO Data Base (www.fao.org)

Table 5.6 reveals that Pakistan’s average domestic price remained at US$153.03 against the average world trade price of US$265.06. However, Pakistan could not get the benefit of higher world price due mainly to the quality of its exported onion; it mainly exported its onion to low priced countries like Afghanistan, Bangladesh, Sri Lanka, India, Thailand, etc. Table 5.7 provides onion export prices by destinations and reveals that
Pakistan’s export price remained lowest at US$69.95 per M. ton, US$93.18 per M. ton, US$132.10 per M. ton and US$140.11 per M. ton to the stated countries against the highest price US$329.70 per M. ton to Philippine, US$274.73 per M. ton to UK, US$309.09 per M. ton to UK and US$305.45 per M. ton to UK during the year 2002-03, 2003-04, 2004-05 & 2005-06 respectively.

### Table 5.7 Pakistan onion exports: destinations & respective prices (prices in US$ per M. ton)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>93.97</td>
<td>93.18</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Australia</td>
<td>180.83</td>
<td>179.25</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Bahrain</td>
<td>121.44</td>
<td>0.00</td>
<td>0.00</td>
<td>149.40</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>121.23</td>
<td>120.18</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>France</td>
<td>169.85</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Kuwait</td>
<td>120.67</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Lebanon</td>
<td>69.90</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Malaysia</td>
<td>144.40</td>
<td>138.00</td>
<td>170.39</td>
<td>169.68</td>
</tr>
<tr>
<td>Oman</td>
<td>107.40</td>
<td>134.70</td>
<td>144.07</td>
<td>156.83</td>
</tr>
<tr>
<td>Philippines</td>
<td>329.70</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>173.66</td>
<td>171.62</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Singapore</td>
<td>143.60</td>
<td>144.97</td>
<td>161.32</td>
<td>166.44</td>
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<td>Sri Lanka</td>
<td>127.93</td>
<td>143.04</td>
<td>142.29</td>
<td>144.25</td>
</tr>
<tr>
<td>Thailand</td>
<td>69.95</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>UAE</td>
<td>133.17</td>
<td>138.35</td>
<td>132.10</td>
<td>142.57</td>
</tr>
<tr>
<td>UK</td>
<td>184.05</td>
<td>274.73</td>
<td>309.09</td>
<td>305.45</td>
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<tr>
<td>India</td>
<td>0.00</td>
<td>0.00</td>
<td>249.13</td>
<td>246.09</td>
</tr>
<tr>
<td>Brunei</td>
<td>199.82</td>
<td>0.00</td>
<td>0.00</td>
<td>217.08</td>
</tr>
<tr>
<td>Iran</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>148.85</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>140.11</td>
</tr>
</tbody>
</table>


Since Pakistan’s onion exports are not as good in quality as the world export are (as reflects from world export trade prices in Table 5.6), we therefore computed Pakistan’s export free trade price (P_{ef}) for pre- and post-WTO periods using the E_s & E_d relationships for the two periods, namely:

**For pre-WTO period:**

\[ E_s = -6506.4 + 1.779103P_d \]  \hspace{1cm} (5.59a)
\[ E_d = 43.19 - 0.08959P_e \] \hspace{1cm} (5.59b)

**For post-WTO period:**

\[ E_s = -12744.43 + 1.779103P_d \] \hspace{1cm} (5.60a)
\[ E_d = 53.93 - 0.08959P_e \] \hspace{1cm} (5.60b)

The so computed P_{ef} along with P_d and P_e are provided hereunder for arriving at the basis
for analyzing the welfare effects of the situation prevailed during the two periods.

<table>
<thead>
<tr>
<th></th>
<th>Pre-WTO Period</th>
<th>Post-WTO Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pakistan's wholesale price ($P_d$)</td>
<td>US$161.79</td>
<td>US$144.26</td>
</tr>
<tr>
<td>Pakistan's estimated free trade price ($P_{et}$)</td>
<td>US$161.66</td>
<td>US$144.27</td>
</tr>
<tr>
<td>Pakistan's export price ($P_e$)</td>
<td>US$100.84</td>
<td>US$151.78</td>
</tr>
</tbody>
</table>

It appears that there has been little difference between Pakistan’s domestic wholesale price ($P_d$) of onion and its estimated free trade price ($P_{et}$) for both pre- and post-WTO periods; however, Pakistan had to bear some cost for its low quality exported stocks during pre-WTO period while it had been able to make some extra money on exports during post-WTO period against its domestic price ($P_d$).

**Welfare Effects**

As earlier mentioned, there has been little differences between Pakistan’s onion domestic price ($P_d$) and its estimated free trade price ($P_{et}$) for both pre- and post-WTO periods, which would mean very negligible effects for producers and consumers in terms of changes in producers and consumers’ surplus. However, there would be cost borne for low quality exports for the pre-WTO and tax received for post-WTO periods.

**Pre-WTO Scenario**

The social welfare effects of onion for pre-WTO period are represented through Figure 5.9 and estimated, as follows.

**Figure 5.9 Welfare effects of onion crop for pre-WTO period**

\[
\Delta PS = (acdf) = \int_{P_d}^{P_e} S(P)dp
\] 

(5.61a)
\[
\Delta C_S = -(a_{b1}f) = - \int_{P_d}^{P_d} D(P) dP \tag{5.61b}
\]

\[
CQ = -(ghij) = -(P_c - P_d)E_d \tag{5.61c}
\]

\[
SWG/C = \Delta PS + \Delta CS + CQ \tag{5.61d}
\]

The functions, \(S(P)\) and \(D(P)\), respectively are onion's supply and demand functions already estimated in model 4.50 in previous Chapter IV and \(CQ\) would measure costs borne due to low quality exports. The \(S(P)\) and \(D(P)\) functions estimated in 4.50 are reproduced, as follows.

\[
S_d = -7246.984 + 1.76686P_d \tag{5.62a}
\]

\[
D_d = 931.346 - 0.01224P_d \tag{5.62b}
\]

\[
E_s = -8178.329 + 1.779103P_d \tag{5.62c}
\]

\[
P_e = 47.671 + 0.31415P_w \tag{5.62d}
\]

\[
E_d = 57.956 - 0.08959P_e \tag{5.62e}
\]

These functions were estimated using data for years 1979-80 to 2004-05, and therefore are valid only for average values of the related variables for period 1980-2005; for all other periods, we would need to adjust intercept values, using average values of the dependent variables and respective explanatory variables.

Our pre-WTO study period relates to period 1985-95, we therefore use mean values of dependent and explanatory variables for 1985-95 to re-adjust intercept values, as follows.

\[
S_d = -5751.13 + 1.76686P_d \tag{5.63a}
\]

\[
D_d = 755.27 - 0.012243P_d \tag{5.63b}
\]

\[
E_s = -6506.40 + 1.779103P_d \tag{5.63c}
\]

\[
P_e = 16.15096 + 0.31415P_w \tag{5.63d}
\]

\[
E_d = 43.19 - 0.08959P_e \tag{5.63e}
\]

For estimation of free market price \((P_{ef})\)

\[
E_s = E_d \tag{5.64a}
\]

Since \(P_d/EXR = P_e\) or \(P_d = P_e*EXR\), replacing \(P_d\) in above equation we get:

\[
P_{ef} = 161.66 \tag{5.64b}
\]

Putting value of \(P_{ef} = 161.66\) given in (5.64b) in \(E_s\) (5.63e)

\[
E_{dr} = 28.71 \tag{5.65a}
\]

Equating \(E_{dr} = E_{st}\)

\[
P_{dr} = 3673.26 \tag{5.65c}
\]
After estimating $P_d$ and $P_e$ in equations (5.64b) and (5.65c) we are in a position to estimate pre-WTO scenario welfare effects specified in model 5.61; values of all other variables (namely $P_d$, $P_e$, $I_s$ are already available in the form of mean values of these variables for the specified period (1985-95).

For estimation of SWG/C specified in model 5.61, we estimate various components of SWG/C, as follows.

$$\Delta PS = \int_{P_d=3676.33}^{P_d=3673.26} (-5751.1316 + 1.76686P_d)dp \quad (5.66a)$$

$$= Rs.2271.53 \text{ thousand}$$
$$= Rs.2.27 \text{ million}$$

$$\Delta CS = -\int_{P_d=3676.33}^{P_d=3673.26} (755.26925 - 0.012243P_d)dp \quad (5.66b)$$

$$= -Rs.2175.25 \text{ thousand}$$
$$= -Rs.2.18 \text{ million}$$

$$CQ = -(P_e - P_d)E_s \quad (5.66c)$$

$$= -US$2082.22 \text{ thousand}$$
$$= -Rs.47313.90 \text{ thousand}$$
$$= -Rs.47.31 \text{ million}$$

$$SWG/C = \Delta PS + \Delta CS + CQ \quad (5.66d)$$

$$= -Rs.47217.6 \text{ thousand}$$
$$= -Rs.47.22 \text{ million}$$

It appears that onion crop economy faced, on average, an overall social welfare cost of Rs.47.22 million per year due mainly to low quality exports; producers and consumers' surplus got negligible changes, almost nullifying each other during the pre-WTO period.

Post-WTO Scenario

Post-WTO scenario is depicted in Figure 5.10 and the associated welfare effects are estimated in model 5.67.
Figure 5.10 Welfare effects of onion crop for post-WTO period

\[ \Delta PS = -(acdf) = - \int_{pd}^{pd} S(P)dp \]  \hspace{1cm} (5.67a)

\[ \Delta CS = (abef) = \int_{pd}^{pd} D(P)dp \]  \hspace{1cm} (5.67b)

\[ ET = (ghij) = (P_e - P_d)E_s \]  \hspace{1cm} (5.67c)

\[ SWG/C = \Delta PS + \Delta CS + ET \]  \hspace{1cm} (5.67d)

Like in previous case, there has been little difference between onion's domestic price \( (P_d) \) and estimated free trade price \( (P_{df}) \), however exports have been effected on a little higher price than domestic price, charging an export tax \( (ET) \) in technical terms.

After adjusting supply and demand functions for post-WTO period (1995-05), the said functions became, as follows.

\[ S_d = -11329.08 + 1.76686P_d \]  \hspace{1cm} (5.68a)

\[ D_d = 1415.75 - 0.012243P_d \]  \hspace{1cm} (5.68b)

\[ E_s = -12744.83 + 1.779103P_d \]  \hspace{1cm} (5.68c)

\[ P_e = 69.12933 + 0.31415P_w \]  \hspace{1cm} (5.68d)

\[ E_d = 53.93 - 0.08959P_e \]  \hspace{1cm} (5.68e)

For estimation of free market price \( (P_{ef}) \)

\[ E_d = E_s \]  \hspace{1cm} (5.69a)

Since \( P_d/EXR = P_e \) or \( P_d = P_e*EXR \), replacing \( P_d \) in above equation we get:
\[ P_{ef} = 144.27 \] \hfill (5.69b)

Putting value of \( P_{ef} = 144.27 \) given in (5.69b) in \( E_s \) (5.68c)

\[ E_{df} = 41.08 \] \hfill (5.70)

\[ \text{Equating } E_{df} = E_{sf} \] \hfill (5.71a)

\[ P_{df} = 7186.67 \] \hfill (5.71b)

After estimating \( P_{ef} \) and \( P_{df} \) in equations (5.69b) and (5.71b) we are in a position to estimate post-WTO scenario welfare effects specified in model 5.67; values of all other variables (namely \( P_d, P_o, E_d \) are already available in the form of mean values of these variables for the specified period (1995-05).

For estimation of SWG/C specified in model 5.67, we estimate various components of SWG/C, as follows.

\[ \Delta PS = \left\{ \int_{P_d = 7186.67}^{P_d = 7186.29} \left( -11329.08 + 1.76686P_d \right) dp \right\} \] \hfill (5.72a)

\[ \Delta PS = -Rs.517.77 \text{ thousand} \]
\[ = -Rs.0.52 \text{ million} \]

\[ \Delta CS = \int_{P_d = 7186.29}^{P_d = 7186.67} \left( 1415.75 - 0.012243P_d \right) dp \] \hfill (5.72b)

\[ \Delta CS = Rs.502.39 \text{ thousand} \]
\[ = Rs.0.50 \text{ million} \]

\[ \text{ET} = (P_o - P_d)E_s \] \hfill (5.72c)

\[ \text{ET} = \text{US$ 303.33} \]
\[ = \text{Rs.15110.01 thousand} \]
\[ = \text{Rs.15.11 million} \]

\[ \text{SWG/C} = \Delta PS + \Delta CS + \text{ET} \] \hfill (5.72d)

\[ \text{SWG/C} = \text{Rs.15094.32 thousand} \]
\[ = \text{Rs.15.09 million} \]

Since there has been little difference between onion's domestic price \( (P_d) \) and its estimated free trade price \( (P_{df}) \), there is thus very small changes found in producers and consumers' surpluses reflecting a free trade situation in Pakistan's domestic economy in case of onion. However, exports were made on a higher price, which resulted in an export tax valuing Rs.15.11 million, giving net social gains during the post-WTO period.
5.6 Potato Crop: Protection Status & Welfare Effects

Protection status:
Table 5.8 provides data on Pakistan's potato domestic wholesale price (\(P_d\)), Pakistan's export trade price (\(P_e\)) and world average trade price (\(P_w\)) for 20 years, covering, 10 years of pre-WTO and 10 years of post-WTO periods.

