Impact of Domestic Policies towards Agricultural Trade Liberalization and Market Reform on Food Security in Pakistan

Ahmad, Munir and Croraton, Caesar and Qayyum, Abdul and Iqbal, Muhammad and Dorosh, Paul

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by

Munir Ahmad, Caesar Cororaton, Abdul Qayyum, and Muhammad Iqbal

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ABSTRACT

The performance of the agriculture sector over the last four decades remained quite satisfactory with an average growth rate of 3.4 percent per annum higher than the population growth rate in the country. Still the country is far behind in its efforts to provide an acceptable level of dietary requirement to its people even at the aggregate level. The daily average availability of calories per person in the country is significantly lower than the other developing and developed nations. Though share of wheat is declining overtime, it is still the dominant source of total calories intake and thus plays a vital role in food security in the country.

Regardless of the reasonable rate of growth in agriculture sector, caloric based poverty increased during the 1990s may be due to the worsening income and landholdings inequality. Further to note is the fact that despite significant improvement in food supply in the aggregate, malnutrition is a widespread phenomenon in Pakistan.

The government of Pakistan had been pursuing interventionist policies quite actively in agricultural inputs as well as outputs markets to ensure food security. Though most of these interventions have now been abolished, but some still remains. Particularly, wheat marketing mainly is being handled by the public sector. The comparison of the incidentals of government-owned departments with that of the private traders clearly shows inefficiency of the former. In addition to cost difference, the corruption is pervasive in commodity marketing particularly in public sector.

Eliminating the government interventions the results of the CGE model lead us to draw four major conclusions: 1) price of wheat would turn out to be too high to be

affordable to the consumers; 2) Production may not increase much to compensate to bring the consumer prices down; 3) The loss in consumer surplus will be more than the producer gain; and 4) All household groups will face lower welfare except the urban non-poor: The latter may look for cheaper food substitutes. The reader is however cautioned for careful implications of these results obtained from static CGE model. The dynamic long-run effects have not been captured in this model.

Though the existing system of procurement and distribution creates disincentives for the private sector to invest in wheat trade, it however may not be advisable to leave the wheat economy fully at the behest of the markets owing to the importance of wheat in household consumption and production. It is suggested that the government should slowly step out of the food market and let the market function freely. However, the system of effective **monitoring** and maintaining an optimal size of buffer stock for wheat can avoid extreme food price fluctuations and shortages in the country. **T**he stock purchase and release by the government should be based on market prices.

ACRONYMS

AM&SL	Agricultural Marketing and Storage Limited
APCOM	Agricultural Prices Commission of Pakistan
CBR	Central Board of Revenue
CEC	Cotton Export Corporation of Pakistan
CGE	Computable General Equilibrium
CPI	Consumer Price Index
EPC	Effective Protection Coefficient
FAO	Food and Agriculture Organization
FAOSTATS	Food and Agriculture Organization Statistics
FAQ	Fair Average Quality
FBC	Federal Bank for Cooperatives
GCP	Ghee Corporation of Pakistan
GDP	Gross Domestic Product
MINFAL	Ministry of Food, Agriculture and Livestock
NFC	National Fertilizer Corporation
NPC	Nominal Protection Coefficient
O&M	Operation and Maintenance
PASSCO	Pakistan Agricultural Services and Storage Corporation
PFDs	Provincial Food Departments
REC	Rice Export Corporation of Pakistan
SAM	Social Accounting Matrix
SOE	State Owned Enterprises
TCP	Trading Corporation of Pakistan
TOT	Terms of Trade
WAPDA	Water and Power Development Authority
WTO	World Trade Organization
ZTBL	Zarai Traqiati Bank Limited

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IMPACT OF DOMESTIC POLICIES TOWARDS AGRICULTURAL TRADE LIBERALIZATION AND MARKET REFORM ON FOOD SECURITY IN PAKISTAN

Munir Ahmad[1], Caesar Cororaton[2], Abdul Qayyum[3], and Muhammad Iqbal[4]

1. INTRODUCTION

Agriculture is the largest income and employment-generating sector of Pakistan's economy. Its' contribution to gross domestic product (GDP) exceeds 23 percent and to employment 42 percent. Exports of raw and processed agricultural products make the major source of national foreign exchange earnings. The sector provides raw materials to domestic industrial sector and acts as an important source of demand for manufactured products. Because of its extensive inter-linkages with rest of the economy, it is widely believed that country's agriculture must maintain a high growth rate in order to ensure a rapid growth of national income, attaining macroeconomic stability, effective employment of growing labor force, improving distributive justice, enhancing food security, and a reduction in rural poverty in Pakistan (Naqvi et. al., 1992 and 1994) and (Mellor, 1988).

The performance of the agricultural sector from 1960 to 2004 was quite satisfactory with an average growth rate of 3.4% per annum. However, there were wide year-to-year fluctuations in growth rates during this period. Within the agricultural sector,

[1]Chief of Research, Pakistan Institute of Development Economics, Islamabad, Pakistan. Email: camunir@hotmail.com
[2] Research Fellow, Markets, Trade, and Institutions Division, International Food Policy Research Institute, Washington D.C. USA. Email: c.cororaton@cgiar.org
[3]Associate Professor, Financial Economics (Monetary Issues and Stock Market Behaviour) Section, Pakistan Institute of Economic Research, Islamabad, Pakistan. Email: qayyumdr@hotmail.com.
[4] Senior Research Economist, Agriculture Section, Pakistan Institute of Development Economics, Islamabad, Pakistan.

the livestock sub-sector grew relatively faster with an annual growth rate of 3.5%. The growth in cereal production was nearly 3.5%. Cereals constitute roughly 97% of the total food grains output including all pulses. Within cereals, wheat is the major food grain contributing about 74% to total production of cereals.

Among the food grains, wheat and rice both grew at faster rates at 3.7% per annum while the growth rates of maize, other cereals, gram and other pulses were 3.4, 0.13, 0.05, and 0.3% respectively (Table 1). Dominant source in growth of wheat, rice and maize has been the higher productivity per unit of land, while in other food grains, the productivity either has declined or the increase is only marginal. The reasons for this trend are the absence of technological breakthroughs in seeds and production technologies for these crops, and changes in consumption pattern towards superior cereals. The other reason is that the public sector R&D efforts remained focused on major crops including wheat, cotton and rice, while the other crops got very little attention.

However, the government of Pakistan has a history of intervening in agricultural markets resulting into under pricing of commodities relative to world levels (Chaudhry, 2001; Dorosh and Valdes, 1990; Nabi, Hamid and Naseem, 1990). Though most of the government interventions have been removed and the markets operate freely, except wheat.[5] The wheat market in the country is characterized by significant government interventions in pricing, procurement, stocking, distribution and transportation. These

[5] The details are given latter sections of the study.

interventions involves heavy subsidy every year ranging from Rs.2.8 billion in 1990/91 to Rs.12.4 billion in 2002/03 (Faruqee, 2005).

Various empirical studies relating to effect of government interventions in wheat marketing in Pakistan are found in literature including Dorosh and Valdes (1990), Hamid et al (1990), Barkley (1992), Ashfaq, Griffith and Parton (2001), and Abedullah and Ali (2001). All of these studies relied on partial measures of analysis, which do not capture the policy effects on all sectors of the economy. The policy interventions often have economy wide effects that can be analyzed using the general equilibrium framework. No systematic work is found to date evaluating the economy wide effects of government interventions in agriculture. This paper bridges this gap providing the detailed review of government policies in agriculture sector in general and wheat in particular, and uses the Computable General Equilibrium framework to analyze the economy wide effects of domestic trade liberalization as well as on food security.

The paper is divided into eight sections. Section two discusses the factors relevant for food security. . The government interventions in agriculture sector are reviewed in section three. Procurement and distribution of food grains are discussed in section four. The fifth section analyzes efficiency and cost-effectiveness of the existing system of procurement and distribution. Section six presents the framework and the results of the CGE model. Section seven discusses the policy options and section 8 concludes.

Table 1—Growth rates of area, production, and yield for various food grains

Year	Wheat	Rice	Maize	Other Cereals	All Cereals	Gram	Other Pulses
Area Growth Rates (%)							
1959/60 to 1969/70	2.75	3.37	3.34	-1.60	2.19	-1.87	-3.28
1969/70 to 1979/80	1.18	2.55	0.88	-1.23	1.11	2.16	0.29
1979/80 to 1989/90	1.40	0.39	2.34	-0.35	1.10	-0.83	0.99
1989/90 to 1999/00	0.85	1.99	1.21	-3.63	0.73	-0.70	-0.34
1999/00 to 2000/01	-3.34	-5.53	-1.87	8.19	-2.94	-6.89	-5.15
2000/01 to 2001/02	-1.50	-11.03	-0.21	3.14	-2.91	3.20	5.19
2001/02 to 2002/03	-0.30	5.25	-0.64	-9.93	-0.06	3.10	3.36
2002/03 to 2003/04	2.27	10.61	1.28	29.94	5.57	1.97	2.82
1959/60 to 2003/04	**1.17**	**1.60**	**1.52**	**-0.78**	**1.01**	**-0.34**	**-0.35**
Yield Growth Rates (%)							
1959/60 to 1969/70	4.31	6.69	1.38	3.48	4.86	0.24	1.86
1969/70 to 1979/80	3.30	0.74	2.15	0.49	2.75	-4.89	-0.33
1979/80 to 1989/90	1.70	-0.38	1.01	-0.50	1.29	9.53	-0.51
1989/90 to 1999/00	3.52	3.32	2.57	1.63	3.61	0.75	1.93
1999/00 to 2000/01	-6.66	-1.41	1.34	-3.38	-5.65	-24.44	-0.56
2000/01 to 2001/02	-2.71	-9.15	1.49	1.00	-3.66	-11.62	-1.70
2001/02 to 2002/03	5.57	9.64	5.10	-0.33	6.56	80.67	6.35
2002/03 to 2003/04	-0.60	-2.12	7.83	-1.25	-1.67	-11.23	-0.99
1959/60 to 2003/04	**2.50**	**1.99**	**1.80**	**0.93**	**2.44**	**0.39**	**0.66**
Production Growth Rates (%)							
1959/60 to 1969/70	7.18	10.28	4.77	1.83	7.17	-1.67	-1.48
1969/70 to 1979/80	4.52	3.30	3.04	-0.76	3.90	-3.81	-0.03
1979/80 to 1989/90	3.12	0.01	3.37	-0.86	2.41	7.95	0.47
1989/90 to 1999/00	4.39	5.37	3.82	-2.06	4.37	0.06	1.58
1999/00 to 2000/01	-1.14	-6.87	-0.54	4.45	-8.44	-29.73	-5.68
2000/01 to 2001/02	-0.47	-19.18	1.28	4.26	-6.45	-8.82	3.40
2001/02 to 2002/03	0.57	15.41	4.39	-10.22	6.50	86.46	9.92
2002/03 to 2003/04	1.65	8.26	9.21	28.31	3.81	-9.48	1.80
1959/60 to 2003/04	**3.72**	**3.66**	**3.38**	**0.13**	**3.50**	**0.05**	**0.30**

Source: Pakistan (2004 and previous issues).
Note: Figures in this Table are computed from Annexure Table 1.

2. FACTORS IN FOOD SECURITY

The concept of food security surfaced during the mid-1970s resulting from the world food crises (FAO, 2003). According to FAO, food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This definition encompasses four dimensions: availability, stability, access, and nutritional status. Keeping in view these dimensions we assess the food security situation in Pakistan.

2.1. AVAILABILITY OF FOOD GRAINS

Agricultural production is the foundation of food availability, especially for calorie and protein. Pakistan has made significant progress in terms of production particularly in major cereals. Per capita availability of cereals increased from 118 kilograms in 1961 to 154 kilograms in 2002, more than 80% of which is accounted for by wheat alone (Table 2).[6] Being the staple food, wheat accounts for over 37% of the cultivated area. Its performance affects the economic growth, import bill, and the nutritional status of the people of Pakistan. Hence, it occupies a pivotal position in national food security goals.

[6] The data is obtained from FAOSTATS food balanced spreadsheets. The latest update includes information till 2002.

Table 2—Production and per capita availability of cereals in Pakistan

Year	Production	Change in Stock	M-X (imports-exports)	Total Availability	Consumption	Per Capita Availability Kg/Year
Cereals ('000 tonnes)						
1961	6167	-308	912	6771	5996	120.2
1970	10999	336	-113	11223	9994	161.6
1980	15514	-1108	-541	13855	11729	145.2
1990	19328	-1279	1305	19356	18504	151.8
1995	23055	-2143	859	21771	18957	151.8
2000	28062	-2204	-1023	24835	21570	151.2
2001	25109	3277	-3080	25296	22287	152.4
2002	24936	3818	-2678	26076	23099	154.1
Wheat ('000 tonnes)						
1961	3814	-308	1080	4586	4204	84.2
1970	7294	336	121	7751	7137	108.6
1980	10856	-1217	601	10240	9104	112.7
1990	14316	-691	2045	15670	14223	128.2
1995	17002	-2243	2702	17462	15759	125.9
2000	21079	-1995	997	20071	17959	125.9
2001	19024	1982	-686	20320	18415	125.9
2002	18227	3469	-1023	20684	18859	125.8

Source: FAOSTATS (August 2004).

The government of Pakistan has been trying to maintain the 2,400 calories per person per day availability since early 1990s from a level of 1,754 calories per person per day in 1961 (Table 3). However, daily average availability of calories per person in the country is lower by 10 and 26% relative to the averages in other developing and developed counties respectively.[7] . The change in diet composition overtime shows a shrinking share of wheat in total calories consumed and a rising share of calories from animals and other sources (Table 3). The share of wheat declined from 48% in 1990 to 41% in 2002 while the share of other cereals declined from 20% in 1970 to 11% in 1990

[7] Average per person per day calorie availability was 2700 in Asia, 2663 in developing, and 3246 in developed countries, while the world average was 2792 in 2002 (FAOSTATS (August 2004).

and has remained at that level since. The share of livestock products in calorie intake increased from 12% in 1970 to 18% in 2002. The share of other items (vegetable oils, vegetables, fruits and sweeteners) has been nearly constant after 1980.