Table 5.8 Pakistan's potato prices for 1985-05 (prices per M. ton)

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan's Domestic Wholesale Price</th>
<th>World Price (US$)</th>
<th>Pakistan's Export Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pak Rs.</td>
<td>US$</td>
<td></td>
</tr>
<tr>
<td>1985-86</td>
<td>1727.00</td>
<td>107.01</td>
<td>163.72</td>
</tr>
<tr>
<td>1986-87</td>
<td>2612.5</td>
<td>152.07</td>
<td>190.01</td>
</tr>
<tr>
<td>1987-88</td>
<td>3752.00</td>
<td>213.19</td>
<td>183.03</td>
</tr>
<tr>
<td>1988-89</td>
<td>2218.75</td>
<td>115.47</td>
<td>216.02</td>
</tr>
<tr>
<td>1989-90</td>
<td>2231.25</td>
<td>104.94</td>
<td>250.05</td>
</tr>
<tr>
<td>1990-91</td>
<td>4479.25</td>
<td>199.76</td>
<td>249.82</td>
</tr>
<tr>
<td>1991-92</td>
<td>3198.00</td>
<td>128.72</td>
<td>216.85</td>
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<td>1992-93</td>
<td>3308.25</td>
<td>127.44</td>
<td>181.91</td>
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<td>1993-94</td>
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<td>1994-95</td>
<td>5339.50</td>
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<td>1995-96</td>
<td>8048.00</td>
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</tr>
<tr>
<td>1996-97</td>
<td>7975.00</td>
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<td>198.29</td>
</tr>
<tr>
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<td>4414.50</td>
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<td>245.09</td>
</tr>
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<td>5337.50</td>
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<td>177.40</td>
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<td>211.53</td>
</tr>
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<td>2003-04</td>
<td>7918.25</td>
<td>137.53</td>
<td>252.55</td>
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<tr>
<td>2004-05</td>
<td>10348.96</td>
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<tr>
<td>Average</td>
<td>5079.81</td>
<td>142.11</td>
<td>218.97</td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical databases)

The prices of potato given in the above table reflect about the same situation observed in case of onion. The domestic price (\(P_d\)) of potato remained, on average, at US$ 142.11 per M. ton against the world average trade price (\(P_w\)) of US$ 218.97 per M. ton during 1985-2005. Pakistan exported its potato at US$184.85 per M. ton (against the world average of US$ 218.97 per M. ton), revealing that Pakistan could not be benefited from the higher world level price due mainly to the quality of its exported potato. Pakistan mainly exported its potato to low-income countries like Afghanistan, Sri Lanka, Myanmar, Angola etc. Table 5.9 provides potato export prices by destinations and reveals that

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>92.61</td>
<td>98.37</td>
<td>141.33</td>
<td>153.37</td>
</tr>
<tr>
<td>Bahrain</td>
<td>140.07</td>
<td>138.87</td>
<td>0.00</td>
<td>250.00</td>
</tr>
<tr>
<td>Brunei</td>
<td>103.91</td>
<td>103.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Ecuador</td>
<td>99.44</td>
<td>98.59</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Germany</td>
<td>118.66</td>
<td>117.64</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Guinea</td>
<td>158.87</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Iran</td>
<td>104.46</td>
<td>103.54</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Malaysia</td>
<td>104.85</td>
<td>104.75</td>
<td>145.72</td>
<td>227.32</td>
</tr>
<tr>
<td>Mauritius</td>
<td>100.07</td>
<td>99.20</td>
<td>201.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Myanmar</td>
<td>157.60</td>
<td>156.23</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Netherlands</td>
<td>103.89</td>
<td>102.99</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Oman</td>
<td>124.35</td>
<td>121.86</td>
<td>142.67</td>
<td>140.92</td>
</tr>
<tr>
<td>Singapore</td>
<td>112.38</td>
<td>110.56</td>
<td>162.34</td>
<td>0.00</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>104.32</td>
<td>121.74</td>
<td>169.86</td>
<td>180.75</td>
</tr>
<tr>
<td>UAE</td>
<td>115.88</td>
<td>111.64</td>
<td>139.24</td>
<td>0.00</td>
</tr>
<tr>
<td>USA</td>
<td>101.04</td>
<td>100.17</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Yemen</td>
<td>333.17</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Colombia</td>
<td>0.00</td>
<td>130.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Angola</td>
<td>0.00</td>
<td>0.00</td>
<td>134.65</td>
<td>0.00</td>
</tr>
<tr>
<td>Kuwait</td>
<td>0.00</td>
<td>0.00</td>
<td>273.75</td>
<td>270.00</td>
</tr>
<tr>
<td>Qatar</td>
<td>0.00</td>
<td>0.00</td>
<td>280.00</td>
<td>280.00</td>
</tr>
</tbody>
</table>

**Source:** United Nations Comtrade Database (www.comtrade.un.org)

Since Pakistan’s potato exports are not as good in quality as the world exports are, we therefore computed Pakistan’s export free trade price \( P_{ef} \) for pre- and post-WTO periods, using the \( E_s \) & \( E_d \) relationships for the two periods, namely:

**For pre-WTO period:**

\[
E_s = -5753.4401 + 1.779103P_d \quad (5.73a)
\]

\[
E_d = 1.9578 - 0.000213P_e \quad (5.73b)
\]

**For post-WTO period:**

\[
E_s = -12274.9804 + 1.779103P_d \quad (5.74a)
\]

\[
E_d = 44.7126 - 0.000213P_e \quad (5.74b)
\]

The so computed \( P_{ef} \) along with \( P_d \) and \( P_e \) are provided hereunder for arriving at the basis for analyzing the welfare effects of the situation prevailed during the two periods.
Pakistan’s wholesale price (\(P_d\)) & US$143.62 & US$140.59  
Pakistan’s estimated free trade price (\(P_{ef}\)) & US$143.63 & US$140.60  
Pakistan’s export price (\(P_e\)) & US$207.33 & US$162.37  
World trade price (\(P_w\)) & US$221.60 & US$216.35

**Welfare Effects**

As reflects from the above prices, there has been free trade situation prevailed in potato’s domestic economy during pre- and post-WTO periods. Pakistan did export its potato on prices higher than its domestic price but could not receive the world average price due to quality below the world average standard level. Accordingly, the associated welfare effects are estimated, as follows.

**Pre-WTO scenario**

\[
\Delta PS = - (acdf) = - \int_{pd} S(P)dp 
\]

\[
\Delta CS = (abef) = \int_{pd} D(P)dp 
\]

\[
ET = (ghij) = (P_e - P_d)E_s 
\]

\[
SWG/C = \Delta PS + \Delta CS + ET
\]

Using the shortened version of the supply and demand functions from model 4.57
(Chapter IV):
\[
S_d = 875.657 + 0.04004P_d \tag{5.76a}
\]
\[
D_d = 1241.395 - 0.048992P_d \tag{5.76b}
\]
\[
E_s = -8178.341 + 1.779103P_d \tag{5.76c}
\]
\[
E_d = 19.87223 - 0.000213P_e \tag{5.76d}
\]
The above functions relate to period 1979-80 to 2004-05, and therefore need to be adjusted for pre-WTO study period 1985-95. Using mean values of dependent and explanatory variables for 1985-95, the adjusted functions become:
\[
S_d = 666.1375 + 0.04004P_d \tag{5.77a}
\]
\[
D_d = 952.2402 - 0.04899P_d \tag{4.77b}
\]
\[
E_s = -5753.4401 + 1.779103P_d \tag{4.77c}
\]
\[
E_d = 1.9578 - 0.000213P_e \tag{4.77d}
\]
For estimation of free market price ($P_{ef}$)
\[
E_s = E_d \tag{5.78a}
\]
Since $P_d/EXR = P_e$ or $P_d = P_e*EXR$, replacing $P_d$ in above equation we get:
\[
P_{ef} = 143.63 \tag{5.78b}
\]
Putting values of $P_{ef} = 143.63$ given in (5.78b) in $Ed$ (5.77d)
\[
E_{df} = 1.9 \tag{5.79}
\]
Equating $E_{df} = E_{sf}$
\[
P_{df} = 3234.98 \tag{5.79b}
\]
After estimating $P_{ef}$ and $P_{df}$ in equation (5.78b) and (5.79b), we are in a position to estimate pre-WTO scenario welfare effects specified in model 5.75; values of all other variables (namely $P_d$, $P_e$, $E_s$ are already available in the form of mean values of these variables for the specified period (1985-95). For estimation of SWG/C specified in model 5.75, we estimate various components of SWG/C, as follows.
\[
\Delta PS = -\left\{\int_{P_d=3234.98}^{P_d=3234.98} (666.14 + 0.04004P_d)dp\right\} \tag{5.80a}
\]
\[= -Rs.6.07 \text{ thousand}\]
\[= -Rs.0.00607 \text{ million}\]
\[
\Delta CS = \int_{P_d=3234.98}^{P_d=3234.98} (952.2379 - 0.048999P_d)dp \tag{5.80b}
\]
\[= Rs.6.05 \text{ thousand}\]
\[= Rs.0.00605 \text{ million}\]
\[ ET = (ghij) = (P_e - P_d)E_s \]  
\[ = US\$121.90 \text{ thousand} \]  
\[ = Rs.2745.65 \text{ thousand} \]  
\[ = Rs.2.75 \text{ million} \]  
\[ SWG/C = \Delta PS + \Delta CS + ET \]  
\[ = Rs.2745.64 \text{ thousand} \]  
\[ = Rs.2.75 \text{ million} \]

Since there had been free trade situation prevailed in potato’s domestic economy, very negligible effects found in terms of producers and consumers' surpluses. However, exports were made on a higher price, which resulted in an export tax (ET) valuing Rs.2.75 million during the pre-WTO period.

**Post-WTO Scenario**

Welfare effects for post-WTO period are estimated, as follows.

**Figure 5.12 Welfare effects of potato crop for post-WTO period**

\[ \Delta PS = -(acdf) = - \int_{pd}^{pdf} S(P) dp \]  
(5.81a)

\[ \Delta CS = (abef) = \int_{pd}^{pdf} D(P) dp \]  
(5.81b)

\[ ET = (ghij) = (P_e - P_d)E_s \]  
(5.81c)

\[ SWG/C = \Delta PS + \Delta CS + ET \]  
(5.81d)

Using the shortened version of the supply and demand functions from model 4.57 (Chapter IV) adjusted for post-WTO period:
\[ S_d = 1365.4975 + 0.04004P_d \quad (5.82a) \]
\[ D_d = 1937.3345 - 0.04899P_d \quad (4.82b) \]
\[ E_s = -12274.9804 + 1.779103P_d \quad (4.82c) \]
\[ E_d = 44.7126 - 0.000213P_e \quad (4.82d) \]

For estimation of free market price \( (P_{ef}) \)
\[ E_s = E_d \quad (5.83a) \]
Since \( P_d/EXR = P_e \) or \( P_d = P_e \times EXR \), replacing \( P_d \) in above equation we get:
\[ P_{ef} = 140.60 \quad (5.83b) \]
Putting values of \( P_{ef} = 140.59 \) given in (5.83b) in Ed (5.82c)
\[ E_{df} = 44.68 \quad (5.84) \]
Equating \( E_{df} = E_{ef} \)
\[ P_{df} = 6924.65 \quad (5.85a) \]

After estimating \( P_{ef} \) and \( P_{df} \) in equation (5.83b) and (5.85b), we are in a position to estimate post-WTO scenario welfare effects specified in model 5.81; values of all other variables (namely \( P_d, P_e, E_s \) are already available in the form of mean values of these variables for the specified period (1995-2005). For estimation of SWG/C specified in model 5.81, we estimate various components of SWG/C, as follows.

\[ \Delta PS = -\left\{ \int_{P_d=6924.65}^{P_d=6924.64} (1365.4975 + 0.04004P_d)dp \right\} \quad (5.86a) \]
\[ \Delta CS = \int_{P_d=6924.65}^{P_d=6924.64} (1937.3345 - 0.04899P_d)dp \quad (5.86b) \]
\[ \Delta ET = (ghij) = (P_e - P_d)E_s \quad (5.86c) \]
\[ \text{US$ 972.88 thousand} \]
\[ \text{Rs. 47,916.70 thousand} \]
\[ \text{Rs. 47,92 million} \]
\[ \text{Rs. 47,916.58 thousand} \]
\[ \text{Rs. 47,92 million} \]
Due to prevalence of free trade situation in potato’s domestic economy, insignificance changes found occurred in terms of producers and consumers’ surpluses. Since exports were made on a higher prices, export tax (ET) valuing Rs.47.92 million per year were received during the post-WTO period.
5.7 Rapeseed Crop: Protection Status & Welfare Effects

Protection status

Table 10 provides data on Pakistan’s domestic wholesale price ($P_d$), Pakistan’s rapeseed import trade price ($P_i$) and world average rapeseed trade price ($P_w$) for 20 years, covering 10 years of pre-WTO and 10 years of post-WTO periods.