Table 3—Per capita availability of calories and shares of various sources

Year	Total		Wheat		Other Grains		Pulses		Animal		Others	
	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%	Calories	%
1961	1754	100	742	42	342	19	114	6	260	15	296	17
1970	2203	100	984	45	438	20	77	3	257	12	447	20
1980	2124	100	967	46	304	14	49	2	261	12	543	26
1990	2410	100	1153	48	274	11	58	2	309	13	616	26
1995	2345	100	1048	45	212	9	59	3	353	15	673	29
2000	2447	100	1000	41	244	10	68	3	436	18	699	29
2001	2426	100	1000	41	256	11	58	2	436	18	676	28
2002	2419	100	999	41	275	11	59	2	437	18	649	27

Source: FAOSTATS (August 2004).

Domestic production, commercial imports and food aid are the main constituents of availability at the national level. . The growth in agricultural production in Pakistan came mainly from the introduction of green revolution technologies in mid 60's, i.e. fertilizer responsive high yielding wheat and rice varieties. The production of cereals and pulses has increased more than three and half times since the early 1960's. Still, Pakistan has been importing significant quantity of wheat and pulses to meet the needs of the fast growing population. The share of imports in wheat consumption during 1961-2003 varied from 26% in 1961 to 1% in 2003 (Table 4). The large wheat deficit during early 1960s was reduced to a great extent during the 1970s by the green revolution. However, later, an increased dependency on wheat import was observed with an exception of a few years.

In case of rice, however, Pakistan has been quite successful in not only producing enough for domestic consumption but in generating an exportable surplus (Table 5).

Table 4—Food balance-sheet for wheat (quantity in '000' tonnes)

Year	Production	Imports	Stock change	Exports	Total	Feed, seed and others	Availability	Import share
1961	3814	1080	-308	0	4586	385	4201	25.71
1970	7294	229	336	108	7751	614	7137	3.21
1975	7673	1345	-482	4	8532	629	7903	17.02
1980	10856	604	-1217	3	10240	1136	9104	6.63
1985	11703	982	-589	51	12045	1174	10871	9.03
1990	14316	2047	-691	2	15670	1447	14223	14.39
1991	14565	972	-983	2	14552	1456	13096	7.42
1992	15684	2018	-1443	3	16256	1552	14704	13.72
1993	16156	2890	-1965	4	17077	1616	15461	18.69
1994	15213	1902	826	8	17933	1524	16409	11.59
1995	17002	2706	-2243	4	17461	1702	15759	17.17
1996	16907	1968	-411	8	18456	1763	16693	11.79
1997	16650	2500	215	5	19360	1667	17693	14.13
1998	18694	2534	-1841	9	19378	1883	17495	14.48
1999	17856	3240	-1507	9	19580	1788	17792	18.21
2000	21079	1048	-1995	61	20071	2112	17959	5.84
2001	19024	149	1982	835	20320	1905	18415	0.81
2002	18227	267	3469	1280	20683	1824	18859	1.42
2003	19183	94	590	43	19824	1918	17906	0.52
2004	19335	108	-213	553	18677	1934	16743	0.65

Source: FAOSTAT (August 2004) and Pakistan (2004).

Table 5—Food balance-sheet for rice (quantity in '000' tonnes)

Year	Production	Imports	Stock change	Exports	Total	Feed, seed and others	Availability	Exports Share
1961	1127	2	0	173	956	110	846	0.15
1970	2200	0	0	229	1971	159	1812	0.1
1975	2619	0	0	476	2143	295	1848	0.18
1980	3125	0	0	1082	2043	238	1805	0.35
1985	2920	0	-67	715	2138	336	1802	0.24
1990	3262	0	-588	741	1933	362	1571	0.23
1991	3245	0	45	1199	2091	353	1738	0.37
1992	3118	0	164	1505	1777	358	1419	0.48
1993	3997	1	-806	1028	2164	417	1747	0.26
1994	3448	12	100	980	2580	380	2200	0.28
1995	3968	0	100	1844	2224	422	1802	0.46
1996	4307	2	-498	1593	2218	451	1767	0.37
1997	4335	0	-199	1759	2377	459	1918	0.41
1998	4676	1	-100	1964	2613	486	2127	0.42
1999	5158	2	-747	1784	2629	512	2117	0.35
2000	4805	1	-209	2010	2587	469	2118	0.42
2001	3884	14	1294	2415	2777	416	2361	0.62
2002	4481	14	348	1680	3163	456	2707	0.37
2003	4848	0	0	1768	3080	485	2595	0.36
2004	4848	0	0	1823	3025	485	2540	0.38

Source: FAOSTAT (August 2004) and Pakistan (2003).

2.2. STABILITY IN SUPPLY OF FOOD GRAINS

Stability relates to a steady supply of food at the national level and is thus directly affected by the performance of the agriculture sector. Apart from production, it also entails better management of domestic production, local markets integration and rational use of buffer stocks and trade (FAO, 2002). Pakistan has faced severe floods and droughts during the last three decades.[8] Consequently, fluctuations/shortages in food grains production have been common. At times, the government imported even up to one fifth of the wheat requirement to meet the shortages. In order to meet the shortages in

[8] Floods occurred during 1973 and 1992 while drought occurred in 1998, 2000 and 2001.

deficit/urban areas and save consumers from high food prices, the government has been actively pursuing the policies of support/procurement prices, storage and distribution though at a very high cost.

2.3. ACCESS TO FOOD

One of the important indicators of economic access to food is the proportion of people below the poverty line (FAO, 1998). The poverty increased during the 1960s despite rapid economic growth while it declined during 1970 through 1987-88 in spite the growth being relatively slower (Table 6). Pakistan economy continued to grow at slower pace with the exception of few years during the 1990s and the declining poverty trends got reversed. However, the daily average availability of calories per person progressively increased over the last four and half decades. Thus, enhanced food availability at the national level does not necessarily translate into actual increased consumption at regional or household level. Thus, determinants other than the national income growth have been instrumental in pushing people below the poverty line. This could be due to worsening income and landholdings inequality in the country (see Table 6 and Annexure Table 2). A rising calorie-based poverty implies that most people had declining access to food. In addition, disparities in access to education and health may also be crucial.

Table 6—Poverty, GDP growth and inequality

Years	Head Count			Food Poverty			Planning Commission			GDP Growth%	Calories	Gini Coefficient
	Overall	Rural	Urban	Overall	Rural	Urban	Overall	Rural	Urban			
1963-64	40.25	38.94	44.53	--	--	--	--	--	--	6.5	1987	0.386
1966-67	44.50	45.62	40.96	--	--	--	--	--	--	3.1	2010	0.355
1968-69	--	--	--	--	--	--	--	--	--	6.5	2270	0.336
1969-70	46.53	49.11	38.76	--	--	--	--	--	--	9.8	2203	0.336
1970-71	--	--	--	--	--	--	--	--	--	1.2	2199	0.330
1971-72	--	--	--	--	--	--	--	--	--	2.3	2262	0.345
1978-79	30.68	32.51	25.94	--	--	--	--	--	--	5.5	2262	0.373
1984-85	24.47	25.87	21.17	--	--	--	--	--	--	8.7	2178	0.369
1985-86	--	--	--	--	--	--	--	--	--	6.4	2170	0.355
1986-87	--	--	--	26.9	29.4	24.5	--	--	--	0	2315	0.346
1987-88	17.32	18.32	14.99	26.4	29.9	22.7	--	--	--	6.4	2175	0.348
1990-91	22.11	23.59	18.64	23.3	26.2	18.2	--	--	--	5.6	2231	0.407
1992-93	22.32	26.24	21.70	20.3	22.5	16.8	--	--	--	2.3	2356	0.410
1993-94	23.60	26.30	19.40	20.8	24.4	15.2	--	--	--	4.5	2409	0.400
1996-97	31.00	32.00	27.00	23.6	26.3	19.4	--	--	--	1.9	2466	0.373
1998-99	32.60	34.80	25.90	32.6	34.8	25.9	30.6	34.7	20.9	4.2	2456	0.410
2000-01	--	--	--	--	--	--	32.1	39.0	22.7	1.8	2426	0.454

Source: Amjad and Kemal (1997); Jafri (1998); Jamal and Ghouse (1999); Qureshi and Arif (1999); Pakistan (2004); Kemal (2005)

2.4. NUTRITIONAL DIMENSION

Effective biological absorption of food in the body is also important for food security as it ensures nutritional security in face of availability. Biological food absorption is affected by the factors like sanitation, clean drinking water[9], quality of food[10] and knowledge of the households regarding proper food storage, processing and basic nutrition.

According to planning commission of Pakistan, per capita food intake in the country is higher than the recommended average at the national level (Khan, 2003). Nonetheless, the same study indicates that one third of all pregnant women were malnourished and over 25% babies had low birth weight in 2001-2. Malnutrition was also a major problem, responsible for more than 30% of all infant and child deaths in the country in 2001-02. The prevalence of moderate to severe underweight, stunting, and wasting among children of less than 5 years of age were about 38, 37 and 13% respectively in 2001-02 (Planning Commission and UNICEF, 2004). Similarly, malnourishment among mothers on the basis of body mass index was 21% in 2001-02 (Khan, 2003). In spite of a decline in population growth rate from 3.06% in 1981 to 1.9% in 2004, it continues to be high. Consequently, Pakistan has to pursue supplementary population policy in order to reduce poverty, raise quality of life and ensure food security. To summarize, there has been enough food available at the national level in

[9]In Hyderabad, contaminated water took 10 lives and 1000 people were hospitalized during 2 months in 2004.

[10]Khan et al (2002) reported that 51% of the vegetable produce was unsuitable for human consumption due to excess chemical residues.

Pakistan at least during the last one and half decades. However, access to quality food appears to be lacking due to rising income and assets holding inequality leading to increase in poverty.

3. GOVERNMENT INTERVENTIONS IN AGRICULTURE: AN OVERVIEW

Agricultural prices are the major determinants of producers' incentives as well as real income in developing countries. The governments in developing countries often adopt agricultural policies to supply food to urban consumers at low prices at the cost of farming communities. In contrast, in developed countries, the farming communities are supported at the cost of taxpayers. Like other developing countries, Pakistan has pursued interventionist policies in outputs markets as well as agricultural input markets since its inception in 1947.

3.1 OUTPUT MARKETS AND TRADE

After independence, the country was confronted with problems like settlement, shortage of food in deficit areas, revenue constraints, and the balance of payment problems (Hamid et al., 1990). The government had no option but resort to interventionist policies in trade and domestic markets. It pursued import substitution in manufacturing by imposing duties and control on imports of manufactures, and levied export taxes on raw cotton and jute to supply cheap raw material to the local industry. This policy resulted in high domestic prices of manufactures far above the world level. The import substitution policy resulted in the overvalued exchange rate that acted as an indirect tax

on agriculture (Hamid et al., 1990). The prices for most agricultural commodities were kept considerably lower than the world prices, and the commodities were put through compulsory procurement by the government agencies. To ensure procurement, the movement of agricultural goods from one district to another was banned in most cases except in cotton (Turvey and Cook, 1976; and Chaudhry, 2001). As a result of all this, the agriculture sector performed poorly resulting in food crises in the country during the 1950s.

To overcome the crises, a formal support price system was initiated in 1960s by fixing the price of wheat. Later on rice, cotton, sugarcane, maize, potato, onion, gram, and oilseed crops were also included. The objective was to shield the farmers against undue fall in prices during the post-harvest period. The policy of compulsory procurement was replaced with a voluntary one, and the prices were raised above the world level. However, exports and movement of commodities remained banned (Chaudhry, 1995).

The favorable commodity price policy trend got reversed in 1970s. Pakistan devalued rupee against US$ by about 131% in 1972 to correct the terms of trade against agriculture.[11] Since most agricultural inputs were being imported, the prices of inputs increased significantly. Also, various institutional and structural reforms were introduced by establishing state-owned enterprises and nationalizing the existing ones to enhance

[11] Pakistan's rupee was linked to the US dollar for a long time and it was fixed by the government at a rate of Rs 4.76/US$. In May 1972, the rupee was devalued by 131 per cent from Rs 4.76/US$ to Rs 10.59/US$. Since the US dollar was devalued against all other currencies, the government of Pakistan also fixed the new rate at Rs 9.97/US$ in March 1973. Pakistan maintained a constant nominal exchange rate throughout the 1970s (Khan 2003a).

government control in marketing and distribution. To effectively pursue its support price agenda, the government established many state-owned enterprises such as:

- 1973- Cotton Export Corporation (CEC)- monopoly in cotton trade;
- 1973- Pakistan Agricultural Storage and Supplies Corporations (PASSCO) and the provincial Food Departments-undertake price stabilization mainly for wheat;
- 1974-Rice Export Corporation (REC)-procurement and monopoly in rice export;
- 1974- Ghee (Edible oil) Corporation of Pakistan (GCP)-development and procurement of non-traditional oilseeds, sunflower, safflower and soybean;
- 1979- Seed Division, a subsidiary, of GCP-procurement operations;
- 1980- Agricultural Marketing and Storage Limited (AM&SL)-onion and potato procurement and export;
- Sugar mills- support price of sugarcane, monopoly procurement within their respective zones.

The policy of nationalization and excessive control on the marketing and trade of agricultural commodities as well as inputs adversely affected the country's macroeconomic situation. To stabilize the economy, the government started structural adjustment program in 1979-80 supported by the IMF and the World Bank. The objective of the program was to eliminate price and trade distortions by gradually moving away from the interventionist policies. As part of reforms, the process of liberalization started with shifting from fixed exchange rate to flexible rates that resulted into devaluation of more than 30% in early 1980s and it reached up to 100% in 1991 that lead to the

difference between open market and official exchange rates to only about 4% (Annexure Table 3).[12]

However, interventions in commodity markets continued during the 1980s but with a new system of fixing the prices recommended by the Agricultural Prices Commission (APCOM) set up in 1981. The bases of price recommendations were the cost of production. Nonetheless, the system of sugar rationing, zoning of sugar mills, and compulsory rice procurement were discontinued. The private sector was permitted to play a limited role in rice trading in 1985-86 and the government reduced the intervention of REC. However, the implementation of support price for paddy was given to PASSCO though its role remained negligible.