Table 5.10 Pakistan’s rapeseed prices for 1985-2005 (prices per M. ton)

<table>
<thead>
<tr>
<th>Year</th>
<th>Pakistan Domestic Wholesale Price</th>
<th>World Price (US$)</th>
<th>Pakistan Import Price (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pak Rs.</td>
<td>USS</td>
<td></td>
</tr>
<tr>
<td>1985-86</td>
<td>4204.00</td>
<td>260.49</td>
<td>308.57</td>
</tr>
<tr>
<td>1986-87</td>
<td>4414.50</td>
<td>256.97</td>
<td>300.02</td>
</tr>
<tr>
<td>1987-88</td>
<td>5109.25</td>
<td>290.31</td>
<td>352.87</td>
</tr>
<tr>
<td>1988-89</td>
<td>5500.25</td>
<td>286.24</td>
<td>346.43</td>
</tr>
<tr>
<td>1989-90</td>
<td>5395.75</td>
<td>251.61</td>
<td>363.30</td>
</tr>
<tr>
<td>1990-91</td>
<td>5870.75</td>
<td>261.82</td>
<td>330.52</td>
</tr>
<tr>
<td>1991-92</td>
<td>5750.00</td>
<td>231.44</td>
<td>303.33</td>
</tr>
<tr>
<td>1992-93</td>
<td>6020.75</td>
<td>231.93</td>
<td>251.45</td>
</tr>
<tr>
<td>1993-94</td>
<td>6411.50</td>
<td>212.56</td>
<td>286.50</td>
</tr>
<tr>
<td>1994-95</td>
<td>15020.75</td>
<td>486.87</td>
<td>303.83</td>
</tr>
<tr>
<td>Average</td>
<td>6369.75</td>
<td>277.02</td>
<td>314.68</td>
</tr>
<tr>
<td>1995-96</td>
<td>15009.75</td>
<td>447.14</td>
<td>312.14</td>
</tr>
<tr>
<td>1996-97</td>
<td>13437.50</td>
<td>344.61</td>
<td>306.32</td>
</tr>
<tr>
<td>1997-98</td>
<td>15062.50</td>
<td>348.70</td>
<td>291.12</td>
</tr>
<tr>
<td>1998-99</td>
<td>19927.00</td>
<td>425.88</td>
<td>237.62</td>
</tr>
<tr>
<td>1999-00</td>
<td>14838.50</td>
<td>286.62</td>
<td>206.94</td>
</tr>
<tr>
<td>2000-01</td>
<td>11979.25</td>
<td>204.99</td>
<td>217.22</td>
</tr>
<tr>
<td>2001-02</td>
<td>19354.00</td>
<td>315.08</td>
<td>255.55</td>
</tr>
<tr>
<td>2002-03</td>
<td>21229.00</td>
<td>362.89</td>
<td>305.76</td>
</tr>
<tr>
<td>2003-04</td>
<td>21500.00</td>
<td>373.43</td>
<td>321.09</td>
</tr>
<tr>
<td>2004-05</td>
<td>20500.00</td>
<td>342.64</td>
<td>262.96</td>
</tr>
<tr>
<td>Average</td>
<td>17283.75</td>
<td>345.20</td>
<td>271.67</td>
</tr>
</tbody>
</table>

Source: FAO (www.fao.org; Statistical databases)

Note: NA = Not Available

The mean values of prices computed for pre-WTO period (1985-95) indicate that, against the domestic price of US$277.02 per M. ton, the world average trade price was US$314.68 per M. ton. However, domestic producers of rapeseed were not allowed to export and take the benefit of higher world price. Hence, ‘no-export’ or ‘zero-export quota’ regime was practiced during pre-WTO period.

In contrast, in the earlier years of post-WTO era, imports of rapeseed were allowed...
through limited numbers of importers who presumed to have been working as cartel. Consequently imports were effected at higher than the world average trade prices. This happened during 1995 to 2001 and later on import prices remained lower than the world average trade prices with the exception of year 2005. On average for post-WTO period, Pakistan’s import prices remained at US$324.69 per M. ton against the world average import trade price of US$271.76 per M. ton. For analysis purpose we would call it as cost of rapeseed import policy.

Welfare effects

Welfare effects of the existing situations (pre- and post-WTO) versus a free trade WTO scenario would be measured in terms of changes in producers and consumers surpluses (ΔPS & ΔCS), which along with cost of rapeseed import policy would make social welfare gains/costs (SWG/C).

Pre-WTO scenario

As already mentioned there was, ‘no-export’ or ‘zero-export quota’ regime in vogue during pre-WTO period. Such a situation can best be represented at point ‘e’ (or ‘d’ or ‘h’) in Figure 5.13.

**Figure 5.13 ‘No-export’ or ‘zero-export quota’ regime during pre-WTO 10 years**

![Diagram](image)

At point ‘e’, domestic supply (S_d) and domestic demand (D_d) are equalized at domestic price \( P_d = Rs.6369.75 \) or US$277.02 per M. ton. If rapeseed were allowed to be freely traded, Pakistan would have exported rapeseed at world average price of US$314.68 per M. ton (Rs.7235.64). Developing export supply function (E_s) on the basis of S_d and D_d functions, we get:
\[ S_d = 221.0780 + 0.000319P_d \quad (5.87a) \]
\[ D_d = 225.4859 - 0.000373P_d \quad (5.87b) \]
\[ E_s = S_d - D_d \quad (5.87c) \]
\[ = -4.4079 + 0.000692P_d \quad (5.87d) \]

The aforementioned \( S_d \), \( D_d \) and \( E_s \) functions are represented in Figure 5.13. It appears that 'no-export' policy have deprived rapeseed producers of producers surplus (PS) equal to area 'acde'; however, it benefited consumers equal to area 'abde'. Hence, welfare effects of 'no-export' regime would be:

\[ \Delta PS = - \int_{P_d=6369.75}^{P_d=7235.64} (221.0780 + 0.000319P_d) \, dp \quad (5.88a) \]

\[ = - \text{Rs.193308.3 thousands} \]
\[ = - \text{Rs.193.31 million} \]

\[ \Delta CS = \int_{P_d=6369.75}^{P_d=7235.64} (225.4859 - 0.000373P_d) \, dp \quad (5.88b) \]

\[ = \text{Rs.193048.9 thousands} \]
\[ = \text{Rs.193.05 million} \]

\[ \text{SWG/C} = \Delta PS + \Delta CS \quad (5.88c) \]

\[ = - \text{Rs.259.42 thousands} \]
\[ = - \text{Rs.0.259 million} \]

It appears that rapeseed crop economy has resulted, on average, in an overall social welfare loss of Rs.0.26 million per year to the society during the study period 1985-95. However, it is worth mentioning that producers of rapeseed has lost Rs.193.31 million per year due to low prices compared to free market price while consumers benefited by Rs.193.05 million annually due to lower prices. It should be noted that losses in terms of producers’ surplus (-Rs.193.31 million) are higher than the gains in terms of consumers’ surplus (Rs.193.05 million).

**Post-WTO scenario**

As already discussed, imports of rapeseed were allowed through limited numbers of importers-cartel and consequently imports were effected at higher (US$324.69 per M. ton) than the world average trade prices (US$271.76 per M. ton) during the post-WTO period. The domestic price remained at US$345.20 per M. ton. For estimation of free trade price, we need to equate import supply and import demand functions. Using the
already estimated supply and demand functions and adjusted for post-WTO period:

\[ S_d = 316.51648 + 0.000319P_d \]  
\[ D_d = 623.80164 - 0.000373P_d \]  
\[ I_d = 307.28516 - 0.000692P_d \]  
\[ I_s = 248.66291 + 0.14371P_i \]  
\[ = 261.2352 + 0.125463P_w \]  

(5.89a)  
(5.89b)  
(5.89c)  
(5.89d)  
(5.89e)

For estimation of free market price \( (P_d) \):

\[ I_s = I_d \]  

(5.90a)

Since \( P_d/EXR = P_i \) or \( P_d = P_i \times EXR \), replacing \( P_d \) in above equation we get:

\[ P_{tf} = 328.68 \]  

(5.90b)

Putting value of \( P_{tf} = 328.68 \) given in (5.90b) in \( I_s (5.89d) \)

\[ I_{sf} = 295.90 \]  

(5.91)

Equating \( I_{sf} = I_{df} \)  

(5.92a)

\[ P_{df} = 16456.61 \]  

(5.92b)

After estimating free trade prices, we are in a position to estimate post-WTO scenario welfare effects using Figure 5.14 and model 5.93.

**Figure 5.14 Price support during post-WTO 10 years**

- 135 -
CGIP = TL + IG = \{- (P_d - P_w) + (P_d - P_l)\}I_d \hspace{1cm} (5.93c)
SWG/C = \Delta PS + \Delta CS + CGIP \hspace{1cm} (5.93d)

Term CGIP stands for cost of government rapeseed import policy and is arrived at subtracting importers gain (IG = P_d - P_l) from and total welfare loss (TL), which occurs due to non prevalence of world price (P_w) in domestic economy and is equal to the difference between domestic price (P_d) prevailed and world average trade price (P_w).

For estimation of SWG/C specified in model 5.93, we estimate various components of SWG/C, as follows.

\[
\Delta PS = \int_{P_d=17283.75}^{P_d=16456.61} (316.51656 + 0.000319P_d)dp \hspace{1cm} (5.94a)
\]

\[
= \text{Rs.}266253.70 \text{ thousand}
\]

\[
= \text{Rs.}266.25 \text{ million}
\]

\[
\Delta CS = -\int_{P_d=17283.75}^{P_d=16456.61} (623.8016 - 0.000373P_d)dp \hspace{1cm} (5.94b)
\]

\[
= -\text{Rs.}510764.40 \text{ thousand}
\]

\[
= -\text{Rs.}510.76 \text{ million}
\]

\[
CGIP = TL + IG = \{- (P_d - P_w) + (P_d - P_l)\}I_d \hspace{1cm} (5.94c)
\]

\[
= \{- (345.20 - 271.67) + (345.20 - 324.69)\}295.32
\]

\[
= -\text{US$} 15631.29 \text{ thousand}
\]

\[
= -\text{Rs.}782645.27 \text{ thousand}
\]

\[
= -\text{Rs.}782.65 \text{ million}
\]

\[
SWG/C = \Delta PS + \Delta CS + CGIP \hspace{1cm} (5.94d)
\]

\[
= -\text{Rs.}1027.16 \text{ million}
\]

The rapeseed crop economy produced, on average, overall social welfare loss of Rs.1027.16 million per year to the society during post-WTO period. The composition of net social loss includes losses of Rs.510.76 million in consumers’ surplus, which are higher than gains of Rs.266.25 million in producers’ surplus, and losses of Rs.782.65 million on account of CGIP, per year.

The above estimation of welfare effects (SWG/C) is based on estimation of Pakistan’s free trade price calculated in equations (5.90) to (5.92). These calculations, which were made by equating Pakistan’s I_d with I_s, gave estimated free trade import price P_{if} = US$328.68 per M. ton (Rs.16456.61) This estimated P_{if} is in fact much higher than the
actual world average import trade price $P_w = \text{US$271.67 per M. ton (Rs.13602.41)}$. One can argue that if welfare effects associated with an existing policy are to be estimated, those should be based on comparing with world average price. We therefore also make estimates of welfare effects based on the stated argument, as follows.

Assuming that world price ($P_w$) fully prevails:

$$\Delta PS = \int_{P_w=13602.41}^{P_d=17283.75} (316.51656 + 0.000319P_d)dp$$

(5.95a)

$$= \text{Rs.1183340 thousand}$$

$$= \text{Rs.1183.34 million}$$

$$\Delta CS = -\left\{\int_{P_w=13602.41}^{P_d=17283.75} (623.8016 - 0.000373P_d)dp\right\}$$

(5.95b)

$$= -\text{Rs.2275220 thousand}$$

$$= -\text{Rs.2275.22 million}$$

$$IT = (P_d - P_i)I_d$$

(5.95c)

$$= \text{Rs.303.16 million}$$

$$SWG/C = \Delta PS + \Delta CS + IT$$

(5.95d)

$$= -\text{Rs.788.72 million}$$

The later scenario suggests an overall net social loss of Rs.788.72 million to the society per year. The losses to consumers (Rs.2275.22 million) are higher than gains to producers (Rs.1183.34 million) while Rs.303.16 million received as import tax.
CHAPTER VI
WTO'S TRADE LIBERALIZATION: IMPLICATIONS FOR PAKISTAN'S CROP SECTOR

This chapter consists of two major sections. The first section presents how the welfare effects associated with the existing policies, discussed in previous chapter, would change when WTO's agreements especially Agreement on Agriculture is fully implemented in Pakistan's own domestic economy. The second section covers the effects of WTO's trade liberalization on Pakistan's crops sector when Agreement on Agriculture and other WTO's agreements are implemented abroad.

6.1 Pakistan's Crop Sector: Implications of the Implementation of WTO's Agreements in Domestic Economy

The major theme of WTO's Agreement on Agriculture, as discussed in Chapter II on Review of Literature, is to gradually reduce 'domestic support', 'import tariffs' and 'export subsidies' and eliminate/abolish all such protections policies over a specified period. Besides Agreement on Agriculture, WTO has several other agreements particularly GATT 1994, which advocate reduction of protection and introduction of liberalization. This means that WTO in general aims at introducing and implementing free trade. If we refer to the way how we estimated the welfare effects of existing policy regimes in previous chapter, we would recall that we estimated welfare effects of existing situation policies comparing with free trade scenarios. For instance, as depicted in Figure 5.1, free trade price $P_{df} = Rs.3313.02$ would have been prevailed instead of existing domestic price $P_{d} = Rs.3101.13$ per metric ton of wheat if free trade was in practice during pre-WTO period. Consequently, there would have been no losses to the producers (in their producers surplus, equal to area 'abef'), no gains to the consumers (in consumers surplus, equal to area 'acdf') and no need of providing import subsidy (equal to area 'ghij'). Hence, the net effect of implementation of free trade would have been, as follows.

\[
\begin{align*}
\Delta PS &= Rs.3102.38 \text{ million} \\
\Delta CS &= -Rs.3462.76 \text{ million} \\
IS &= Rs.1122.24 \text{ million} \\
SWG/C &= Rs.761.85 \text{ million}
\end{align*}
\]

It appears that the welfare effects shown associated with existing policies discussed in previous chapter would reverse if WTO's suggested trade liberalization policies are implemented. Hence, all the welfare effects reported previously are reproduced here with
reverse signs as the effects of WTO's trade liberalization policies.

**Free trade scenario: Empirical results**

**Wheat crop:**

<table>
<thead>
<tr>
<th>Period</th>
<th>ΔPS</th>
<th>ΔCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-WTO Period (1985-95)</strong></td>
<td>Rs.3102.38 million</td>
<td>-Rs.3462.76 million</td>
</tr>
<tr>
<td><strong>Post-WTO Period (1995-05)</strong></td>
<td>-Rs.918.91 million</td>
<td>Rs.967.95 million</td>
</tr>
</tbody>
</table>

IS (import subsidy) = Rs.1122.24 million
SWG/C = Rs.761.85 million

**Basmati Rice Crop:**

<table>
<thead>
<tr>
<th>Period</th>
<th>ΔPS</th>
<th>ΔCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-WTO Period (1985-95)</strong></td>
<td>Rs.657.95 million</td>
<td>-Rs.448.76 million</td>
</tr>
<tr>
<td><strong>Post-WTO Period (1995-05)</strong></td>
<td>Rs.649.48 million</td>
<td>-Rs.430.19 million</td>
</tr>
</tbody>
</table>

ET (export tax) = -Rs.1403.79 million
SWG/C = -Rs.1194.60 million

**Cotton crop:**

<table>
<thead>
<tr>
<th>Period</th>
<th>ΔPS</th>
<th>ΔCS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-WTO Period (1985-95)</strong></td>
<td>Rs.6496.10 million</td>
<td>-Rs.5835.34 million</td>
</tr>
<tr>
<td><strong>Post-WTO Period (1995-05)</strong></td>
<td>Rs.12648.44 million</td>
<td>-Rs.12463.10 million</td>
</tr>
</tbody>
</table>
CS$^{16} = $498.21 million
SWG/C = $683.55 million

Sugarcane Crop:

**Pre-WTO Period (1985-95)**
\[
\Delta PS = -$134671.18 million \\
\Delta CS = $142842.28 million \\
IT (import tax) = -$8441.20 million \\
SWG/C = -$270.11 million
\]

**Post-WTO Period (1995-05)**
\[
\Delta PS = -$199521.21 million \\
\Delta CS = $208428.66 million \\
IT (import tax) = -$10815.05 million \\
SWG/C = -$1911.61 million
\]

Onion Crop:

**Pre-WTO Period (1985-95)**
\[
\Delta PS = -$2.27 million \\
\Delta CS = $2.18 million \\
CQ (cost of low quality) = $47.31 million \\
SWG/C = $47.22 million
\]

**Post-WTO Period (1995-05)**
\[
\Delta PS = $0.52 million \\
\Delta CS = -$0.50 million \\
ET (export tax) = -$15.11 million \\
SWG/C = -$15.09 Million
\]

Potato Crop:

**Pre-WTO Period (1985-95)**
\[
\Delta PS = $0.00607 million \\
\Delta CS = -$0.00605 million \\
ET (export tax) = -$2.745 million \\
SWG/C = -$2.750 million
\]

---

$^{16}$Extra cost paid by textile producers for import of cotton is actually the cost to the society.
Post-WTO Period (1995-05)
\[ \Delta PS = \text{Rs}.0.0043 \text{ million} \]
\[ \Delta CS = -\text{Rs}.0.0042 \text{ million} \]
\[ ET (\text{export tax}) = -\text{Rs}.47.917 \text{ million} \]
\[ SWG/C = -\text{Rs}.47.92 \text{ million} \]

Rapeseed Crop:

Pre-WTO Period (1985-95)
\[ \Delta PS = \text{Rs}.193.31 \text{ million} \]
\[ \Delta CS = -\text{Rs}.193.05 \text{ million} \]
\[ SWG/C = \text{Rs}.0.26 \text{ million} \]

Post-WTO Period (1995-05)

Scenario 1 (When based on Pakistan's estimated free trade prices)
\[ \Delta PS = -\text{Rs}.266.25 \text{ million} \]
\[ \Delta CS = \text{Rs}.510.76 \text{ million} \]
\[ CGIP^{17} = \text{Rs}.782.65 \text{ million} \]
\[ SWG/C = \text{Rs}.1027.16 \text{ million} \]

Scenario 2 (When based on world level trade prices)
\[ \Delta PS = -\text{Rs}.1183.34 \text{ million} \]
\[ \Delta CS = \text{Rs}.2275.22 \text{ million} \]
\[ YT = -\text{Rs}.303.16 \text{ million} \]
\[ SWG/C = \text{Rs}.788.72 \text{ million} \]

Discussion

1. The estimates of social welfare gain or cost (SWG/C), provided in the previous section, reflect the net welfare effects of free trade scenarios for Pakistan's society as a whole; wherein positive sign reflects gains and negative sign costs of the trade liberalization. In determining the magnitude and sign of SWG/C, import subsidy or tax, export subsidy or tax, government handling of the commodity or government policy encouraging or discouraging monopoly/cartels play important role, and some time conceal what actually happens to the welfare of producers and consumers. Hence, if the motive is to see the effect of trade liberalization on producers and consumers, then changes in producers and consumers surpluses

\[^{17}\text{CGIP stands for cost of government's rapeseed import policy.}\]
(ΔPS and ΔCS) should particularly be looked into.

2. A comparison of ΔPS and ΔCS associated with free trade scenario for various agricultural commodities under study is presented, as follows.

<table>
<thead>
<tr>
<th>Crops/commodities</th>
<th>Pre-WTO</th>
<th>Post-WTO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ΔPS (Million Rs.)</td>
<td>ΔCS (Million Rs.)</td>
</tr>
<tr>
<td>Wheat</td>
<td>3102.38</td>
<td>(-)3462.76</td>
</tr>
<tr>
<td>Basmati rice</td>
<td>657.95</td>
<td>(-)448.76</td>
</tr>
<tr>
<td>Cotton</td>
<td>6496.10</td>
<td>(-)5835.34</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>(-)134671.18</td>
<td>142842.28</td>
</tr>
<tr>
<td>Onion</td>
<td>(-)2.27</td>
<td>2.18</td>
</tr>
<tr>
<td>Potato</td>
<td>0.00607</td>
<td>(-)0.00605</td>
</tr>
<tr>
<td>Rapeseed</td>
<td>193.31</td>
<td>(-)193.05</td>
</tr>
<tr>
<td>Scenario 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The free trade scenario reflects greater gains in case of Basmati rice, cotton, sugarcane, potato and rapeseed in both pre- and post-WTO periods; however, the gains are accrued by producers in cases of Basmati rice, cotton and potato and consumers in case of sugarcane. In case of rapeseed, consumers seem benefiting substantially more than losses to producers in the post-WTO scenario.

In case of wheat losses to consumers are heavier than gains to producers in pre-WTO period but, gains to consumers are higher in post-WTO scenario. In case of onion, though free trade scenario reflects a slightly higher loss to the producers during pre-WTO period, producers seem to be having substantial gains under free trade during the post-WTO period.

Thus, in almost all crops, the free trade scenario reflects higher gains in one or the other form (PS or CS), especially in the post-WTO period; same is true for pre-WTO period with the exception of onion and wheat crops.
6.2 Pakistan’s Crop Sector: Implications of the Implementation of WTO’s Agreements in International Market

The Agreement on Agriculture in particular and other WTO agreements in general are expected to produce similar trade liberalization effects in other countries. As a consequence of reducing domestic support, domestic prices in foreign countries would go up. The higher domestic prices would help international prices to rise. In addition to this, reduction of export subsidies would also increase international prices, especially the export prices.

WTO’s agreements also encourage market access, which means reduction of taxes and tariffs on imports. Consequently, prices would decrease. This decrease in prices is expected to offset, up to some extent, the increase in prices caused by reduction in domestic support and export subsidies. There is still sufficient ground to assume that even after offsetting the increase in prices caused by market access, world prices ($P_w$) would in general rise. FAO (2005, p.57) has found that impacts of trade liberalization on world commodity prices would be positive; it reports a 4 percent and 19 percent increase in wheat prices, 4 percent and 11 percent increase in rice prices, -1 percent and 6 percent in maize prices and 3 percent and 11 percent increase in all cereal prices for a market price support phase-out and all support phase-out trade reform program, respectively. Minot et al. (2007), after reviewing a number of studies on policies distorting global markets for agricultural commodities, presents empirical estimates of increase in world prices of agricultural commodities due to trade liberalization under various scenarios of elimination of domestic support, export subsidies and import tariffs. A commodity wise account of such estimates is provided, as follows.