The process of trade liberalization continued during the 1990s. The role of REC and CEC gradually declined and both were merged into Trading Corporation of Pakistan (TCP). The AM&SL, which was involved in onion and potato business, was closed down in 1993 because of its ineffectiveness and financial losses and its role was transferred to PASSCO. The private sector was allowed to participate in export of agricultural commodities like rice, raw cotton, fruits and vegetables. Some incentives were also given to the private sector like duty drawback; 25% freight subsidy on fruits, vegetables, and fresh fish and export financing. The government has also encouraged export of wheat and its milling products both by private and public sector, and announced subsidy at the rate

[12]Pakistan followed a managed floating exchange rate system and the State Bank of Pakistan used to fix the daily rate. This system was abolished in 1998 and the banks and authorized dealers were allowed to fix their own buying/selling rates based on supply and demand in the market (Khan, 2003a).

of Rs.3250/tonne amounting to about US$1 million in 2001. Later it was reduced to Rs2500 per tonne in 2002-03.

Despite efforts to liberalize agriculture, interventions in fixing agricultural prices and involvement of state trading still continue. Several parastatals are still operative. The government continues to fix support prices and procure certain commodities and continues to promote organizations such as provincial Food Departments (PFDs), PASSCO and Trading Corporation of Pakistan (TCP). The PFDs and PASSCO are exclusively involved in wheat trading, while TCP is involved in procurement of cotton and cotton export. However, subsidy on cotton is not a regular feature. Private traders are free to buy the commodity and export but abiding by the rules and regulations set by the government of Pakistan.

As part of structural adjustment program, the reduction in border protections was also initiated during the mid eighties. The maximum applied tariff rates reduced from 225% in 1987-88 to 70% in 1995 and in the recent years to 25% (see Table 7). Though there are no domestic market distortions but high border protection continues in edible oil industries.

All non-tariff barriers have been dismantled completely. Import surcharges and license fees were removed during 1993 to 1995 (FAO, 2000). All items are freely importable including textile products except for 30 items on negative list mostly on religious, environmental, security and health grounds.

Table 7—Bound and applied tariff rates

Products	Bound Rate	1995	1998	2000	2002	2005
Cereals	100-150	0-65	0-25	0-15	0-25	0-25
Wheat	150	0	0	0	25	0
Wheat Flour	150	10	10	10	10	10
Rice	100	25	25	15	5-10	5-10
Oilseeds	100	10-70	0-45	0-15	0-10	0-10
Vegetable Oils[1]	100	25-70	15-45	15-35	10-25	5-25
Live Animals	100	15-65	10-45	10-35	5-25	5-25
Meat	100	35-70	15-45	10-35	10-25	5-25
Dairy	100	25-70	25-45	25-35	25	5-25
Sugar	100	35-70	25-45	15-35	10-25	5-25
Coffee and Tea[2]	100-150	15-70	15-45	25-35	20-25	5-25
Fruits and Vegetables	100	35-65	35-65	--	10-25	5-25

Source: FAO (2000); CBR (various issues);
Note: [1] There are also specific rates for some oils e.g., Soybeans oil (crude and refined) Rs.9050/tonn, Palm oil from 10200 to 16850/tonn; [2] Bound rates for coffee 100% and tea 150%, applied rates for tea are also high.

3.2. INPUTS MARKETS

The government also has a history of intervening in agricultural input markets. In the early 1960s, the government introduced subsidies for most agricultural inputs to promote and intensify their uses. The subsidies are of two types: budgeted and implicit. The first type appears in government budgets and includes subsidies on fertilizers, pesticides, and tube-wells. In implementing the subsidies, the government picks up the difference between the cost of input delivered to the farmers and the price actually paid by the farmer. The second type does not appear in government budgets and consists of subsidies on electricity, irrigation water and agricultural credit. The subsidy on irrigation is equal to the difference between the revenues collected from the farmers as water charges and the cost incurred by the government on operation and maintenance of the canal system excluding the capital costs (Qureshi, 1993). Agricultural credit subsidy is

the difference between the interest rate charged on agricultural loans and the rate charged on non-agricultural loans, and the subsidy on electricity is the difference between rates charged on electricity use in agriculture and in non-agriculture purpose (Qureshi, 1993).

The subsidy on pesticides increased from Rs. 128 million in 1972 to Rs. 421 million in 1977 but declined thereafter reaching 62 million in 1980-81. Pesticide subsidy was abolished in 1981-82 and the market was completely liberalized. The benefits of liberalization are visible from a remarkable growth in pesticide use. Subsidy on seed had been minor and was eliminated in 1982-83. Currently, the private companies handle about 50% of the seed market mostly through imports. Punjab Seed Corporation and Sindh Seed Corporations are major state-owned seed agencies and operate under losses, discouraging private investment in seed farms. The subsidy on tube-wells that was abolished in 1994-95 varied across areas. The applicable rates for the 1cusec capacity were Rs.16000, 18000 and 20000/unit in non-perennial canal command area, the saline areas, and rain-fed areas respectively.

Table 8 shows the subsidies to the agriculture sector since the mid 1980s. Of the budgeted subsidies, fertilizer subsidy was important until 1990. The subsidy on fertilizer started declining since and was removed after 1996. However, natural gas subsidy continues to the fertilizer producers. Before the denationalization in 1986, the government owned enterprises were heavily involved in fertilizer business. The fertilizer industry was deregulated in 1986 and a gradual reduction in subsidy was introduced, the subsidy on locally produced fertilizer was eliminated in 1993, while minor subsidy continued on imported fertilizer up to 1996. On the other hand, the government of

Pakistan has imposed 15% sales duty on all fertilizers and a 5% custom duty on imported fertilizer resulting into a negative subsidy on fertilizers. Currently, NFC a state-owned company registered as a private limited company controls about 50% of the domestically produced nitrogen and 80% of the phosphate fertilizer. Now, only the private sector imports and distributes fertilizers.[13]

Table 8—Subsidies on agricultural inputs (million Rupees)

Year	Irrigation (Nominal)	Irrigation (Real)	Institutional Credit	Electricity	Fertilizer
1984/85	828	627	543	103	1500
1989/90	1410	779	1207	1380	1257
1990/91	1545	757	1526	1625	1248
1991/92	2701	1206	1744	1796	1191
1992/93	3111	1275	1993	1724	810
1993/94	2565	933	1980	330	583
1994/95	3386	1082	1986	330	67
1995/96	4203	1243	1000	349	47
1996/97	4550	1185	1000	604	-
1997/98	5111	1238	83	972	-
1998/99	4237	967	437	1336	-
1999/00	4608	1024	279	652	-

Source: Chaudhry and Sahibzada (1995); Pakistan (2002a); Qureshi (1993); WTO notifications
Note: No study is found that has actually computed the subsidies beyond 2000.

There appears to be no significant impact of withdrawal of fertilizer subsidy on the use of nutrients. The ratio of nitrogenous to phosphatic fertilizer has however deteriorated after the mid 1980s mainly because of a faster increase in prices of phosphatic fertilizer after deregulation (Table 9). The worsening imbalance in nutrients has adverse implications for productivity of wheat and other important crops.

[13]----- There have been frequent disruptions in gas supply to the fertilizer producing industry due to attacks on gas pipelines by some fanatic groups. Government has to import urea to meet shortages in the country. Recently, the government of Pakistan has announced subsidy on imported urea fertilizer by fixing price of Rs. 450 per 50 kg bag of urea against the c.i.f Karachi price of Rs. 870 per bag.

Table 9—Per hectare fertilizer use, nutrient use ratio, and fertilizer prices

Year	NPK-Nutrients Kg/hectare	N:P Ratio	DAP (Rs./50kg)	Urea (Rs./50kg)
1979/80	54	3.53	75	75
1984/85	63	3.18	133	128
1989/90	88	3.84	217	185
1994/95	99	4.06	379	235
1998/99	113	4.51	665	346
1999/00	123	3.71	649	327
2000/01	135	3.34	670	363
2001/02	132	3.66	710	394
2002/03	138	3.61	765	411
2003/04	140	3.75	913	420

Source : Pakistan (2005 and previous issues)

The government of Pakistan has pursued a multidimensional policy in advancing credit to the farmers. Subsidized loan called '*taccavi'* were provided to the farmers for natural disaster like floods. The share of the advances under this scheme remained minimal in total credit over time. Taccavi scheme was discontinued in the mid 1990s. The second source of credit is from the Federal Bank of Cooperatives (FBC) established in 1976. The State Bank of Pakistan has been providing cheap credit to the FBC. The commercial banks are the third source for institutional agricultural credit. The specialized bank in this case is the Zarai Traqiati Bank Limited (ZTBL), formerly named as Agricultural Development Bank of Pakistan (ADBP). Presently, it accounts for over 62% of the total agricultural credit.

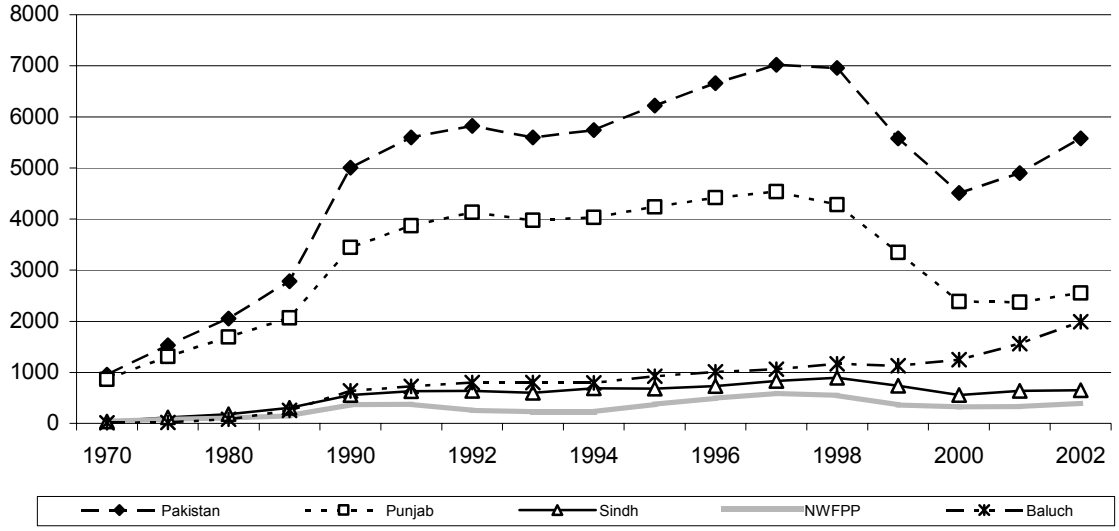
In order to streamline agricultural credit across sectors, the government has formed an Agricultural Credit Advisory Committee. Credit quotas are fixed for different farm sizes i.e. 70% of total production credit must go to the farmers with less than 12.5 acres of land, 20% for farmers having land between 12.5 to 25 acres and only 10% is

fixed for cultivators with more than 25 acres. In reality, much of the share goes to the well off farmers. The subsidy on agricultural credit has declined recently from 1986 million rupees in 1995 to 279 million rupees in 2000 (Table 8) as banks stopped advancing interest free short-term loans.

The subsidy on electricity in agriculture has been an important part of total subsidy up to 1993. However, it has been mostly eliminated except in Baluchistan province where it continues as a flat rate on agricultural tube-wells. The exact amount of subsidy on electricity is not available except for the period 1995- 2000 reported in WTO notifications.[14] The withdrawal of subsidy had an adverse effect on consumption of electricity in agriculture (Figure 1)

[14]Recently, Prime Minister of Pakistan has announced 33% subsidy on electricity consumed by agricultural tube-wells that will be equally shared by the Federal and Provincial Governments concerned and WAPDA (Rizvi, 2003)

Figure 1—Consumption of electricity in Pakistan and its provinces



Source: Annexure Table 4.

A significant subsidy on irrigation water is provided to the farmers, which also is not budgeted. The subsidy has swelled in the last two decades in monetary terms: from 828 million rupees in 1984-85 to 4,608 million rupees in 1999-2000. However, the subsidy has either declined or remained constant during the 1990s. Nonetheless it is in fact a big drain on the exchequer. Also, maintenance of the canal system has not been carried out since long resulting into declining water use efficiency and frequent breaching of canals and canal closures (Chaudhry et al., 2000). Due to lower and uncertain supply of canal water many farmers in saline areas are heavily pumping underground water leading to lowering of water table, adding further to salinity levels, and reducing productivity.

4. PROCUREMENT AND DISTRIBUTION OF GRAINS FOR FOOD SECURITY

The marketing and distribution of food grains in Pakistan involves both private and public sector. The intermediaries engaged in marketing channels include village shopkeepers, Arthies (commission agents), wholesalers and *Beoparies (traders)*. The grains reach the consumers either unprocessed or processed through processors/millers, wholesalers, and retailers. The private sector deals in all grains but wheat marketing has remained mainly with the public sector, while rice marketing is also now private sector activity.

4.1. WHEAT MARKETING

Government of Pakistan intervenes heavily in wheat marketing in order to ensure cheap and sustained food supply in the country. The federal and provincial governments procure wheat with the objectives of supporting producer incomes and stabilizing grain and flour prices for the consumers.

The support price for wheat among other crops is worked out by the APCOM basically based on the cost of production. APCOM recommends the level of price to the MINFAL. The proposed support price is then circulated to the Planning Commission, Ministry of Finance, Ministry of Commerce and a few other ministries for their feedback, and finally the proposal is sent to the cabinet for a decision (Faruqee, 2005). The support price is normally announced before the sowing of crop in order to enable the farmers to

respond to the price incentives. The support price represents a minimum floor price which the government protects through public procurement that in fact becomes de facto the procurement price for wheat (Dorosh, 2004).

The MINFAL in consultation with the provincial food departments sets the overall wheat procurement targets. The wheat is then procured by the government agencies: PASSCO on behalf of federal government and food departments of the provinces (PFDs). Over the last two decades, the actual procured wheat has ranged between 15-45% of total production in the country. The PFDs have been procuring the major portion of wheat (63% in 1990,83% in 1999), and the remaining was procured by PASSCO. Punjab is the only surplus province in wheat, and up to 95% of the total procurement comes from this province (Table 10). The rest is procured mainly from Sindh. To achieve the procurement targets, usually the inter-provincial wheat movement (often inter-district movement also) is banned from May to August.

The PASSCO and PFDs procure wheat directly from producers or through marketing agents. The suppliers are required to offer *fair average quality* (FAQ) for procurement. The supplier bears the transportation cost to the procurement centers while cost of shifting to government storage is borne by the Food Department. If the quality falls below the specification, the product is rejected. The limits on impurities are over 1% of dirt/dust in wheat, 5% in case of other grains and 5% for damaged and shriveled grains. The procurement centers accept wheat in bulk/lots of 10 bags or more of standard

weight of 100 kilograms. The bags are supplied by the procurement centers on loan or payment basis.

Table 10—Wheat procurement from provinces by PFDs and PASSCO ('000' tonnes)

Year	Punjab		Sindh	NWFP Balochistan	Pakistan				Rice Procurement
	Procured	%			Total Procured	% of Total Production	% by PASSCO	% by PFDs	
1986-87	4101.7	81.46	815.9	117.5	5035.1	41.90	35.18	64.82	1285.2
1987-88	2936.5	73.87	973.2	65.5	3975.2	31.36	30.29	69.71	834.4
1988-89	2720	77.85	740	34	3494	24.23	31.40	68.60	1078.6
1989-90	3394.4	82.09	694.7	45.8	4134.9	28.88	26.70	73.30	1334
1990-91	3704.2	83.95	660.9	47.3	4412.4	30.29	37.03	62.97	816.5
1991-92	2592	82.05	542	25	3159	20.14	25.85	74.15	491.9
1992-93	2571	79.13	659	19	3249	20.11	30.58	69.42	954.5
1993-94	3339	81.04	708	73	4120	27.08	29.85	70.15	831.2
1994-95	2987	81.97	613	44	3644	21.43	32.97	67.03	283.5
1995-96	3152	84.28	565	23	3740	22.12	30.48	69.52	205.4
1996-97	2963	85.93	423	62	3448	20.71	22.90	77.10	-
1997-98	2438	89.47	283	4	2725	14.58	26.38	73.62	-
1998-99	3542	88.91	438	4	3984	22.31	17.44	82.56	-
1999-00	3476	85.41	594	0	4070	19.31	18.36	81.64	-
2000-01	7890	91.94	648	44	8582	45.11	24.25	75.75	-
2001-02	3478	85.22	441	162	4081	22.39	23.02	76.98	-
2002-03	3759	92.93	275	11	4045	21.09	22.44	77.56	-
2003-04	3185	90.64	321	8	3514	18.02	*	*	-

Source: Pakistan (2005); Salam (2003); * These figures were not available.

Both PFDs and PASSCO, in addition to their storage facilities which is for about 4.5 million tonnes for all food grains, rent space from the private sector. The PASSCO normally distributes wheat grains to the armed forces, Northern Areas and AJK. Some of the stock is also sold to the deficit provinces through the PFDs. The provincial food departments are responsible for the public distribution system and they release wheat on a predetermined pan-territorial issue price to the registered millers based on the quota

decided by the provincial and federal governments.[15] The imported wheat is also routed through the PFDs for distribution at the same issue price.[16] The system of uniform issue price which continued until 2001 did not cover all the costs involved from procurement to distribution. In May 2001 government introduced cascading release prices and linked the issue price for wheat from its stock to the month of delivery resulting into higher issue prices in the later months of the crop year. The major purpose of this system has been to reduce losses born by the government and to encourage the participation of private sector storage. But, we believe that the government will still keep the issue price lower than the market price and might not help much the trade in private sector.[17]

The present public procurement and distribution system involves heavy subsidy ranging from Rs.2.75 billion in 1990/91 to Rs.12.35 billion in 2002/03 as import subsidy and the difference between procurement price and issue price and incidental costs (Table 11). The major beneficiaries in this process are in general the flour mills, particularly some the selected/registered ones. Since the subsidized rates are applied only to the wheat purchased from the government that partially meets the full capacity of the industry, the

[15] To meet the additional requirements the registered flour mills like other mills purchase wheat grain from the open market.

[16] The decision regarding the quantity to be imported and the procedures to be adopted is made however by the Economic Coordination Committee (ECC) which meets in June every year. The decision of the ECC is then implemented by MINFAL including financing and shipping from abroad.

[17] Restrictions on the movements of wheat within the provinces were removed in May 2001 in order to ensure smooth supply and widespread availability of food, and also help wheat producers to benefit from the price differentials. But, it never happened practically. The State Bank of Pakistan also allowed the banks to provide finance to the private sector's wheat purchases, and the other incentives include some tax exemptions and reduced import duties on materials and facilities used for grain handling and storage (FAO, 2003). In principle the government has also allowed the private sector to participate in export/import of wheat. However, no data is available for the private sector.

additional requirement is met through buying from the open market. Consequently, the flour prices are almost determined by the market forces.[18]

The wheat pricing and procurement system does not help the farming communities particularly the marginal/small farmers who generally have very small or no marketable surplus. Though marginal/small farmers buy back during later months of the year, they generally sell wheat grains in the market immediately after the harvest due mainly to two reasons. Firstly, it is obligatory for them to pay their loans acquired either in cash or against the deferred payment arrangements of which private traders/commission agents generally are the granters – violation could result in denial of such facilities in future. Second, the PFDs and PASSCO accept wheat grains in bulk of at least 10 bags of 100kg each. Third, generally the PFDs -- the main procurer of wheat, operate in the grain markets through commission agents and do not have their own procurement centers.

4.2. RICE MARKETING

Rice procurement/trade had remained a monopoly of the government for a long period. Government used to purchase rice mainly through dealers at the procurement

[18]The provision of cheaper wheat grain resulting into setting up more and more flour mills in the country by the influential to get advantage of subsidized wheat, while in fact there is already 70% over-capacity (Arshad, 2005).The rent seeking activities in public procurement and distribution system are pervasive and thus cannot be ignored. During the ban on wheat movement, some traders do sell outside the districts at higher prices unlawfully. The bribe for such movement has been as high as Rs.4000/truck in recent years amounting over 4% of the market price (Dorosh, 2004). The misuse of quota in supplying wheat to the flourmills is also significant. Smith et al. (1999) conclude that nearly 70% of the listed mills in Sanghar district in Sindh province are not operational and 40% of them do not even exist. Moreover, allocation of quota in excess of mills' capacity is also common.

centers in the controlled areas. However, the growers were allowed to pool to form required lots of 240 bags. The dealers used to get the paddy processed into rice only from the authorized mills and the government had bans on rural rice husking mills in controlled areas during procurement season. No dealer was allowed to remove rice from the mills without obtaining a disposal order from the food department.

Rice marketing is now with private sector, but it remains subject to the support price mechanism, managed by PASSCO, although no paddy procurement has been reported since 1995/96 (Table 10).

Table 11—Total federal and provincial budgeted subsidy (million Rupees)

Year	Provincial Subsidy	Federal Subsidy	Total Subsidy	Real Subsidy[a]
1990-91	1988	762	2750	6322
1991-92	1831	2175	4006	8451
1992-93	1325	2148	3473	6666
1993-94	2760	354	3114	5378
1994-95	1890	1449	3339	5098
1995-96	3169	6648	9817	13522
1996-97	5173	5761	10934	13482
1997-98	2443	4119	6562	7499
1998-99	9375	-	9375	10135
1999-00	6045	923	6968	7273
2000-01	5502	1356	6858	6858
2001-02	5940	2668	8608	8317
2002-03	6671	5681	12352	11566

Source: Faruqee (2005). [a] Real subsidy computed using CPI assuming 2000-01=100.

4.3. BASIC TENETS OF GOVERNMENT INTERVENTIONS IN WHEAT ECONOMY

Wheat price has been a politically sensitive issue. Therefore, the government has used instruments to achieve the following objectives: 1) protect the producers from price fluctuations through the guaranteed minimum support price; 2) achieve desired output

targets; 3) induce adoption of new technologies; 4) shield consumers against rise in prices particularly the urban consumers; and 5) ensure food security.

5. EFFICIENCY AND COST-EFFECTIVENESS OF THE EXISTING SYSTEM VIS-À-VIS PRIVATE AGENTS/PRODUCERS

5.1. EFFECTS OF POLICY ON PRODUCERS AND CONSUMERS

Below, we review the effects of price policy based on three aspects: a) Comparing terms of trade in agriculture relative to consumer prices, international commodity prices and domestic input prices; b) Resource transfers from the agriculture to non-agriculture sector; and c) Monthly wholesale price of wheat and the support price.

5.1.1 Aggregate Terms of Trade [19]

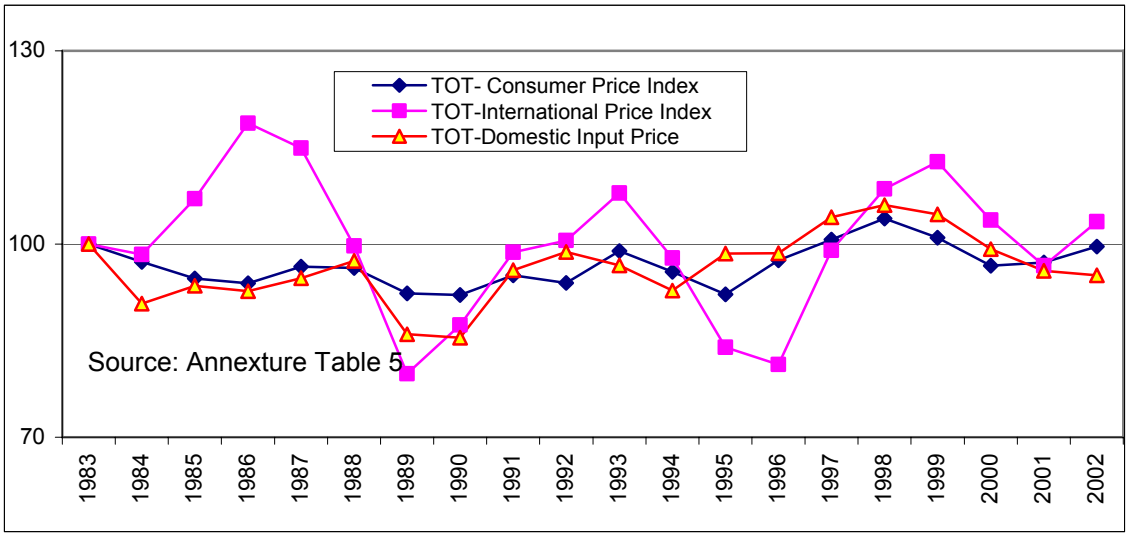
The changes in crops prices[20] relative to consumer prices, international prices of agricultural commodities, and domestic input prices[21] (also called terms of trade – TOT) can be helpful to evaluate the profitability of the farm sector, and changes in standard of living of the farming community. Zahid and Hyder (1986) analyzing the terms of trade concluded that the increase in producer prices relative to the consumer price index remained lower than the base year during 1973-83. .

Figure 2 indicates that the increase in producer price index was relatively less than the consumer price index during 1983 to 2003 except for the duration of 1997-2000,

[19] This section benefited heavily from Khan and Ahmad (2005)
[20] Included commodities are wheat, rice, maize, bajra, jowar, barley, sugarcane, cotton, gram, moong, mash, masoor, onion, potato, tomato, mango, banana, apple, guava and citrus: Annual wholesale prices were used.
[21] Inputs include fertilizer, diesel oil, water, and pesticides.

and the farming community remained relatively worse off. Nonetheless, the TOT has improved since the mid 1990s.

Figure 2—Aggregate Terms of Trade in Agriculture



The trend in relative producer price index with respect to international commodity prices shows that the terms of trade were favorable for almost half of the reference period. Interestingly, a regular 3-4 years cycle can be observed. However, the variations in the cycles have reduced overtime. Two factors can be hypothesized for these cyclical trends: 1) the government of Pakistan announce support/procurement prices for various crops and keeps them at the same level for a couple of years; and 2) the government interventions have declined significantly over time in compliance with the World Bank and IMF conditionalities as well as World Trade Organization..

Zahid and Hyder (1986) show that the producer price index relative to input prices remained in favor of farming community from 1973 to 1983, most importantly owing to the input subsidies. Figure 7.2 shows that domestic producer prices of crops

relative to the major agricultural input prices remained below the base year (i.e. 1983) except for the period from 1997 to 2000 – prices of most of the agricultural commodities were fixed at a significantly higher level during this period.

5.1.2 Nominal and Effective Protection Coefficients

The policy effects on agricultural incentives can also be evaluated by comparing the domestic prices with the parity prices obtained by adjusting the world prices with transportation and other costs. The nominal protection coefficient (NPC) measures the actual divergence between domestic price and international price, and relates only to the distortions in the output market. The effective protection coefficient (EPC) measures the net effect of government interventions upon value-added in any production process and incorporates distortions in the inputs markets as well. The NPC and EPC measures for 1960-2002 of major agricultural commodities and of wheat for the latest years are given in Table 12. The values greater than one imply protection indicating positive incentives. The values less than one imply disincentive for production.