**Wheat**

More than 18 percent global demand for wheat is met through international trade. Most of the exports is from the OECD countries to developing countries. The major exporters are the United States, Canada, Australia, the EU25 and Argentina. From 2000 onward, EU and the US have largely eliminated export subsidies, but still continue to provide support to domestic production through marketing assistance loan payments, direct and countercyclical payments, crop insurance and surplus disposal programmes (Vocke, Allen and Ali, 2005). The OECD countries support for wheat, averaging 35 percent of the value of production during 2002-04, amounting to about US$17 billion of income transfers to producers (OECD, 2005a).
A number of studies have estimated the effects of trade and domestic reforms on the world price of wheat. Some have tried to isolate the impact of domestic support granted to producers in developed countries from full trade liberalization scenarios, including border measures. According to FAPRI (2002), the removal of all distortions (full liberalization) leads to increases in the world wheat prices by 4.8 percent while USDA (2001) estimates 18.1 percent increase in world wheat prices. However, different results come when role of domestic support is included in the estimates. FAPRI (2002) states that the increase in wheat prices would be 7.6 percent higher under a tariff-removal-only scenario than under a full liberalization scenario. The difference shows the effect of domestic support policies such as set-aside programmes in the EU and the US, removal of which results in a substantial increase in production and exports, diminishing the price effect. Contrary to that USDA (2001) reflects an increase in wheat prices resulting from the elimination of OECD domestic policies which is 12 percent larger than the price effect from the elimination of tariffs i.e. 3.4 percent. The simulation results of Poonyth and Sharma (2003) on three trade liberalization scenarios based on the Harbinson modalities and the EU and US proposals presented at the WTO negotiations during 1999-2002 reflect price increases in the world market price of wheat, in all the scenarios. However, the proposal of the US, suggesting cuts on applied tariffs instead of bound tariffs, leads to the highest increase in the world wheat price i.e. 12 percent.

Rice
Both, the developed and developing countries protect rice. According to Wailes (2004), the average level of protection on rice is over 70%. The leading rice exporters are Thailand, India, Vietnam and the United States. Bouet (2006) and Tokarick (2005) project that full trade liberalization would increase world rice prices by only 2-3 percent. Whereas USDA (2001) estimates that rice prices would rise by about 10 percent. Wailes (2004) presents the results from two models. A static partial equilibrium model of rice markets that is highly disaggregated by type of rice projects that full trade liberalization would increase the price of long grain rice by 2 percent, on average, and that of medium and short-grain rice by a full 90 percent. Thus weighted average price increase is 33 percent. The second model is less disaggregated by type of rice, but includes dynamic effects. According to this model, full trade liberalization would increase rice prices by 25-35 percent.
Cotton

Cotton prices decreased from a peak in 1995 until 2001, but they have partially recovered since then. The long-term trend is affected by competition with synthetic fibers that increased their share of the textile fiber market from 48 percent in 1995 to 55 percent in 1999. In addition, the global recession of 2001-02 depressed cotton prices further because textile demand is more income elastic than is the demand for grains. In addition to stagnant demand, cotton prices have been pushed down by increased government support for cotton growers. The International Cotton Advisory Committee estimates that worldwide direct assistance to cotton growers was US$4.9 billion in 2001-02. The US accounted for US$2.3 billion, equivalent to US$0.24 per lb of cotton produced.

Other sources, using a broader definition of assistance, estimate that the US Government provides US$3.9 billion to the cotton sector (Oxfam 2002). China is the second largest provider of subsidies to local cotton growers. Till recently, it maintained a reference price about 20 percent above the international price at a cost of US$1.2 billion, equivalent to US$0.10 per lb. To reduce cotton stocks, which reached 120 percent of consumption in 1998, China started subsidizing exports and effectively banned imports.

The EU spends US$700 million to provide, over US$0.50 per lb to small numbers of cotton growers in Greece and Spain, while India spends US$500 million on cotton subsidies. Other cotton producers, such as Benin, Brazil, Egypt, Mali and Turkey, also provide subsidies to farmers, totaling US$211 million (less than US$0.10 per lb) that is 4 percent of the world total subsidy (ICAC 2002).

Several recent studies have attempted to assess the impact of these subsidies on world prices. The Centre for International Economics, in Canberra, used a five-region world model of fiber, textile and garment markets in 2000-01 to simulate the impact of US and European subsidies on cotton production and exports. They find that removing US and EU subsidies to cotton growers would raise the world cotton price by 11 percent. Removing import restrictions on textiles and clothing would independently raise cotton prices by 2 percent (CIE 2001). While ICAC (2002) estimates that the impact of removing US cotton subsidies would have increased the world price by 20 percent in 2001-02. Removing all cotton subsidies worldwide would have raised the world price by over 50 percent. Sumner (2003) carried out a detailed simulation of the impact of US cotton subsidies. His model incorporates 11 commodities and 24 regions of the world, and it simulates the effects of six programmes that support US cotton producers. His
estimates reflects that over the marketing years 1999-2002, US subsidies depressed the world cotton price by 12.6 percent.

The above discussion helps understand that trade liberalization would change world prices of food grains/food commodities less than that of commercial crops like cotton, sugar, etc. We, therefore, assume a range from 2.5 to 10 percent rise in world price ($P_w$) for wheat, rice, onion and potato and 5 to 20 percent increase in that of cotton, sugarcane/sugar and rapeseed, and examine their effects on Pakistan’s domestic economy. The estimation of a 2.5 percent increase in $P_w$ of wheat crop is provided in detail in the following paragraphs while results of other estimates are provided in table 6.2.

Sugar
The market for sugar is one of the most distorted in the world. According to Bouet (2006), the average level of protection for sugar is over 50 percent. The OECD countries provide about US$5.3 billion to support sugar farmers in their countries. In 2002, the US maintained a tariff rate quota of 1.3 million tons, restricting imports enough to make domestic prices twice as high as the international price. Forty two countries are given quotas to export sugar to the US, but US imports are only a fraction of what the US would import without import restrictions. The support given to US sugar cane producers was US$1.2 billion in 2002. The EU maintains a tariff rate quota, with a large, €98 per ton in-quota tariff and a prohibitive, €339 per ton out-of-quota tariff. Annual support for sugar producers in the EU was estimated at US$2.4 (El-Obeid and Beghin 2005). Japan uses a specific tariff to limit sugar imports and protect its farmers. The support given to Japanese farmers is about US$400 million. Many developing countries also have high levels of protection for local farmers.

A number of studies have estimated the impact of trade liberalization on the world sugar market. The Food and Agricultural Policy Research Institute carried out a study of sugar liberalization using a non-spatial partial equilibrium econometric model of the world sugar market with 29 countries and regions (El-Obeid and Beghin 2005). According to this model, the removal of all trade restrictions including tariffs, tariff rate quotas and state trading, would increase the world price of sugar by 27 percent at the end of the nine-year simulation period. When the removal of all production support is included, the world price rises 48 percent compared to the base scenario. Whereas, the EU would change from a net exporter to a net importer of sugar. On the other hand, the results from CGE models tend to indicate that trade liberalization has smaller effects on world sugar prices.
For example, Bouet (2006) simulates the impact of full global trade liberalization by using the MIRAGE CGE model that represents 20 countries and regions of the world, including 14 developing countries and regions. In this simulation, trade liberalization causes sugar prices to rise by only 2 percent.

Welfare Effects

Wheat Crop

Fortunately, majority of the commodity’s supply and demand functions, studied in Chapter IV, include the world price ($P_w$) as one of the determinants; hence, the effect of trade liberalization in world economy through rise in the world price ($P_w$) can be analyzed. Using those functions or their modified shortened versions provided in Chapter V for pre- and post-WTO periods, we estimate the effect of a 2.5 percent increase in $P_w$ of wheat and its associated welfare effects in terms of changes in producers and consumers surpluses, as follows.

Pre-WTO Scenario

We reproduce the shortened version of supply and demand functions estimated in model 5.3 for 1985-95 pre-WTO period, as follows.

\[
S_d = 13309.145 + 0.41528P_d \quad (6.1a)
\]

\[
D_d = 16492.400 - 0.046974P_d \quad (6.1b)
\]

\[
I_d = 3183.975 - 0.462254P_d \quad (6.1c)
\]

\[
I_s = 896.911 + 5.2191P_1 \quad (6.1d)
\]

\[
= 1025.737 + 4.7556P_w \quad (6.1e)
\]

Using equation (6.1e) and putting 2.5 percent-enhanced value of $P_w$, that is, $1.025P_w$

\[
I_s = 1025.737 + 4.7556(1.025P_w = 156.05) \quad (6.2a)
\]

\[
= 1767.829 \text{ thousand M. tons} \quad (6.2b)
\]

Equating $I_s = 1767.829$ with $I_d$ given in (6.1c) and solving for $P_d$

\[
I_s = I_d \quad (6.3a)
\]

\[
1767.829 = 3183.975 - 0.462254P_d \quad (6.3b)
\]

\[
P_d = 3063.59 \text{ Rs. per M. ton} \quad (6.3c)
\]

Substituting $P_d = 3063.59$ in (6.1 a & b) and solving for $S_d$ and $D_d$

\[
S_d = 13309.145 + 0.41528P_d \quad (6.4a)
\]

\[
= 14581.394 \text{ thousand M. tons} \quad (6.4b)
\]

\[
D_d = 16492.400 - 0.046974P_d \quad (6.5a)
\]

\[
= 16348.503 \text{ thousand M. tons} \quad (6.5b)
\]
After estimating the effect of the enhanced $P_w$ on $P_d$, $S_d$ and $D_d$, we now compute the associated welfare effects of changes in $P_d$ from Rs.3101.13 to Rs.3063.59 per M. ton.

Welfare Effects

Welfare effects of the changes in Pakistan’s wheat domestic price from the existing level of $P_{d0} =$ Rs.3101.13 due to new level of $P_{df} =$ Rs.3063.59 are measured in terms of changes in producers and consumers surpluses ($\Delta PS$ & $\Delta CS$), using the following model.

$$\Delta PS = - \int_{P_d=3101.13}^{P_d=3063.59} S(P)dp \quad (6.6a)$$

$$= - \int_{P_d=3101.13}^{P_d=3063.59} (13309.145 + 0.41528P_d)dp$$

$$= - \frac{[13309.145(3101.13) + \frac{\text{wheat}}{1}(3101.13)^2] - [13309.145(3063.59) + \frac{\text{wheat}}{1}(3063.59)^2]}{(13309.145(3063.59) + \frac{\text{wheat}}{1}(3063.59)^2)}$$

$$= - \text{Rs.547,6415 million} \quad (6.6b)$$

$$\Delta CS = \int_{P_d=3101.13}^{P_d=3063.59} D(P)dp \quad (6.7a)$$

$$= \int_{P_d=3101.13}^{P_d=3063.59} (16492.400 - 0.046974P_d)dp$$

$$= \text{Rs.624.5182 million} \quad (6.7b)$$

$$\text{SWG/C} = \Delta PS + \Delta CS \quad (6.8a)$$

$$= -547.6415 + 624.5182 \quad (6.8b)$$

$$= \text{Rs.76.88 million}$$

It appears that the trade liberalization in the world market would benefit Pakistan’s wheat economy to the tune of Rs.76.88 million; this would happen as a result of an increase of Rs.624.52 million in consumers surplus and a decrease of Rs.547.64 million in the producers surplus per year.

Post-WTO Scenario

We reproduce the shortened version of supply and demand functions of wheat estimated in model 5.12 for 1995-05 post-WTO period, as follows.

$$S_d = 15339.196 + 0.41528P_d \quad (6.9a)$$

$$D_d = 20266.082 - 0.04697P_d \quad (6.9b)$$

$$I_d = 4926.886 - 0.46225P_d \quad (6.9c)$$

$$P_i = 17.45159 + 0.91124P_w \quad (6.9d)$$

$$I_s = 149.468 + 5.2191P_i \quad (6.9e)$$
\[
I_s = 240.5894 + 4.7556P_w \quad \text{(6.9f)}
\]

Using equation (6.9f) and putting 2.5 percent-enhanced value of \( P_w \), that is, \( 1.025P_w \)

\[
I_s = 240.5894 + 4.7556(162.6573) \quad \text{(6.10a)}
\]

\[
= 1014.122 \text{ thousand M. tons} \quad \text{(6.10b)}
\]

Equating \( I_s \) with \( I_d \) given in (6.9c) and solving for \( P_d \)

\[
I_s = I_d \quad \text{(6.11a)}
\]

\[
1014.122 = 4926.886 - 0.46225P_d \quad \text{(6.11b)}
\]

\[
P_d = 8464.605 \text{ Rs. per M. ton} \quad \text{(6.11c)}
\]

Substituting \( P_d = 8464.605 \) in (6.9 a & b) and solving for \( S_d \) and \( D_d \)

\[
S_d = 15339.196 + 0.41528P_d \quad \text{(6.12a)}
\]

\[
= 18854.377 \text{ thousand M. tons} \quad \text{(6.12b)}
\]

\[
D_d = 20266.082 - 0.04697P_d \quad \text{(6.13a)}
\]

\[
= 19868.499 \text{ thousand M. tons} \quad \text{(6.13b)}
\]

**Welfare Effects**

Welfare effects of the changes in Pakistan’s wheat domestic price from the existing level of \( P_{do} = \text{Rs. 8505.31} \) due to new level of \( P_{df} = \text{Rs. 8464.605} \) are measured in terms of changes in producers and consumers surpluses (\( \Delta PS \) & \( \Delta CS \)), using the following model.

\[
\Delta PS = - \int_{P_{df}}^{P_{do}} S(P) dp \quad \text{(6.14a)}
\]

\[
= - \int_{P_{df}=8464.605}^{P_{do}=8505.31} (15339.196 + 0.41528P_d) dp
\]

\[
= - \text{Rs. 767.807 million} \quad \text{(6.14b)}
\]

\[
\Delta CS = \int_{P_{df}}^{P_{do}} D(P) dp \quad \text{(6.15a)}
\]

\[
= \int_{P_{df}=8464.605}^{P_{do}=8505.31} (20266.082 - 0.04697P_d) dp
\]

\[
= \text{Rs. 808.703 million} \quad \text{(6.15b)}
\]

\[
\text{SWG/C} = \Delta PS + \Delta CS \quad \text{(6.16a)}
\]

\[
= -767.807 + 808.703
\]

\[
= \text{Rs. 40.896 million} \quad \text{(6.16b)}
\]

Thus the trade liberalization in the world market would benefit Pakistan’s wheat economy by Rs.40.896 million; this would happen as a result of an increase of Rs.808.703 million
in consumers’ surplus and a decrease of Rs.767.896 million in the producers’ surplus per year.