Table 12—The nominal and effective protection coefficients for selected commodities

Year	Wheat		Basmati		IRRI		Cotton		Sugarcane	
	(NPC)	EPC	(NPC)	EPC	(NPC)	EPC	(NPC)	EPC	EPC	(NPC)
1960-61	(1.20)	1.24	(0.84)	0.85			(1.05)	1.07	(2.71)	2.75
1965-66	(1.54)	1.56	(0.90)	0.92			(1.03)	1.04	(3.83)	3.85
1970-71	(1.59)	1.56	(0.84)	0.83	(0.87)	0.87	(1.20)	1.19	(2.15)	2.13
1975-76	(0.84)	0.82	(0.50)	0.49	(0.75)	0.75	(0.68)	0.68	(0.68)	0.68
1982-83	(0.73)	0.70	(0.46)	0.38	(0.95)	1.01	(0.92)	0.95	(0.75)	0.73
1983-84	(0.55)	0.47	(0.46)	0.37	(0.96)	0.96	(0.77)	0.73	(0.96)	
1999-00	(0.90)	0.84*	(0.80)	0.74	(0.90)	0.88	(0.61)	0.48	(1.08)	
2000-01	(0.79)	0.69*	(0.79)	0.75	(1.30)	1.54	(0.99)	0.94	(0.83)	
2001-02	(0.64)	0.52*	(0.76)	0.72	(1.24)	1.45	(1.05)	1.00	(0.95)	
2002-03	(0.63)						(1.12)			
2003-04	(0.64)						(1.02)			
2004-05	(0.76)						(1.00)			

Source : EPCs for the years 1960-61 to 1975-76 are Gotsch and Brown (1980), from 1982-83 and 1983-84 are from Appleyard (1987), and the other measures are author's own calculations. NPC for the years 2002-03 to 2004-05 from Orden and Salam.

Note : Figures in parentheses are NPCs for the same years. * EPCs do not incorporate inputs subsidies.

Table 12 shows that all major crops except Basmati rice were highly protected against the international prices during the 1960s. However, the domestic price relative to international prices had started falling during the late 1960s. Afterward, NPCs and EPCs for IRRI rice, cotton and sugarcane either remained higher than or close to one except for a few years. On the other hand, these measures for wheat and basmati rice remained significantly lower than one. Two other important conclusions can be drawn from Table 12. First, Basmati rice growers are the most adversely affected by the policy disincentives followed by the wheat growers; and second, IRRI rice and cotton growers are relatively better off followed by sugarcane growers.[22]

[22] Recently, government of Pakistan has decided to discourage the sowing of those crops where there is no comparative advantage and consumes huge water resources, e.g. sugarcane and IRRI rice.

5.1.3 Effects on supply and demand and net resource transfers

Evaluating policy interventions, Hamid et al. (1990) show that production of major crops under interventions has been lower compared to no interventions. The study estimates that the wheat output would have been higher by 10 to 17% during the 1960s [23]and 1970s, while production would have been higher by 14% during 1980s. However, in basmati rice, the underproduction was 25% and 40% during 1970s and 1980s. Dorosh and Valdes (1990) concluded that production of wheat was lower by 24% and basmati rice by 52% during 1978-87 owing to government interventions. The farm income without intervention could have been higher by 40%. The study further indicated that without intervention, Pakistan could have been a wheat exporter. Hamid et al. (1990) concluded that the consumption of all crops except sugar was higher than it would have been without interventions. The over-consumption in wheat was in the range of 6 to 12%.

Ashfaq, Griffith and Parton (2001) analyzing welfare impact of wheat price policies conclude that net welfare loss to the society ranged from about Rs.11billion during 1993-96 to about Rs.27 billion in 1974-75. These losses ranged from about 4% to 15% of the GDP from agriculture sector. The flow of transfers has been from producers and government to the consumers (Barkley, 1992; Ashfaq, Griffith and Parton, 2001). Abedullah and Ali (2001) found that the support price benefits both the producers and the consumers, and imposes a heavy cost on the government exchequer. The cost is higher

[23] Nonetheless, Hamid et al. (1990) has also shown that there was price protection for wheat during 1960s except for a few years, which does not match with this result regarding under production in wheat.

than the ensuing benefits to the producers and consumers, resulting in a net loss to society.

To summarize, government interventions in agriculture resulted in huge net resource transfers from the agriculture sector to the other sectors of the economy. These transfers have been about Rs.25 billion per annum during 1978-87 (Dorosh and Valdes, 1990), while a recent study, Chaudhry (2001), shows that the resource transfer in nominal terms varied from Rs. 40 billion in 1984-85 to Rs. 214 billion per annum in 1999-2000.

5.2. COST-EFFECTIVENESS OF THE EXISTING SYSTEM

With rising incomes and urbanization, the demand for an efficient marketing structure goes up (Kurosaki, 1996). Market inefficiencies take away significant amount of public and private resources, increase price risk and discourage investment (Deomampo, 1997; Kurosaki, 1996). This section looks at different marketing efficiency parameters such as marketing margins, market integration and the cost of public and private distribution.

5.2.1 Marketing margins

The marketing efficiency can be assessed by quality, quantity and price to consumers and the net returns to producers. The market inefficiencies lead to greater difference between producer and consumer prices (the marketing margin). The higher marketing costs or/and profits of the intermediaries could be the reasons of inflated market margins. The higher costs are usually a result of poor market infrastructure (like

roads, transport, storage, and utility services), high post harvest losses, lack of grading, and improper handling of the products. The marketing profits are greater in marketing involving greater risk of losses, exploitative system and greater investment.

In Pakistan, certain commodities involve very high marketing margins, 45% for onions and 85% for banana where the big part comprises the intermediaries' profits (Siddiqui, 1979; Mohyuddin, 1992; Khushk and Smith, 1996; Mustafa and Iqbal, 1996; Khushk *et al.,* nd; and Lashari et al, 2002). In onions, only 5% is attributable to costs, the rest 40% is made up of the profit of the intermediaries, in banana, it involves 49% profit and 30% marketing cost. Pulses also involve huge marketing margins ranging from 55% to 74% dominated by profits shared by various intermediaries (Siddiqui, 1979). Since the prices of wheat and wheat flour are controlled by the government, the marketing margins are generally not high. The marketing margin for wheat varies from 5% in grains to 58% in case of milled wheat.

5.2.2 Market integration

Competitiveness of markets can be evaluated based on how the price formation is interrelated (over time and space). High association between prices overtime and space indicates good integration and the price signals are expected to operate properly. Qureshi (1974) estimated the correlation coefficients between the price movements in village markets and wholesale markets for six commodities, wheat, cotton, *Gur,* oilseeds, gram and paddy and concluded that the markets are well integrated. Mohammad (1977) using

average weekly wholesale prices data for wheat in 12 districts supported the results of Qureshi (1974).

Kurosaki (1996) concluded that in case of wheat, the farm-gate prices are almost perfectly explained by the government support price and the distance from the town. Despite most farmers selling their wheat to private traders and not to the procurement centers, the farm-gate prices are integrated with the support price in the town. This follows from active competition among private traders and substantial procurement by the government. However, the government releases significantly influence market price of wheat and keep them suppressed. The farm-gate price of basmati paddy was not explained well by the support price which according to Kurosaki followed negligible procurement of Basmati by the government.

Tahir and Riaz (1997) using weekly prices of cotton, wheat and rice in selected markets of southern Punjab concluded that the agricultural markets are integrated in the long run with short run integration only in special cases. The study indicated only long run integration of wheat markets since wheat is heavily regulated and the procurement centers actively participate in purchases at the time of harvest and few months after . Besides, the movement is banned for few months after the harvest. Therefore, wheat markets are expected to be less integrated in the short-run.

5.2.3 Incidental Costs

During the procurement and distribution operations, the parastatals incur heavy costs. The increasing incidentals and the narrow difference between the procurement and

release prices of wheat continued to be a matter of great concern. High incidentals also make the exports of wheat uncompetitive in the international market (Slam, 2003). Table 13 shows that the PFD incidentals ranged from Rs.920 to Rs.2350 per tonne during 1996/97 to 2002/03, while for PASSCO the range was from Rs.1218 to Rs. 2431 per tonne during the same period. The difference between incidental costs of these two parastatals has mainly been due to the use of gunny bags (Slam, 2003).

The comparison of the incidentals with that of the private traders shows that the private sector incidentals ranged from Rs.1427 to Rs.1920 during the last couple of years and are much lower than of the state-owned enterprises (Table 13).

Table 13—Incidentals in wheat procurement and storage (Rs/tonne)

	PFD	PASSCO	Private
1996/97	919.6	1217.59	
1997/98	1079.87	1718.99	
1998/99	1439.95	1778.85	
1999/00	1482.22	1906.44	
2000/01	1637.35	1680.73	1687-1920
2001/02	2130.6	2125.83	
2002/03	2350	2430.96	1427-1730

Source : Slam (2003).

6. WELFARE ANALYSIS OF WHEAT POLICY

In order to analyze the welfare impacts of the wheat policy in Pakistan, we construct a CGE model and calibrate it to the 2001-02 social accounting matrix (SAM) developed by Dorosh, Niazi and Nazli (2004). We conduct policy experiments to analyze the household effects of possible reforms in wheat policy. Before explaining the results of the CGE model, the structure of wheat economy – based on a simple analysis, and how the wheat production activity is linked with the overall economy – using SAM, are briefly discussed.

6.1. WHEAT MARKETING FLOWS: CONSUMER SUBSIDIES AND PRODUCER TAXES

Wheat policy and marketing are complex . To obtain a basic idea about wheat marketing and government subsidies involved, we do a very simple analysis (see Annexure Table 6) for the period 1996-97 to 1999-00 for which the government storage cost is available. Average wheat production in the country during this period was about 18.6 million tones ranging from 16.7 million tones in 1996-97 to 21.1 million tones in 1999-00. On an average, about 35% (i.e. 6.5 million tones) of the produce is normally kept on farms for home consumption or to sell later in the open market. About 10% of the total produce is reserved for feed, seed etc.

Net average sale in the open market was 5.38 million tones, while average government purchase was 4.85 million tones during this period. Government imports on

average remained around 2.79 million tones ranging from 2.33 million tones in 1998-99 to 4.11 million tones in 1997-98. On an average, about 19.5 million tones of wheat were available for human consumption in the country during 1996 to 2000.

Average support price was Rs.6375/tone, while average storage and transportation cost afforded by the government was Rs.1443/tone/year. Consequently adjusted price for wheat procured and distributed by government came out Rs.7818/tone. Average wholesale price in Lahore market remained around Rs.6804 ranging from Rs.5475/tonne in 1996-97 to Rs.7415/tonne in 1997-98, which was higher than the support price.

Government issued wheat grain stock to millers at the average rate of Rs.6463/tone, which was 18% lower than its own cost per unit and 5% lower than the wholesale price in the open market. To meet the shortages, government also imported wheat at a price of about Rs.7818/tonne (import parity at Lahore). Assuming the government stores imported wheat for at least 6 months resulting into cost of imported wheat equal to Rs.9509/tones. The imported wheat is also sold to millers on the same release price as the domestic wheat, i.e. Rs.6463/tonne. The difference between cost of imported wheat and the release price was Rs.3046/tonne resulting in a 32% subsidy provided by the government.

The overall produce of the farmers is evaluated as follows: produce kept for own consumption, the quantity sold in the open market and the quantity used for feed, seed and etc are valued on average wholesale Lahore market price. Though the quality of the wheat grain used for feed may be relatively poor than the average quality wheat, but on the other hand wheat used for seed is usually of higher quality. Thus, it is reasonable to

use average wholesale price to value this quantity. The total value of output sold either to the government, in open market or kept at home for self-consumption turns out to be Rs.125.86 billion. On the other hand if the farm output is valued on import parity prices, then it would be Rs.163.81 billion. This difference is over 23.17% implying that the farmers are being taxed equivalent to 23.17%.

The government wheat procurement costs worth Rs.39.74 billion – includes storage and transportation cost, and cost of imported wheat (Rs.26.70 billion). The total operation thus costs Rs.66.44 billion. Government releases/sells wheat to millers at the same issue price irrespective of the origin of purchase – imported or domestically procured wheat. On an average, the sale value of wheat was Rs.51.70 billion costing government Rs.14.74 billion every year.

Flourmills purchase fixed quantity/quota of wheat from the government and the rest for milling is purchased from the open market. Government sells wheat to the millers at a price lower than its cost incurred on procurement and storage. Consequently, the rent to the millers is the difference between government cost per tone of wheat and the wheat release price per tone, which was equal to Rs.1355/tonne. Profit of the millers can be computed as the difference between the issue price and the wholesale price, which was equal to Rs.342/tone. Consequently, average gain of the millers per tone was Rs.1697. As a result total subsidy enjoyed by the millers was equal to the average gain per tone multiplied by the total quantity of wheat procured either domestically or imported. This amount equals Rs.11.05 billion.

Basically, non-farm rural and urban consumers buy wheat/wheat flour from the open market. Millers sell wheat-flour in the market without differentiating the source of purchase for wheat grains. On the other hand, on-farm consumption of wheat is also valued at the market price. One of the objectives of the government interventions is to keep food prices within affordable range for the consumers. If government does not intervene in the market and leave the market forces to function, the wheat price will move towards international price level. The difference between domestic wholesale price and the import parity price multiplied by the quantity consumed is the partial equilibrium[24] welfare gain to the consumers. However, we shall recompute this using our model to get a sense of the general equilibrium welfare gain to the consumers. The wedge between these two prices is about 22.24%. In value terms consumers' partial welfare gain from the existing policy was about Rs.38.27 billion.

The partial equilibrium total producer welfare loss was Rs.37.96 billion and the policy costs to government by about Rs.14.74 billion, while millers' gain from the wheat policy was Rs.11.05 billion. The resulting loss to the society was about Rs.3.37 billion comprised mainly of the difference between the gain to the millers and subsidy provided by the government that appears unaccounted for in the system.