In similar way we estimate the effect of other specified ranges of changes in world prices ($P_w$) of wheat as well as other commodities and provide the empirical results in table 6.2. The estimated welfare effects reported in table 6.2 suggest negligible effects of world prices in cases of onion and potato, and substantial effects in cases of other crops like wheat, Basmati rice, cotton, sugarcane and rapeseed. In all five cases of crops, where effects are substantial, net social welfare effects are turned out to be positive. However, in cases of wheat and sugarcane, consumers seem to be benefited more than losses to the producers in both pre- and post-WTO scenarios. In case of Basmati rice, producers’ gains are higher than losses to the consumers. In cases of cotton and rapeseed, producers’ gains were higher than consumers’ losses during pre-WTO period and consumers’ benefits are higher than producers’ losses during post-WTO scenario.
Table 6.2 Changes in social welfare ($\Delta PS$, $\Delta CS$ and NSG/C) due to changes in world prices

<table>
<thead>
<tr>
<th>Scenarios (Percent Change in Prices)</th>
<th>Pre-WTO period (Rs. In million)</th>
<th>Post-WTO period (Rs. in million)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\Delta PS$</td>
<td>$\Delta CS$</td>
</tr>
<tr>
<td>Wheat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 percent</td>
<td>(-) 547.64</td>
<td>624.52</td>
</tr>
<tr>
<td>5 percent</td>
<td>(-) 1118.83</td>
<td>1276.53</td>
</tr>
<tr>
<td>7.5 percent</td>
<td>(-) 1688.26</td>
<td>1927.19</td>
</tr>
<tr>
<td>10 percent</td>
<td>(-) 2257.62</td>
<td>2578.42</td>
</tr>
<tr>
<td>Basmati rice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 percent</td>
<td>833.92</td>
<td>(-) 566.27</td>
</tr>
<tr>
<td>5 percent</td>
<td>1011.08</td>
<td>(-) 683.55</td>
</tr>
<tr>
<td>7.5 percent</td>
<td>1189.47</td>
<td>(-) 800.62</td>
</tr>
<tr>
<td>10 percent</td>
<td>1369.10</td>
<td>(-) 917.50</td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 percent</td>
<td>3288.55</td>
<td>(-) 2986.84</td>
</tr>
<tr>
<td>10 percent</td>
<td>6586.75</td>
<td>(-) 5914.92</td>
</tr>
<tr>
<td>15 percent</td>
<td>9891.67</td>
<td>(-) 8781.62</td>
</tr>
<tr>
<td>20 percent</td>
<td>13204.50</td>
<td>(-) 11588.02</td>
</tr>
<tr>
<td>Sugarcane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 percent</td>
<td></td>
<td>146302.30</td>
</tr>
<tr>
<td>10 percent</td>
<td></td>
<td>149763.60</td>
</tr>
<tr>
<td>15 percent</td>
<td></td>
<td>153225.60</td>
</tr>
<tr>
<td>20 percent</td>
<td></td>
<td>156688.50</td>
</tr>
<tr>
<td>Onion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 percent</td>
<td>(-) 0.164</td>
<td>0.156</td>
</tr>
<tr>
<td>5 percent</td>
<td>(-) 0.164</td>
<td>0.156</td>
</tr>
<tr>
<td>7.5 percent</td>
<td>(-) 0.244</td>
<td>0.233</td>
</tr>
<tr>
<td>10 percent</td>
<td>(-) 0.323</td>
<td>0.308</td>
</tr>
<tr>
<td>Potato</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 percent</td>
<td>0.010</td>
<td>(-) 0.011</td>
</tr>
<tr>
<td>5 percent</td>
<td>0.010</td>
<td>(-) 0.011</td>
</tr>
<tr>
<td>7.5 percent</td>
<td>0.010</td>
<td>(-) 0.011</td>
</tr>
<tr>
<td>10 percent</td>
<td>0.010</td>
<td>(-) 0.011</td>
</tr>
<tr>
<td>Rapeseed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 percent</td>
<td>76.63</td>
<td>(-) 76.37</td>
</tr>
<tr>
<td>10 percent</td>
<td>157.51</td>
<td>(-) 156.90</td>
</tr>
<tr>
<td>15 percent</td>
<td>238.43</td>
<td>(-) 237.38</td>
</tr>
<tr>
<td>20 percent</td>
<td>319.85</td>
<td>(-) 317.81</td>
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CHAPTER VII
SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter consists of three sections. The first section summarizes the results of research carried out in connection with the estimation of supply and demand functions of Pakistan’s major crops, identification of protection status available to major crops and arriving at social welfare effects attached with such protection as well as welfare effects of liberalizing trade at domestic and world levels. The second section draws conclusions on the basis of supply and demand functions of major crops developed and welfare effects assessed of various scenarios. The third section presents recommendations and policy prescriptions based on the findings of the study.

7.1 Summary of Findings

This study has covered seven major crops of Pakistan’s crops sector, including wheat, Basmati rice, cotton, sugarcane, onion, potato and rapeseed. Summary of the results of analysis (covering estimation of supply and demand functions, identification of protection status available to the crops, social welfare effects associated with protection status and estimated welfare effects of liberalizing trade at domestic and world levels) are provided under related crops heading in the following paragraphs.

Wheat crop

1. A simultaneous-equations recursive econometrics model specified for capturing supply and demand functions of Pakistan wheat economy produced the following results\(^{18}\).

\[
S_d = 11040.9577 + 0.41528P_d + 2.4625FNTWT
\]
\[
D_d = 13485.77 + 0.41528P_d
\]
\[
D_d = 750.129 - 0.046974P_d + 136.07POP
\]
\[
P_t = 16896.20 - 0.046974P_d
\]
\[
I_d = 3410.43 - 0.462254P_d
\]
\[
P_t = 23.1559 + 0.91124P_w
\]
\[
I_s = 5642 + 5.2191P_i - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w
\]
\[
I_s = 268.6924 + 5.2191P_i
\]

\(^{18}\)These are the final results achieved after making several adjustments made in the short-run econometrics model tried; interested persons may see the details of adjustments made in Chapter IV.

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\[= -5521.1413 + 4.7556P_w - 0.96151S_{dt-1} + 0.68329D_{dt-1} + 0.017019S_w\]
\[= 389.5862 + 4.7556P_w\]

2. The estimated model indicates that domestic supply of wheat (S_d) largely determines by domestic wholesale price of wheat (P_d) and nutrient-fertilizers (FNTWT) used, domestic demand (D_d) by P_d and size of Pakistan’s population (POP) and import supply (I_d) by Pakistan’s predicted import price (P^*, which is pre-determined by world price P_w), Pakistan’s lagged supply and demand (S_{dt-1} & D_{dt-1}) and world current supply of wheat (S_w).

3. The wheat economy has been governed by a ‘price tax-cum-import subsidy’ regime during the pre-WTO period (1985-86 to 1994-95) and ‘price support-cum-import tax’ regime during the post-WTO period (1995-96 to 2004-05).

4. The ‘price tax-cum-import subsidy’ regime practiced during pre-WTO period faced on average Rs.761.85 million net loss per annum to the society, which resulted from Rs.3102.38 million total losses in producers surplus, Rs.3462.76 million total gains in consumers surplus and Rs.1122.25 million total cost of subsidy provided on import. The ‘price support-cum-import tax’ regime in vogue during the post-WTO period caused an overall net social welfare gain of Rs. 217.74 million per year to the society, which resulted from Rs.918.91 million per year gains in producers surplus, Rs.967.95 million losses in consumers surplus and Rs. 266.78 million gains from import tax per annum.

5. In case we compare welfare effects of existing policies to producers and consumers, then gains in consumers surplus had been greater (Rs.3462.73 million per annum) than losses in producers’ surplus (Rs.3102.38 million per annum) during pre-WTO period. In case of post-WTO period, losses to consumers had been higher (Rs.967.95 million per annum) than gains to the producers (Rs.918.91 million per annum).

6. Thus if trade liberalization was introduced in the domestic economy during pre-WTO period, it would have incurred greater losses to wheat consumers (Rs.3462.76 million) than gains to producers (Rs.3102.38 million). In case of post-WTO period, gains in consumers’ surplus (Rs.967.95 million) would have been higher than losses in producers’ surplus (Rs.918.91 million per annum).
7. In case of trade liberalization in world wheat markets\textsuperscript{19}, Pakistan’s wheat economy would have been benefited during both pre- and post-WTO periods; net social gains would have been in the range of Rs.76.88 million to Rs.320.80 million per year during earlier and Rs.40.90 million to Rs.168.54 million per year during the later period. However, consumers’ gains would have been higher than producers’ losses in both the periods.

**Basmatic rice**

8. Simultaneous-equations recursive model specified for Basmatic rice economy has turned out with the following estimated supply and demand functions.

\[
S_d = 245.5799 + 0.052582P_d + 0.37609FNT - 21.172TR \\
= -40.2421 + 0.052582P_d + 0.37609FNT \\
= 750.5248 + 0.052582P_d \\
D_d = 565.31 - 0.008451P_d + 0.011751P_WIR + 0.2002GDPPR \\
= 1043.901 - 0.008451P_d \\
E_s = -293.3762 + 0.061033P_d \\
E_d = -26.29 - 0.23247P_e + 1.1063P_w + 0.028086GDPPW \\
= 574.5015 - 0.23247P_e
\]

9. The above model indicates that domestic supply of Basmatic rice \(S_d\) is mainly determined by domestic wholesale price of Basmatic rice \(P_d\) and nutrient-fertilizers used (FNT) while GDP of Pakistan (GDPPR), price of IRRI rice (PWIR) and price Basmatic rice \(P_d\) determine domestic demand \(D_d\). The world level rice trade price \(P_w\) and world GDP (GDPPW) determine the export demand \(E_d\). Export supply \(E_s\) is determined as an identity equation \(E_s = S_d - D_d\), reflecting \(P_d\) as the major determinant.

10. The Basmatic rice economy remained under ‘price tax-cum-export tax’ regime during both, pre and post-WTO periods. This regime practiced during pre-WTO period caused on average Rs.1194.60 million per year net welfare gain to the society, which resulted from Rs.448.76 million gains in consumers’ surplus, Rs.657.95 million losses in the producers’ surplus and Rs.1403.79 million received as export tax. The same ‘price tax-cum-export tax’ policy in post-WTO period created an overall gain of Rs.2844.61 million per year to the society, resulting from Rs.430.19 million gains in consumers’

\textsuperscript{19} We assumed a 2.5 to 10 percent increase in world prices of wheat, Basmatic rice, onion and potato and 5 to 20 percent increase in that of cotton, sugarcane and rapeseed under trade liberalization in world markets and simulated its effects on Pakistan’s domestic economy.
surplus, Rs.649.48 million losses in producers’ surplus and Rs.3063.90 million received as export tax.

11. If the welfare effects of existing policies to the producers and consumers are compared, then losses in producers’ surplus had been greater (Rs.657.95 million per annum) than gains in consumers’ surplus (Rs.448.76 million per annum) during pre-WTO period. While during the post-WTO period, losses to producers had been higher (Rs.649.48 million per annum) than gains to the consumers (Rs.430.19 million per annum).

12. Thus if trade liberalization was introduced in the domestic economy during pre-WTO period, it would have acquired greater gains in producers surplus (Rs.657.95 million per year) than losses in consumers’ surplus (Rs.448.76 million per year). And during the post-WTO period, gains in the producers surplus (Rs.3649.48 million per year) would have been greater than losses in consumers surplus (Rs.430.18 million per year).

13. In case of trade liberalization in world rice markets, Pakistan’s Basmati rice economy would have been benefited during both pre- and post-WTO periods; net social gains would have been in the range of Rs.276.65 million to Rs.451.60 million per year during earlier and Rs.333.45 million to Rs.637.40 million per year during the later period. However, producers’ gains would have been higher than consumers’ losses in both the periods.

Cotton crop

14. The simultaneous-equations recursive econometrics model specified for supply and demand functions of Pakistan cotton crop produced the following results.

\[
S_d = 2281.182 + 0.016205P_d + 4.8092FNTSN + 0.002246CAT \\
= 4363.309 + 0.016205P_d \\
D_d = 2014.8 - 0.12361P_d + 0.16801GDPPR + 236.14TR \\
= 5547.909 - 0.12361P_d \\
E_s = -1184.600 + 0.139815P_d \\
E_d = -142.35 - 3.8984P_e + 4.1879P_w \\
= 1791.517 - 3.8984P_e
\]

15. The estimated model reflects that domestic supply of cotton (S_d) is determined by domestic price (P_d), nutrient-fertilizers used in cotton crop (FNTSN) and credit (CAT) available. The domestic demand (D_d) is determined by domestic price (P_d) and Pakistan’s GDP (GDPPR). The Pakistan level cotton export trade price (P_e) and world
level trade price ($P_w$) determines the export demand ($E_d$) of Pakistan’s cotton.

16. The cotton crop economy remained under ‘Export-tax’ regime during pre-WTO period (1985-86 to 1994-95) and ‘depressed prices’ regime during post-WTO period (1995-96 to 2004-05). The ‘Export-tax’ regime practiced during pre-WTO period caused on average Rs.296.82 million per year net social welfare gains to the society, which resulted from Rs.6496.10 million losses in producers surpluses, Rs.5835.34 million gains in consumers surpluses and Rs.957.59 million gains in the form of export tax. The ‘Depressed Price’ regime practiced during post-WTO period produced Rs.683.55 million losses per year to the society, which resulted from Rs.12648.44 million losses in producers’ surplus, Rs.12463.10 million gains in consumers’ surplus and Rs.498.21 million as cost to the society incurred due to the imports, which were made at higher prices for better quality of cotton coupled with higher domestic demand for import due to depressed production induced by lower domestic prices.

17. In case welfare effects of existing policies to producers and consumers are compared, then losses in producers’ surplus had been greater (Rs.6496.10 million per annum) than gains in consumers’ surplus (Rs.5835.34 million per annum) during pre-WTO period. In case of post-WTO period, losses to producers had been higher (Rs.12648.44 million per annum) than gains to the consumers (Rs.12463.10 million per annum).

18. In case trade liberalization was introduced in Pakistan’s domestic economy, it would have created greater gains in producers’ surplus (Rs.6496.10 million per year) than losses in consumers’ surplus (Rs.5835.34 million per year) during the pre-WTO period. While in case of post-WTO period, gains in producers’ surplus (Rs.12648.44 million per year) would have been greater than losses in consumers’ surplus (Rs.12463.10 million per year).

19. In case of trade liberalization in world cotton markets, Pakistan’s cotton economy would have been benefited during both pre- and post-WTO periods; net social gains would have been in the range of Rs.302.11 million to Rs.1616.48 million per year during earlier and Rs.78.50 million to Rs.660.88 million per year during the later period. However, producers’ gains would have been higher than consumers’ losses in the earlier period and consumers’ gains would have been higher than producers’ losses during the later period.
Sugarcane crop

20. The simultaneous-equations recursive econometrics model of supply and demand functions developed for sugarcane crop has given the following results.

\[
S_{dsc} = 5987.70 + 0.0968173P_{dsr} + 4.356FNT + 0.20343WAT \\
= 39421.93 + 0.096817P_{dsr}
\]

\[
D_{dsc} = 34442.31 - 0.11033P_{dsr} + 4.6073GDP \\
= 43909.85 - 0.11033P_{dsr}
\]

\[
P_{isr} = -18.407 + 0.93649P_{wsr}
\]

\[
I_{ssc} = -13681.00 + 20.049P_{isr}^\hat{} - 0.46585S_{d}^\hat{} + 0.65814D_{d}^\hat{}
\]

\[
= -4865.193 + 20.049P_{isr}
\]

21. The results reflect that domestic supply of sugarcane \((S_{dsc})\) is determined by domestic price of sugar \((P_{dsr})\), nutrient-fertilizers used \((FNT)\) and water available \((WAT)\) and domestic demand \((D_{dsc})\) is determined by price of sugar \((P_{dsr})\) and Pakistan’s GDP \((GDP)\). Unlike other crops, sugarcane is not imported into or exported from Pakistan.

We have therefore, converted white sugar imports into its cane equivalent; consequently, we have a cane import supply \((I_{ssc})\) function, which is determined by Pakistan’s predicted import price of sugar \((P_{isr}^\hat{})\) and Pakistan’s predicted supply and demand of sugarcane \((S_{dsc}^\hat{} & D_{dsc}^\hat{})\).

22. The sugarcane economy of Pakistan was governed by a ‘price support-cum-import tax’ regime during both pre and post-WTO periods. This policy had resulted in Rs.270.11 million net social welfare gains per year to the society during pre-WTO period\(^{20}\). The composition of this benefit included Rs.134671.18 million gains in producers’ surplus, Rs.142842.28 million losses in consumers’ surplus and Rs.8441.20 million received by the government as import tax. The same policy remained in vogue during post-WTO and resulted in Rs.1911.61 million gains per year to the society, being an outcome of Rs.199521.21 million gains in producers’ surplus, Rs.208424.66 million losses in consumers’ surplus and Rs.10815.05 million gained as import tax.

23. When welfare of producers and consumers are compared, losses in consumers’ surplus had been greater (Rs.142842.28 million per annum) than gains in producers’ surplus.

\(^{20}\) These welfare estimates are based on supply and demand functions of sugarcane wherein the price of white sugar is taken as determinant of cane’s supply, demand and imports. Hence, gains or losses shown here would represent the direction of gains and losses in the social welfare of the two stakeholders of cane and white sugar; however, these would not reflect in what proportion the two stakeholders would gain or lose.
surplus (Rs.134671.18 million per annum) during pre-WTO period. In the post-WTO period too, the losses in consumers’ surplus had been higher (Rs.204824.66 million per annum) than gains to the producers’ surplus (Rs.199521.21 million per annum per year).

24. If trade liberalization was affected in domestic economy, it would have produced greater gains to consumers worth Rs.142842.28 million and Rs.204824 million per year, on average, than losses to producers valuing Rs.134671.18 million and Rs.199521.21 million per year during the pre- and post-WTO periods respectively.

25. In case of trade liberalization in world sugar markets, Pakistan’s sugarcane economy would have been benefited during both pre- and post-WTO periods; net social gains would have been in the range of Rs.8400.20 million to Rs.9096.65 million per year during earlier and Rs.26677.00 million to Rs.27939.61 million per year during the later period. However, consumers’ gains would have been higher than producers’ losses in both the periods.

**Onion crop**

26. The supply and demand functions of Pakistan’s onion crop, specified as a simultaneous-equations recursive model, yielded the following empirical results.

\[
S_d = -7398.232 + 1.76686P_d + 8.0593FNTON \\
= -7246.984 + 1.76686P_d \\
D_d = -153 - 0.012243P_d + 0.029129PCI + 5.3718POT \\
= 931.346 - 0.01224P_d \\
P_e = 47.671 + 0.31415P_w \\
E_s = -8178.329 + 1.77910P_d \\
E_d = -307.159 - 0.08959P_e + 0.0089GDPWD + 0.1470S^d \\
= 57.956 - 0.08959P_e
\]

27. It appears that domestic supply (S_d) of onion is determined by the domestic price (P_d) and nutrient-fertilizers used (FNTON) while its domestic demand (D_d) is influenced by domestic price (P_d), consumers per capita income (PCI) and size of Pakistan’s population. The export demand (E_d) of onion is determined by Pakistan’s export trade price (P_e), world GDP and predicted domestic supply (S^d) of onion.

28. A free trade situation prevailed in case of onion in Pakistan’s domestic economy during both pre- and post-WTO periods. However, during pre-WTO period, Pakistan had to face low export price due to export of low quality onion. Hence Pakistan had to bear net social welfare cost worth Rs.47.22 million per year during pre-WTO period. During
post-WTO period, Pakistan exported onion on a little higher price and gained net social welfare of Rs.15.09 million per year.

29. Though an approximate-free trade situation prevailed in Pakistan’s onion domestic economy, its exports faced low prices. During post-WTO period, onion’s exports received higher prices (US$151.78 per M. ton) than its domestic market (US$144.26 per M. ton) but it still could not be benefited from the world average price (US$260.56 per M. ton). This suggests that the quality of Pakistan’s onion would need improvements up to a level world major market desires.

30. Pakistan’s onion domestic market is already exercising free trade. If trade liberalization was introduced in the world onion market, it would have incurred a negligible net social cost in the range of Rs.0.007 million to Rs.0.015 million per year during the pre-WTO period and Rs.0.002 million to Rs.0.015 million per year during the post-WTO period.

**Potato crop**

31. The supply and demand functions of Pakistan’s potato crop, specified as a simultaneous-equations recursive model, yielded the following empirical results.

\[ S_d = 535.3725 + 0.04004 P_d + 11.435\text{FNTPO} + 0.00000205\text{CAT} \]
\[ = 875.657 + 0.04004P_d \]

\[ D_d = -2.6662 - 0.048992P_d + 0.052187\text{PCI} + 3.7324\text{POT} \]
\[ = 1241.395 - 0.048992P_d \]

\[ E_d = 83.453 - 0.000213P_e + 0.008997\text{GDPWD} - 0.000614S_w - 0.0168E_w \]
\[ = 19.87223 - 0.000213P_e \]

\[ E_s = -8178.341 + 1.779103P_d \]

32. The domestic supply \((S_d)\) function of potato is determined by domestic price \((P_d)\), nutrient-fertilizers used \((\text{FNTPO})\) and credit available \((\text{CAT})\) while domestic demand \((D_d)\) by domestic price \((P_d)\), Pakistan’s per capita income \((\text{PCI})\) and Pakistan’s population \((\text{POT})\). The export demand \((E_d)\) of potato is determined by Pakistan’s average export trade price, GDP of the world \((\text{GDPWD})\) and world levels of supply \((S_w)\) and export \((E_w)\) of potato.

33. Like onion in potato too, there has been free trade situation prevailed in potato’s domestic economy during pre- and post-WTO periods. Pakistan did export its potato on prices higher than its domestic price but could not receive the world average price due to quality below the world average standard level. Due to prevalence of free trade situation,
very negligible effects found in terms of producers and consumers’ surpluses. Since
exports were made on a higher price relative to Pakistan’s domestic price, export tax
worth Rs.2.75 million and Rs.47.92 million per year were generated during the pre- and
post-WTO periods, respectively.

34. Free trade is already operative in Pakistan’s potato domestic economy. In case
trade liberalization is introduced at global level, it would have no significant effect on
Pakistan’s domestic economy unless quality of Pakistan’s potato improves.

Rapeseed crop

35. The supply and demand functions of Pakistan’s rapeseed crop, specified as a
simultaneous-equations recursive model, produced the following empirical results.

\[ S_d = -50.98 + 0.68686 \, P_d + 5.7996 \, F N T R D \]
\[ = 260.0826 + 0.000319 P_d \]
\[ D_d = 254.89 - 0.000373 P_d + 0.27467 \, G D P P R + 32.234 \, T R \]
\[ = 384.1446 - 0.000373 P_d \]
\[ I_d = 124.062 - 0.000692 P_d \]
\[ P_i = -2.209 + 0.87303 P_w \]
\[ I_s = -63.097 + 0.14371 P_i - 0.8321 S_d^* + 0.95306 D_d^* \]
\[ = 77.21784 + 0.14371 P_i \]
\[ = 75.45176 + 0.125463 P_w \]

36. The estimated model indicates that the domestic supply \( (S_d) \) is influenced by
domestic price \( (P_d) \) of rapeseed and nutrient-fertilizers used in rapeseed crop \( (F N T R D) \)
and domestic demand \( (D_d) \) is determined by domestic price \( (P_d) \) and Pakistan’s GDP
\( (G D P P R) \). The import supply \( (I_s) \) is determined by predicted average import trade price
\( (P_i) \) of rapeseed (which in turn determined by world average trade price; \( P_w \)), predicted
domestic supply \( (S_d^*) \) and predicted domestic demand \( (D_d^*) \) for rapeseed.