This simple, partial equilibrium analysis already highlights the fact that consumers are subsidized at the cost of the farmers, and the millers absorb almost the whole subsidy provided by the government to implement wheat policy. We now turn to

[24] Partial equilibrium in the sense that the impact on prices of the rest of the commodities is not taken into account.

our CGE model to get a sense of the general equilibrium effects of removing these price distortions on wheat. For our policy experiments, we recalibrate our model to reflect the decade of 1990s where the import share remained around about 10%. However, production tax and consumption subsidy were 23%, and 22% respectively[25] (computed from Annexure Table 6).

6.2 SOCIAL ACCOUNTING MATRIX (SAM)

The discussion in this section focuses on the structure of production, foreign trade, household consumption expenditure and sources of their income.

Production Sectors: The SAM 2001-02 has 34 production sectors: 12 sectors relate to agriculture, 17 belong to industry, and 5 sectors to services. Wheat production is divided into activities -- irrigated and non-irrigated, while wheat milling is considered as single sector. Paddy production is separated into 'paddy IRRI -- course varieties' and 'paddy basmati – aromatic varieties', and the rice milling was also divided into two categories as well.

The SAM shows that 66.2% of total wheat production[26] goes to wheat milling, 25.9% to the livestock sector[27], 1.8% to poultry, and 6.1% to rest of the sectors (Table 14). Moreover, wheat is an intermediate commodity with zero final demand by end-users. The output of wheat milling is mainly wheat flour, which is a final commodity with 85.6

[25] In Annexure Table 6, production tax is computed using information under the 'Average' column and the following rows using the formula: (1-row AA/row AB) *100. Consumption subsidy is (1-row AH/row AM)*100.
[26] Wheat activity includes grain and its by-products, i.e. wheat straw etc.
[27] Livestock includes cattle and dairy. Poultry is in a separate account.

% demanded by the consumers, and only 14.4% absorbed as an intermediate input in the rest of the production system (Table 14).

Table 14—Link of wheat with other major sectors,%

Structure of Demand for Wheat Grain*	
Final demand:	
by consumers	0.0
Intermediate demand:	
by wheat milling	66.2
by livestock**	25.9
by poultry	1.8
by others	6.1
Structure of demand for Wheat milling (flour)	
Final demand:	
by consumers	85.6
Intermediate demand:	
by other intermediate demand	14.4
Structure of Inputs of Wheat Milling	
Intermediate input:	
From wheat grain	44.1
From others	34.1
Primary factors	21.8
Structure of Inputs of Livestock**	
Intermediate input:	
From wheat grain	5.0
From others	41.8
Primary factors	53.2

Source: 2001-02 Social Accounting Matrix.
* Wheat is composed of wheat grain and its by-products.
** Includes cattle and diary only.

In terms of value added, agricultural and industrial sectors contribute about 23% each to the total, while the service sector contributes more than 50%. Within the agricultural sector, livestock sector has more than 10% share, while wheat production (irrigated and non-irrigated combined) contributes less than 2%. In the industrial sector, the combined share of textile and cotton lint and yarn is 5%, while wheat milling shares

only 1.2%. In terms of total output in the country, overall agriculture contributes 20% while the industrial sector shares 38%.

In overall activities of the agriculture sector, the value addition is about 57%, while 43% is being absorbed as intermediate inputs (Table 15). However, the value addition in industrial sector (i.e. 30 percent) is much lower than the agriculture.

Within the agriculture sector, forestry and 'other crops category'[28] have higher value added ratios than the rest of the sub-sectors. These ratios in industrial sector are lower in all sub-sectors relative to mining, energy and cement. In terms of capital-labor ratios, the industrial sub-sectors have generally higher ratios than that in the agriculture sector, except livestock and poultry sub-sectors.

Table 15 further shows that the foreign trade sector is relatively small compared to the overall domestic sector. Only 10% of the total production goes in the export market, and the share of imports in the commodities is only 14.5%.

[28] Includes all other crops except wheat, paddy, sugarcane, cotton, all fruits and vegetables, and forestry.

Table 15—Elasticities and parameters

	Trade						Production (%)			
	Elasticities		Exports (%)		Imports (%)		Value-Added Ratio	Value-added Share	Output Share	Capital-Labor
Sectors	Armington	CET	Share	Intensity (a)	Share	Intensity (b)	va ÷ (x)	va÷(total va)	x÷(total x)	Ratio (c)
Wheat irrigated**		1.1	0.6	3.6	0.3	2.5	50.8	1.8	1.8	0.3
Wheat non-irrigated							50.9	0.1	0.1	0.3
Paddy IRRI							60.2	0.2	0.2	0.5
Paddy basmati							60.2	0.5	0.4	0.5
Cotton							61.2	1.4	1.1	0.3
Sugarcane							60.0	1.0	0.8	0.7
Other major crops*	3.3	3.3	0.5	2.7	0.6	4.5	71.0	2.8	2.0	0.3
Fruits & vegetables*	1.9	1.9	1.1	3.8	1.3	6.9	64.2	3.6	2.8	0.6
Livestock, cattle, dairy*	2.0	2.0	0.1	0.1	0.7	1.1	53.2	10.3	9.7	9.0
Poultry*	1.3	1.3	0.0	0.1	0.0	0.0	51.6	0.7	0.7	9.0
Forestry*	2.5	2.5	0.5	31.4	0.2	25.2	82.1	0.3	0.2	0.0
Fishing Industry*	1.3	1.3	1.1	23.8	0.0	0.1	57.1	0.6	0.5	2.3
Agriculture			**3.9**	**1.9**	**3.1**	**2.4**	**57.4**	**23.2**	**20.1**	
Mining*	2.8	2.8	0.8	18.6	9.3	80.5	74.6	0.6	0.4	2.3
Vegetable oil*	3.3	3.3	0.0	0.0	2.3	20.0	7.9	0.2	1.4	6.7
Wheat milling	1.1	1.1	0.5	1.8	0.8	4.3	21.8	1.2	2.8	4.4
Rice milling IRRI*	2.6	2.6	1.7	46.6	0.0	0.0	30.7	0.2	0.4	3.7
Rice milling Basmati*	2.6	2.6	2.3	28.6	0.0	0.0	29.0	0.5	0.8	3.7
Sugar*	2.7	2.7	0.0	0.1	0.3	1.9	32.2	1.4	2.2	3.3
Other food*	2.0	2.0	12.1	51.5	1.1	12.4	36.9	1.7	2.3	4.7
Cotton lint, yarn*	3.8	3.8	9.0	27.1	0.7	4.3	21.6	1.4	3.3	3.3
Textiles*	3.8	3.8	31.9	39.7	1.6	4.8	22.2	3.6	8.0	2.7
Leather*	4.1	4.1	2.3	42.8	0.1	5.2	8.3	0.1	0.5	2.9
Wood products*	3.4	3.4	0.0	0.3	0.6	8.6	36.3	0.7	0.9	1.8
Chemicals*	3.3	3.3	1.4	15.9	11.2	69.9	28.2	0.5	0.9	3.8
Cement, bricks*		2.9	0.0	0.2			55.0	1.4	1.3	7.4
Petroleum refining*	2.1				9.7	50.1	19.4	0.6	1.5	2.9
Other manufacturing*	3.8	3.8	16.6	33.2	54.0	71.0	25.4	2.6	5.0	2.6
Energy							60.8	3.4	2.8	4.0
Construction							41.6	3.2	3.8	0.4
Industry			**78.6**	**20.5**	**91.6**	**31.4**	**30.3**	**23.3**	**38.4**	
Commerce	1.1	1.1	0.1	0.1	0.2	0.4	84.0	15.3	9.1	0.4
Transport		1.1	17.4	15.9			53.9	11.8	10.9	1.5
Housing							81.8	4.9	3.0	
Private services	1.1	1.1	0.0	0.0	5.0	6.0	53.5	12.9	12.0	1.5
Public services							66.2	8.6	6.5	
Services			**17.5**	**4.2**	**5.2**	**2.0**	**64.3**	**53.5**	**41.5**	
Total			**100.0**	**10.0**	**100.0**	**14.5**	**49.8**	**100.0**	**100.0**	

Source: 2001-2002 Social Accounting Matrix of Pakistan.

va-value added; x- output; CET-constant elasticity of transformation

*Half of recent GTAP elasticities (Hertel, et al, 2004),

** imported and domestic wheat are perfect substitutes.

(a) export ÷ output; (b) imports ÷ composite good; (c) total labor ÷ total capital in I.

However, large variation is observed across sectors: For example, export intensity ratio (EIR)[29] in forestry and fisheries are 31.4% and 23.8% respectively, while the ratio in the rest of agriculture sub-sectors is almost zero. The EIR in agriculture is only 1.9%, while it is 20.5% in the industrial sector. Within the industrial sector, 'other food' has the highest EIR, i.e. 51.5%, followed by 'rice milling IRRI' of 46.6%. The EIR in leather is 42.8%, while the textile sub-sector shows 39.7%. In terms of the sector wise contribution to overall exports from the country, textile shares 31.9% followed by transport 17.4 percent. The overall contribution of the unprocessed agricultural commodities towards total exports is only 3.9%.

The industrial sector has a high import intensity ratio (IIR)[30], i.e. 31.4% (Table 15). Within the industrial sector, mining has IIR of 80.5% followed by 'other manufacturing' 71% and chemicals 69.9%. The IIR in petroleum sub-sector is also high, i.e. 50.1%. In terms of import share, 'other manufacturing' captures 54% of the overall imports.

The Household Sector: There are 19 household groups in the 2001-02 SAM, which are defined in Table 17. The household categorization is based on location, size of land holdings, rural and urban, and poor and non-poor. The structure of consumption of each of the household groups is presented in Table 16. Among the commodities the livestock sub-sector has the largest share in the consumption basket of the households but

[29]Export intensity ratio is defined as the sector's export divided by its output.

[30]Import intensity ratio is defined as the sector's imports divided by its total domestic supply.

there is substantial variation across household groups ranging from 24.9% for the household group h14 to 14.4% for the groups h3 and h6.

The wheat milling along with transport, textile, other manufacturing, and 'fruits and vegetables' also come under the major consumption expenditure categories. For wheat milling the expenditure share varies from 11.7% in household group h15 to 4.4% in groups h2 and h5.

Table 16—Consumption share

	Households									
Commodities	**h1**	**h2**	**h3**	**h4**	**h5**	**h6**	**h7**	**h8**	**h9**	**h10**
Other major crops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Fruits_ vegetables	4.8	4.4	5.7	4.8	4.4	5.7	5.6	5.2	6.1	6.6
Livestock, cattle, dairy	19.9	22.8	14.4	19.9	22.8	14.4	19.5	26.1	21.6	19.3
Poultry	1.1	1.2	1.7	1.1	1.2	1.7	1.1	1.0	1.4	
Forestry	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.0
Fishing Industry	1.9	0.0	0.5	1.9	0.0	0.5	2.5	0.0	0.1	2.7
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable oil	2.9	2.8	2.7	2.9	2.8	2.7	3.3	3.3	3.3	3.4
Wheat milling	6.9	4.4	7.5	6.9	4.4	7.5	6.6	6.4	7.4	8.2
Rice milling IRRI	0.7	0.2	0.2	0.7	0.2	0.2	1.2	0.2	0.2	1.1
Rice milling Basmati	2.5	0.6	0.7	2.5	0.6	0.7	4.2	0.8	0.8	4.0
Sugar	5.0	3.6	5.3	5.0	3.6	5.3	4.9	4.8	7.3	5.9
Other food	1.2	0.9	1.3	1.2	0.9	1.3	1.2	1.0	1.9	1.6
Cotton lint, yarn										
Textiles	5.5	6.6	4.9	5.5	6.6	4.9	6.0	6.2	5.3	6.7
Leather	0.2	0.4	0.3	0.2	0.4	0.3	0.2	0.3	0.3	0.3
Wood products										
Chemicals	3.0	4.3	4.9	3.0	4.3	4.9	1.9	2.2	1.8	0.5
Cement, bricks	0.9	1.2	1.4	0.9	1.2	1.4	0.5	0.6	0.5	0.1
Petroleum refining	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.8	0.7
Other manufacturing	5.8	8.4	9.6	5.8	8.4	9.6	3.7	4.4	3.5	1.0
Energy	0.6	0.7	0.7	0.6	0.7	0.7	0.6	0.7	1.0	0.9
Commerce	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4
Transport	13.5	13.6	13.6	13.5	13.6	13.6	13.3	13.4	13.3	13.1
Housing	1.4	1.6	2.4	1.4	1.6	2.4	1.5	1.3	1.8	1.9
Private services	14.5	14.7	14.6	14.5	14.7	14.6	14.4	14.4	14.4	14.2
Public services	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 2001-2002 Social Accounting Matrix of Pakistan.

Table 16—Consumption share - continued

	Households								
Commodities	**h11**	**h12**	**h13**	**h14**	**h15**	**h16**	**h17**	**h18**	**h19**
Other major crops	0.1	0.2	0.2	0.1	0.3	0.2	0.2	0.2	0.2
Fruits_ vegetables	6.2	7.0	6.0	6.5	7.1	6.0	6.7	6.2	6.9
Livestock, cattle, dairy	22.3	17.5	20.7	24.9	15.9	19.9	17.9	18.3	18.0
Poultry	1.0	1.4	0.7	0.9	1.5	1.4	1.0	1.7	1.1
Forestry	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Fishing Industry	0.0	0.2	1.2		0.3	0.9	0.7	0.8	0.6
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vegetable oil	3.6	3.4	3.2	3.4	3.8	3.2	3.9	2.7	3.8
Wheat milling	7.7	8.3	10.9	9.1	11.7	6.0	10.3	4.0	9.1
Rice milling IRRI	0.2	0.2	0.6	0.3	0.1	0.3	0.5	0.2	0.4
Rice milling Basmati	0.8	0.7	2.3	1.0	0.5	1.1	1.7	0.9	1.5
Sugar	5.5	8.2	8.2	5.8	9.6	5.0	7.0	3.3	5.8
Other food	1.2	1.9	1.5	1.0	2.2	1.6	1.5	1.9	1.6
Cotton lint, yarn								0.0	
Textiles	6.5	5.3	6.1	6.8	5.1	5.8	6.6	5.8	6.8
Leather	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.3	0.4
Wood products								0.0	
Chemicals	2.1	2.3	0.4	0.9	1.2	2.9	1.3	3.5	1.4
Cement, bricks	0.6	0.6	0.1	0.3	0.3	0.8	0.4	1.0	0.4
Petroleum refining	0.7	0.8	0.6	0.6	0.8	0.8	0.8	0.9	1.0
Other manufacturing	4.0	4.4	0.8	1.8	2.2	5.7	2.5	6.9	2.7
Energy	0.8	0.9	0.8	0.7	1.0	0.9	1.0	1.1	1.2
Commerce	3.5	3.5	3.4	3.4	3.4	3.5	3.4	3.4	3.4
Transport	13.3	13.3	13.1	13.1	13.2	13.4	13.2	13.1	13.0
Housing	1.7	1.8	1.6	1.5	1.8	2.5	1.7	6.3	3.5
Private services	14.4	14.4	14.1	14.2	14.3	14.4	14.3	14.1	14.1
Public services	3.3	3.4	3.3	3.3	3.3	3.4	3.3	3.3	3.3
	100.0	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: 2001-2002 Social Accounting Matrix of Pakistan

The sources of household income include labor, capital, land and water, dividend, and the rest of the world.[31] Table 17 shows that the urban poor receives about 76.2% of their income from non-agricultural unskilled wages, and about 18% from capital – exclusively informal. The major portion of income for the urban non-poor households comes from two sources: 'other income' (44.2%) -- largely dividend income[32] and non-agricultural skilled wages (i.e., 33.3%). The main sources of income for rural non-farm households include informal capital (i.e. 63.4%) and non-agricultural unskilled wages (29.7%). On the other hand rural non-farm non-poor receive only 50% from informal capital, while 43% comes from non-agricultural unskilled wages. Rural agricultural landless workers obtain a major part of their income from agricultural wages and capital informal, and to some extent this group benefits from non-agricultural unskilled wages. The farm households source their income from labor, capital informal, land and water at various degrees.

6.3. THE CGE MODEL

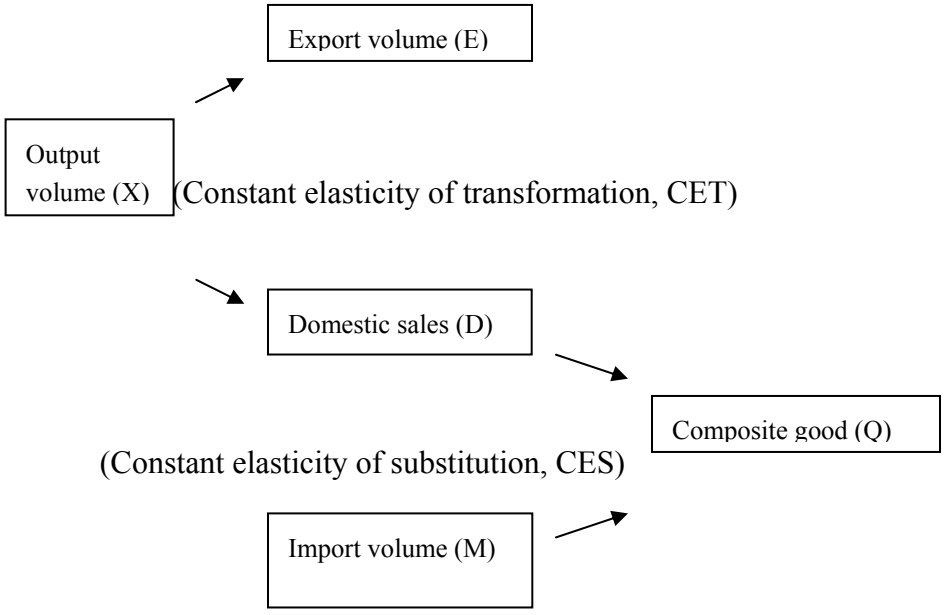
Basic features of the CGE model are briefly discussed in this section, while the details can be found in Annexure 9. The model, called PKCGEM, is a static one-period

[31] The SAM distinguishes 10 types of labor. There are four types of capital -- livestock, other-agriculture, formal and informal. Only firms receive the capital formal, while households get capital livestock, other-agriculture and informal at various amounts. However, for purposes of our CGE model we lumped them together into one category, and therefore into one source of household income. There are 12 land categories in each of the agricultural sector. We grouped them into one category for the CGE analysis, and therefore one source of household income.

[32] This is the only household group receiving the dividend income.

model.[33] It incorporates 34 production sectors, 10 labor types, capital, land, water, and 19 household categories. Figure 3 indicates that the model specifies a transformation function between export (E) and domestic sales (D) using constant elasticity of transformation (CET). In case the export price (Pe) increases relative to the local price (Pl) the export supply will go up while domestic sales would decline.

Figure 3—The basic model



Prices:

Output price : $Px \cdot X = Pe \cdot E + Pl \cdot D$, where Pl is local prices

Export price: $Pe = Pwe \cdot er$, where Pwe is world price of export and er is exchange rate

Domestic price: $Pd = Pl \cdot (1+itxr)$, where itxr is indirect tax rate

Import price: $Pm = Pwm \cdot er \cdot (1+ tm) \cdot (1+itxr)$, Pwm is world price of imports and tm is tariff rate

Composite price: $Pq \cdot Q = Pd \cdot D + Pm \cdot M$

[33]The model has a number of special features which allow one to analyze other market issues such as price ceiling, price floor, and buffer stock management.

Table 17—Sources of household income

	Household	Labor										K	Land	Water	Others
		L1	L2	L3	L4	L5	L6	L7	L8	L9	L10				
h1	Large Farmers in Sindh	13.2							0.1	0.2		31.4	37.2	12.6	5.3
h2	Large Farmers in Punjab	8.6								0.5		43.3	33.5	8.7	5.4
h3	Large Farmers in Other Pakistan	9.8							0.0	0.1		52.4	32.3		5.4
h4	Medium Farmers in Sindh		14.5						0.5	2.6		39.6	37.4		5.3
h5	Medium Farmers in Punjab			10.8					0.0	4.3		52.3	27.2		5.4
h6	Medium Farmers in Other Pakistan				14.9				1.0	1.9		38.2	38.4		5.5
h7	Small Farmers in Sindh					6.8			4.3	4.7		57.9	20.4		5.8
h8	Small Farmers in Punjab						7.9		4.2	10.0		51.8	20.3		5.8
h9	Small Farmers in Other Pakistan							6.0	3.4	8.2		63.6	12.5		6.2
h0	Small Farm Renters (landless) in Sindh					11.6			14.7	4.0		48.5	15.6		5.7
h11	Small Farm Renters (landless) in Punjab						9.0		6.1	14.3		48.7	16.1		5.8
h12	Small Farm Renters (landless), Other Pakistan							10.1	2.3	12.2		55.0	14.7		5.7
h13	Rural agricultural workers (landless) in Sindh								36.0	15.1		42.8			6.2
h14	Rural agricultural workers (landless) in Punjab								33.6	15.7		45.2			5.5
h15	Rural agricultural workers (landless) in Other Pakistan								15.6	3.1		76.0			5.4
h16	Rural non-farm non-poor									43.0		49.9			7.2
h17	Rural non-farm poor									29.7		63.4			6.9
h18	Urban non-poor									11.9	33.3	10.6			44.2
h19	Urban Poor									76.2		18.0			5.8

L1=labor in large farm; L2=labor in medium farm in Sindh; L3= labor in medium farm in Punjab; L4= labor in medium farm in other Pakistan; L5=labor in small farm in Sindh; L6= labor in small farm in Punjab; L7= labor in small farm in other Pakistan; L8=agricultural wage labor; L9=non-agricultural wage labor (unskilled); L10= non-agricultural wage labor (skilled); K=capital

Source: 2001-2002 Social Accounting Matrix of Pakistan.

The supply side of the model assumes profit maximization. The first-order conditions for profit maximization generate the necessary supply and input demand functions.

On the demand side, the substitution is allowed between imports and domestic goods using a constant elasticity of substitution (CES) function. This substitution indicates product differentiation where imports and domestically produced goods are treated as imperfect substitutes. If the import price in local currency (Pm) declines relative to domestic price (Pd), the demand for imports will rise while the demand for local goods would decline. The demand side assumes cost minimization and the first-order conditions generate the import and domestic demand functions. The trade elasticities in the CES and CET functions are presented in Table 15.[34]

The pricing mechanism operates as follows. The output price (Px) is composite price of export (Pe) and local (Pl) prices. Indirect taxes are added to the local price to determine the domestic price (Pd), which together with import price (Pm) will determine the composite commodity price (Pq). The composite price (Pc), which incorporates consumption tax or subsidy, is the price paid by the consumers. The import price (Pm) is denominated in domestic currency, and is affected by the world price of imports, the exchange rate (er), the tariff rate (tm), and the indirect tax rate (itx). The direct effect of a

[34]The elasticities used in our analysis are half the level of the recently estimated parameters of the GTAP model (Hertel et al 2004). The trade elasticity parameters used for irrigated and non-irrigated wheat, and wheat milling is 1.1, which is much lower than the GTAP elasticity of 4.5. Two sensitivity analyses are conducted using elasticity parameters values of 2.2 and 0.8 for these sectors.

tariff reduction is a reduction in Pm -- if large enough will reduce the composite price (Pq).

The households are assumed to maximize their utility based on Cobb-Douglas (CD) functional form. The intermediate demand is determined by a set of fixed Leontief coefficients. Sectoral capital is fixed and labor supply is also fixed.

The macroeconomic closure used in the model is as follows:

Total (E–M) = Total (S–I) + Total (Tx–G)

where E is total exports of goods and services, M is total imports of goods and services, S is total private savings, I is total private investment, Tx is total government income and G is total government expenditure. The left side of the above equation indicates total external balance and is assumed fixed. This is equivalent to assuming constant foreign savings. The nominal exchange rate is the numéraire. The foreign trade sector is effectively cleared by changes in the real exchange rate, which is the ratio of the nominal exchange rate multiplied by the world prices and divided by the domestic price index. The S–I, the first part on the right hand side of the equation, represents the private sector balance and is solved in the model. Savings of firms are fixed, while dividend income is endogenous[35]. The second term (Tx-G) on the right hand side of the equation represents the total government balance: government income and expenditure are assumed fixed. A

[35]The rationale for fixing savings of firms and endogenizing dividend income is to capture the impact of changes in pricing policies on the income of the owners of firms. In the 2001-02 SAM, the entire dividend income of firms goes to urban non-poor households only, which implies that this group owns the firms.

compensatory indirect tax is introduced to offset whatever loss/gain in revenue is incurred during the implementation of the policy experiments.

6.3.1 Policy Experiments

In computing the base run we recalibrated the model to capture the following features:

a) Wheat import is 10% of total supply. In the 2001-02 SAM wheat imports is only 2.5% of supply. Thus this adjustment recalibrates the model to the structure in the 1990s.

b) Increase world price for wheat so that when we impose production tax and consumption subsidy import prices will be higher than the producer prices after tax (23% higher) and consumer prices after subsidy (22% higher). These taxes and subsidies have been mentioned in Section 6.1.

c) Imported and domestically produced wheat are perfect substitutes.

We analyze the two price distortions in wheat economy in a two-step simulation procedure.[36] The first step involves consumption subsidy only, while the second step deals with production tax only. The total effect is the sum of the results from each of these two steps. The rationale for this two-step procedure is given in Figures 4 and 5.

Figure 4 shows the analysis of subsidy. Point A is the equilibrium distorted by consumption subsidy. The price at q_0 is P_s where the consumer enjoys a subsidy of AB. If

[36]Furthermore, imports of wheat are fixed. Also, there is no cost minimization condition in wheat demand.

the subsidy is eliminated, q_0 may be unaffordable for the consumer. At P_0 the consumer will only be able to buy q_1 where the new equilibrium is at point D. The elimination of subsidy effectively shifts the demand curve to DD_1 and the supply curve to SS_1. The shift in the supply curve would actually cause shift in resource away from wheat sector to other sectors because of reduced demand. The elimination of subsidy reduces consumer welfare equal to the area of the triangle ABD.

The analysis of production is presented in Figure 5. The usual application of a production tax shifts quantity from q_0 to q_1 where consumer faces a higher price at P_c while producer receives a lower price at P_x. The government generates production tax of CB per unit of q. The elimination of production tax will generate two effects: an increase in producer surplus equal to the area P0PxBA; and an increase in consumer surplus equal to P0PcCA. If accommodated in the CGE model as such, it will overestimate the effects. Since the change in consumer surplus is analyzed in the first step (Figure 4), we are interested to capture the change in producer surplus only. In order to achieve this objective we introduce an adjustment factor so that P_c remains equal to P_0.