37. The rapeseed crop economy of Pakistan remained under ‘no-export’ quota regime
during pre-WTO period and governed by ‘price support’ policy during post-WTO period.
The ‘no-export’ quota regime of pre-WTO period caused a net social welfare loss worth
Rs.0.259 million per year to the society, which resulted from Rs.193.31 million losses in
producers’ surplus and Rs.193.05 million gains in consumers’ surplus. The ‘price support’
regime of post-WTO was analyzed using two alternate options, first based on Pakistan’s
free trade price and second on world average trade price. Since the estimated \( P_{1f} \) in the
first option turned out to be much higher than the actual world average trade price, the
second option's welfare effects were therefore estimated basing on world average price. The first option results revealed Rs.1027.16 million losses per year to the society, due to Rs.510.76 million losses in consumers' surplus, Rs.266.55 million gains in producers' surplus and Rs.782.65 million losses in terms of cost of import policy. The estimates of second option results showed an overall welfare loss of Rs.788.72 million per year to the society. The composition of this net loss includes gains of Rs.1183.34 million in producers' surplus, losses of Rs.2275.22 million in consumers' surplus and a gain of Rs.788.72 million through import tax.

38. In case changes in producers and consumers' surpluses are compared, then losses in producers' surplus (Rs.193.31 million per annum) had been slightly higher than gains in consumers' surplus (Rs.193.05 million per annum) during pre-WTO period. However, during post-WTO period, losses in consumers' surplus had been higher by Rs.510.76 million and Rs.2275.22 million per year, than gains in the producers' surplus by Rs.266.55 million and Rs.1183.34 million per year for the first and second options, respectively.

39. Thus the domestic economy of rapeseed would have been benefited in both pre- and post-WTO periods if free trade was exercised. The gains in producers surplus (Rs.197.52 million per year) would have been higher than losses in consumers surplus (Rs.197.25 million per year) during pre-WTO scenario. While gains in consumers' surplus would have been greater (Rs.510.76 million per year) than losses in producers' surplus (Rs.266.25 million per year) as far as first option is concerned; gains in consumers' surplus would have been greater (Rs.2275.22 million per year) than losses in producers' surplus (Rs.1183.34 million per year) as per second option's estimates during post-WTO period.

40. In case of trade liberalization in world rapeseed markets, Pakistan's rapeseed economy would have been benefited during both pre- and post-WTO periods; net social gains would have been in the range of Rs.0.26 million to Rs.1.85 million per year during earlier and Rs.732.40 million to Rs.2940.61 million per year during the later period. However, producers' gains would have been higher than consumers' losses in the earlier period and consumers' gains would have been higher than producers' losses during the later period.
7.2 Conclusions

The aforementioned findings help to draw following conclusions regarding Pakistan’s crop sector and effects of trade liberalization introduced/to be introduced under WTO.

First, there has been different policy interventions exercised in Pakistan’s crop sector. Wheat has been subjected to ‘price tax-cum-import subsidy’ during pre-WTO and ‘price support-cum-import tax’ during post-WTO period. Basmati rice has remained under ‘price tax-cum-export tax’ regime during both, pre and post-WTO periods. The cotton crop economy has been under ‘Export-tax’ regime during pre-WTO period and ‘depressed prices’ regime during post-WTO period. The economy of sugarcane has been governed by ‘price support-cum-import tax’ policy during both pre- and post-WTO periods. As far as onion and potato crops are concerned, there has been free trade situation prevailed in the domestic economy during both pre- and post-WTO periods. In case of onion, Pakistan had to face low export price due to export of low quality onion, while in case of potato, it exported potato on prices higher than its domestic price but could not receive the world average price due to quality below the world average standard level. In case of rapeseed, no trade was permitted during pre-WTO period but imports were allowed during post-WTO period.

Second, the aforementioned policy interventions seem to have been lessened during post-WTO period as reflects from relatively lower gaps between Pakistan’s domestic prices and world prices than that of pre-WTO period. During post-WTO period, the interventions produced net welfare gains in almost all cases with the exception of rapeseed. The interventions in the form of import subsidy/tax, export subsidy/tax, government handling of the commodity, government policy encouraging or discouraging monopoly/cartels and quality of the commodities (in some of the cases) played important role in determining net social gains or losses. Such subsidies and taxes would vanish in case of trade liberalization; a comparison of the welfare effects in terms of producers and consumers’ surpluses therefore seems in order. When changes in producers and consumers’ surpluses are compared, losses have been heavier than gains in all commodities studied. However, in two crops, Basmati rice and cotton, interventions caused more losses (Rs.649.48 million and Rs.12648.44 million per year) to the producers than benefits to consumers (Rs.430.19 million and Rs.12463.10 million), respectively. In contrast, in three other crops namely wheat, sugarcane and rapeseed, losses (Rs.967.95 million, Rs.208424.66 million and Rs.510.76 million 1st option and
Rs.2275.22 million 2nd option) to consumers have been higher than gains (Rs.918.91 million, Rs.199521.21 million and Rs.266.25 million 1st option and Rs.1183.34 million) to producers, respectively. In the remaining two crops, onion and potato, free trade situation had prevailed, which caused minimal but higher losses (Rs.0.52 million and Rs.0.0043 million per year) to producers than gains (Rs.0.50 million and Rs.0.0042 million) to consumers, respectively.

Third, in case the trade liberalization was introduced in Pakistan’s domestic economy, gains would have been greater than losses in terms of producers and consumers’ surpluses for all the commodities studied. In two crops, Basmati rice and cotton, gains to the producers would have been higher on average by Rs.649.48 million and Rs.12648.44 million per year than losses of Rs.430.19 million and Rs.12463.10 million per year to consumers during post-WTO period (1995-2005), respectively. Whereas in case of wheat, sugarcane and rapeseed, higher gains (Rs.967.95 million, Rs.208424.66 million and Rs.510.76 million 1st option and Rs.2275.22 million 2nd option) would have accrued to consumers than gains (Rs.918.91 million, Rs.199521.21 million and Rs.266.25 million 1st option and Rs.1183.34 million) to producers, respectively. In case of onion and potato, free trade situation had already prevailed with minimal negative or positive social effects.

Fourth, if trade liberalization was introduced in the world market, it would have negligible effects of world prices in cases of onion and potato, and substantial effects in cases of other crops like wheat, Basmati rice, cotton, sugarcane and rapeseed. In all five cases of crops, where effects are substantial, net social welfare effects are turned out to be positive. However, in cases of wheat and sugarcane, consumers seem to be benefited more than losses to the producers in both pre- and post-WTO scenarios. In case of Basmati rice, producers’ gains are higher than losses to the consumers. In cases of cotton and rapeseed, producers’ gains were higher than consumers’ losses during pre-WTO period and consumers’ benefits are higher than producers’ losses during post-WTO scenario.

Fifth, in cases of certain crops, quality seemed to have been a major factor in determining import/export prices, consequently affecting welfare effects. Pakistan had to import high quality cotton on higher price than its domestic market prices. In cases of onion and potato, Pakistan had to export on lower prices and could not receive the world prices due to quality of its commodities below the world acceptable standard level.
7.3 Recommendations

Based on the analysis carried out in previous chapters, discussions made and conclusions drawn, the following recommendations are made as policy prescription for appropriate actions at various stakeholders’ levels.

1. In a good number of the estimated supply and demand functions of commodities under study, own prices seem to have not been significantly working due mainly to government interventions, which prohibited the market forces to work. Therefore, government interventions should be minimized to let market forces properly work.

2. The intensity of government policy interventions seem to have been lessened during post-WTO period as reflects from relatively lower gaps between Pakistan’s domestic prices and world prices than that of pre-WTO period. This trend of lowering gap between domestic and international prices should be continued till the two prices arrive at the same level.

3. Amongst the various variables determining supply of commodities studied, nutrient-fertilizers have found to have played significant role. Therefore, supply of various nutrient-fertilizers, their availability at appropriate times and their use on crops in recommended proportions should be given due attention in future input use policy.

4. The estimated welfare effects of existing domestic policy interventions in terms of producers and consumers’ surpluses revealed heavier losses than gains in almost all commodities studied. Trade liberalization simulations worked out for post-WTO period reflected that producers’ gains in case of Basmati rice and cotton and consumers’ gains in cases of wheat, sugarcane and rapeseed would have been higher relative to losses to their counterparts if trade liberalizations were introduced. Hence, Pakistan should implement trade liberalization as per procedures set by WTO. Pakistan would need to take some particular crop specific steps elaborated in the following recommendations.

First, in the recent past (1995-05), Pakistan kept its wheat domestic price higher than world average, imported wheat at lower price and sold it in the domestic market at higher price and consequently caused higher losses to consumers than gains to producers. Remedy thus lies in allowing world price to prevail.

Second, in case of Basmati rice, export prices were kept higher than domestic prices and consequently producers suffered more than gains to consumers. The situation improved in second period of study (1995-05) when the gap between domestic and export
prices narrowed down relative to the first period of study. This trend should be continued to arrive at a free trade situation. This motive can be achieved allowing more and more exporters to export rather than restricting Basmati exports to a group of exporters acting as a cartel.

Third, similar to Basmati rice, the domestic prices of cotton were kept lower than world prices; consequently producers suffered and Pakistan transformed from a net exporter during 1985-95 to a net importer during 1995-05. In addition, Pakistan had to import high quality cotton. To eliminate the present losses to producers, which are greater than the gains in consumers’ surpluses, world level prices should be allowed to prevail in domestic economy. Cotton breeders should also explore developing cotton varieties capable of producing quality fiber, whose demand is on increase with advancement in textile industry.

Fourth, domestic prices of sugar were kept higher than the world prices, producing gains in producers’ surpluses much lower than losses in consumers’ surpluses\(^\text{21}\). Hence, world level sugar prices should be allowed to prevail to help vanishing existing welfare losses.

Fifth, free trade situation exists in Pakistan’s onion and potato domestic markets, but Pakistan can not obtain the benefits of much higher world prices due to low quality of these commodities. Hence, quality improvements should be the priority actions in these two commodities cases.

Sixth, due to non-allowing of exports of rapeseed during earlier period (1985-95), domestic rapeseed prices remained depressed and much lower than the world prices. Consequently, Pakistan which was capable of exporting its rapeseed at higher world prices became importer during later period (1995-05) of study. Currently (1995-05), rapeseed domestic prices are much higher than world average prices, which help produce gains to producers but such gains are much lower than losses to consumers. World prices should therefore be allowed to prevail to minimize welfare losses.

5. Trade liberalization simulations worked out for world market reflect higher consumers’ gains for wheat, cotton, sugarcane and rapeseed and producers’ gains for Basmati rice and onion than the losses to producers and consumers, respectively. Pakistan

\(^{21}\) The estimates of welfare are based on supply and demand functions of sugarcane wherein the price of white sugar is taken as determinant of cane’s supply, demand and imports. Hence, the estimated gains or losses represent the direction of gains and losses in the social welfare of the two stakeholders of cane and white sugar; however, these would not reflect in what proportion the two stakeholders would gain or lose.
should therefore keep its efforts continue for implementation of WTO’s induced trade liberalization on global basis and especially by the major global players particularly US, EU and other OECD countries.

6. Government of Pakistan is involved, directly or indirectly, in trading of agricultural commodities in the forms of trading through State Trading Enterprises (STEs), setting minimum export and maximum import price levels, allowing limited numbers of private traders to export or import and banning import or export of the commodities. WTO allows STEs with the condition that these do not hurt private sector and recommends that the role of STEs be gradually reduced. Pakistan should intensify its efforts for liberalizing trade in all these stated areas.

7. Government of Pakistan should step up its role as facilitator of trade as envisaged in the ‘Green Box’ of Agreement on Agriculture and other WTO agreements. More importance should be given to research, development and out-reach areas and to the introduction and adoption of international quality standards developed by FAO/WHO’s Codex Alimentarius Commission.
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