Figure 4—Analysis of subsidy

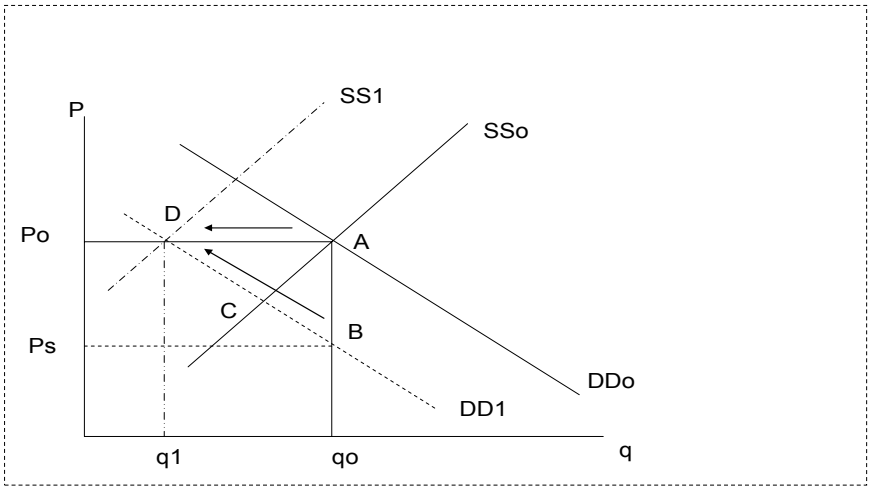
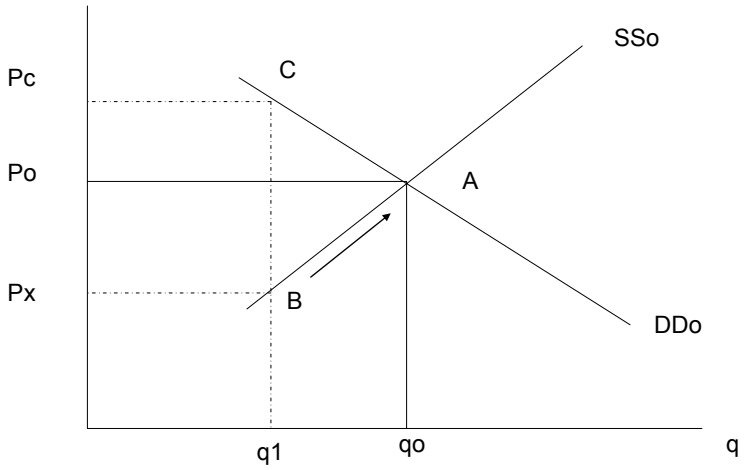


Figure 5—Analysis of subsidy



We compare the results of the consumption subsidy and production tax analyses with the solution of the model where the wheat market is free from these distortions. Free market is characterized as follows: wheat imports are not fixed, but perfect substitutes for domestic wheat; and zero consumption subsidy and production tax.

6.3.2 Simulation Results

Table 18 shows the results for wheat assuming free market, consumption subsidy of 22% and production tax of 23%.

The consumption subsidy of 22% lowers the consumer price by 28.7% relative to the free market price. It also lowers the consumer price and import price ratio to 0.78. The amount of subsidy is about 29.4 billion rupees. Since there is no production tax in the present simulation, the ratio of output price after tax and import price is practically the same as in the free market.

Thus, if consumption price subsidy on wheat is eliminated its consumer price increases by 28.7%, which in turn reduces total wheat demand by -3.8%. Wheat import declines by 1.5%, which is largely due to the freeing of wheat importation. Consumer demands for domestically produced wheat declines by 4%. On the other hand, overall production of wheat declines by 4.1% and wheat export declines by 4.9%. The latter would have only small impact because of minor share in total production (Table 15). These results are consistent with the theoretical insights derived from Figure 4 where the movement from Point A -- distorted by consumption subsidy, to Point B -- free from

distortion, lowers quantity demand to q_1. This movement results in loss of consumer welfare.

The production tax analysis is also presented in Table 18. We applied an adjustment factor of 0.173 on consumer price so that the consumer price with or without production tax remains the same as explained earlier. The production tax of 23 percent lowers the output price by 30.3%. Thus, the elimination of production tax the output price would increase by 30.3%, which in turn will lower the cost of production by 18.9%. Overall production will increase by 1.3%. Output sold to the domestic market will increase by 0.3%, while exports will increase by 58.9%. The increase in exports is largely due to improved price competitiveness of wheat as a result of lower cost of production. These set of results are consistent with the theoretical insights derived in Figure 5.

Table 18—Free market versus distorted market for wheat

Wheat grain	Free market	Distorted Market			
		With Subsidy		With Production Tax	
		Levels	% Change*	Levels	% Change*
Prices:					
Consumer price	1.08	0.84	28.7	1.08	
Consumption subsidy	0.00	0.22		0.17**	
Amount of subsidy (bil rupees)**	0.00	29.43			
Import Price	1.08	1.08		1.08	
Domestic Price	1.08	1.08		1.33	-18.9
Output Price	1.00	0.99		1.00	
Output tax	0.00	0.00		0.23	
Output Price after tax	1.00	0.99		0.77	30.3
Price ratios:					
Consumer price ÷ Import price	1.00	0.78		1.00	
Output price after tax ÷ Output price	1.00	1.00		0.77	
Output price after tax ÷ Import price	0.92	0.92		0.71	
Quantities:					
Total demand	1.19	1.24	-3.8	1.19	0.1
From imports	0.12	0.12	-1.5	0.12	-1.5
From domestic supply	1.07	1.12	-4.0	1.07	0.3
Total production	1.20	1.25	-4.1	1.18	1.3
To domestic market	1.07	1.12	-4.0	1.07	0.3
To export market	0.04	0.04	-4.9	0.02	58.9

*Market reform relative to free market.
**Subsidy financed by all sectors because government income is fixed by assumption
***Adjustment factor

Before discussing the effects on factor prices, household income and welfare, we highlight the impact on wheat milling and livestock sectors, both are closely linked to wheat production[37]. Table 19 shows that the elimination of consumption subsidy would have larger impact on wheat milling than on livestock, which is consistent with the structure shown in Table 14. The elimination of production tax has significantly lower

[37]Detailed sectoral results concerning the elimination of price subsidy on wheat, which we will not discuss in full length, are presented in Annexure Table 8, while detailed results of eliminating production tax on wheat are in Annexure Table 9. Results in Table 19 were drawn from these tables.

impact on wheat milling and livestock sectors relative to the dismantling of consumption subsidy.

Table 19— Impact of wheat market reform on flour and livestock

	% Change*	
	With Subsidy	With production Tax
Wheat flour		
Prices:		
Consumer price	4.88	0.05
Import price	-0.39	0.00
Domestic price	5.12	5.93
Output price	5.43	0.06
Quantities:		
Total demand	-4.62	0.04
From imports	6.83	0.17
From domestic supply	-5.10	0.03
Total production	-5.32	0.03
To domestic market	-5.10	0.03
To export market	-15.60	0.03
Livestock		
Prices:		
Consumer price	0.00	0.10
Import price	-0.39	0.00
Domestic price	0.00	0.09
Output price	0.39	0.10
Quantities:		
Total demand	-0.12	0.01
From imports	0.66	0.20
From domestic supply	-0.13	0.00
Total production	-0.13	0.00
To domestic market	-0.13	0.00
To export market	-2.12	-1.33

Market reform relative to free market

The impact on factor prices is presented in Table 20. Farm and agricultural wages decline if consumption subsidy is eliminated. The decline is due to the reduction in output because of lower demand for wheat. However, non-agricultural wages -- both skilled and unskilled improve. These results clearly indicate that the elimination of wheat

consumption subsidy, some of the resources devoted to wheat production will relocate to other sectors of the economy -- non-agriculture as well as agriculture.

Table 20— Impact of wheat market reform on factor prices

	% Change*	
	With Subsidy	With production Tax
Wage, own farm labor, large farm	-1.60	0.45
Wage, own farm labor, medium farm, Sindh	-1.11	0.33
Wage, own farm labor, medium farm, Punjab	-0.94	0.30
Wage, own farm labor, medium farm, Other Pakistan	-3.33	0.96
Wage, own farm labor, small farm, Sindh	-1.15	0.37
Wage, own farm labor, small farm, Punjab	-1.36	0.45
Wage, own farm labor, small farm, Other Pakistan	-1.04	0.29
Agricultural wage	-1.11	0.21
Non-agricultural wage unskilled	0.20	0.09
Non-agricultural wage skilled	0.32	0.04
Average return to capital	-0.28	0.08
Return to land	-0.03	0.11
Return to water	-4.11	0.40

*Market reform relative to free market

Wheat production uses significant amount of irrigation water followed by fruits and vegetables. The reduction in wheat production will lower the return to water. The return to land increases indicating re-allocation of land use from wheat production to other agricultural crops and other agricultural sub-sectors.

The effects on household income, consumer prices, and welfare have also been analyzed and are presented in Table 21. The effect of elimination of wheat consumption subsidy on income is generally negative on agricultural and rural households. This is largely due to the reduction in wheat output, which in turn reallocates resources from wheat production to other sectors. Thus, prices of factors heavily used in wheat production decline.

Consumer prices generally increase as a result of the elimination of consumption subsidy. The consumption-weighted consumer prices are shown in Column 2 in Table 21. The results show that the weighted consumer price does not increase for all households. Rather, four household groups face lower consumer prices including large farmers in Punjab (h2), medium farmers in Punjab (h5), rural non-farm non-poor (h16), and urban non-poor (h18). This is due to the fact that these households have relatively low share of wheat consumption in their consumption basket. The decline in weighted consumer prices for these groups indicates that the prices of other items in their consumption basket decline at a much higher rate than the increase in the price of wheat. The reduction in prices is due mainly to the increase in production of other sectors as a result of resource diversion away from wheat. The households that face rising weighted consumer price have much higher wheat consumption share in their consumption basket as indicated in Table 16.

As discussed earlier the elimination of consumption subsidy would entail a reduction in consumer surplus. Our results indicate that the overall reduction in consumer welfare as measured by EV[38] amounts to -2.889 billion rupees, or -0.08% of the total household income. With the exception of urban non-poor, all household groups suffer from a reduction in consumer welfare but in varying amounts. The highest reduction (-0.99%) in welfare relative to income is observed for the large farmers in Sindh (h1). The reduction in welfare is dominated by the income effects over the price effects. This is

[38] See Annexure 9 for the derivation of the EV used in the analysis.

followed by rural agricultural landless workers in Sindh (h13) and large farmers in Punjab (h2) with welfare reduction 0.71% and 0.64% relative to their income, respectively. For group h2 the welfare reduction is due to the negative income effects, and for h13 decline in welfare results both from negative income effect and the increase in average consumer price -- reinforcing one another.

The urban non-poor (h18) household group experiences a net welfare gain amounting 1.592 billion rupees, or 0.09% of its income. The net gain in welfare effect comes largely from the reduction in its consumption-weighted average consumer price as shown in Table 21 since there appears to have no income effect. The net effect comes from two offsetting effects: the positive effect on labor income and the negative effect on dividend income. Table 17 indicated that this group sourced 11.9% and 33.3% of its income from unskilled and skilled non-agricultural labor. Since non-agricultural wages increase for both levels of skills (Table 20), therefore the group's labor income improves. However, the dividend income drops for this group since the elimination of consumption subsidy in the analysis is applied to the user price of wheat. When consumption subsidy is eliminated the wheat millers -- the main wheat users as processor, have to pay a higher price. That in turn reduces their profits. Since savings of firms is held fixed by assumption in the simulation, this implies reduction in dividend income. The dividend income entirely goes to the urban non-poor resulting into decline in their income.

Table 21—Household welfare effects of market reform on wheat

	Free Market and With Subsidy				Free Market and With Production Tax				Combined Effects	
	% change*		Eqiuvalent		% change*		Eqiuvalent		Eqiuvalent	
	income	Weighted Consumer Price	Variation, EV (mil rupees)	EV % of income	income	Weighted Consumer Price	Variation, EV (mil rupees)	EV % of income	Variation, EV (mil rupees)	EV % of income
Households	1	2	3	4	5	6	7	8	(3+7)	(4+8)
Large Farmers in Sindh	-0.94	0.02	-188	-0.99	0.28	0.07	37	0.20	-151	-0.79
Large Farmers in Punjab	-0.72	-0.08	-410	-0.64	0.21	0.07	94	0.15	-316	-0.49
Large Farmersin Other Pakistan	-0.33	0.03	-39	-0.36	0.14	0.06	10	0.09	-29	-0.27
Medium Farmers in Sindh	-0.30	0.02	-143	-0.32	0.15	0.07	42	0.09	-101	-0.23
Medium Farmers in Punjab	-0.25	-0.08	-251	-0.17	0.14	0.07	102	0.07	-149	-0.10
Medium Farmers in Other Pakistan	-0.64	0.03	-242	-0.68	0.25	0.06	68	0.19	-174	-0.49
Small Farmers in Sindh	-0.28	0.00	-172	-0.30	0.13	0.07	33	0.06	-139	-0.24
Small Farmers in Punjab	-0.29	0.02	-998	-0.32	0.14	0.07	210	0.07	-788	-0.25
Small Farmers in Other Pakistan	-0.26	0.05	-399	-0.32	0.11	0.07	47	0.04	-352	-0.28
Small Farm Renters (landless) in Sindh	-0.44	0.08	-224	-0.51	0.14	0.07	33	0.08	-191	-0.44
Small Farm Renters (landless) in Punjab	-0.30	0.07	-173	-0.38	0.15	0.07	31	0.07	-142	-0.31
Small Farm Renters (landeless) in Other Pakistan	-0.26	0.07	-52	-0.35	0.13	0.07	7	0.05	-45	-0.30
Rural agricultural workers (landless) in Sindh	-0.46	0.21	-146	-0.71	0.15	0.07	10	0.05	-136	-0.66
Rural agricultural workers (landless) in Punjab	-0.47	0.14	-417	-0.62	0.12	0.07	32	0.05	-385	-0.57
Rural agricultural workers (landess) in Other Pakistan	-0.34	0.23	-59	-0.62	0.14	0.07	2	0.02	-57	-0.60
Rural non-farm, non-poor	-0.05	-0.02	-131	-0.03	0.08	0.07	43	0.01	-88	-0.02
Rural non-farm poor	-0.11	0.17	-394	-0.30	0.08	0.07	9	0.01	-385	-0.29
Urban non-poor	-0.02	-0.11	1,592	0.09	0.07	0.07	27	0.00	1,619	0.09
Urban Poor	0.10	0.12	-43	-0.02	0.08	0.07	26	0.01	-17	-0.01
Total			-2,889	-0.08			863	0.03	-2,026	-0.06

*Market reform relative to free market

The impact of reduction in production tax is positive on all household groups. The increase in consumption-weighted consumer prices in all household groups is too small to have any significant impact on changing the welfare of the households. However, all household groups enjoy a positive increase in welfare arising from the increase in producer surplus. In monetary terms, the overall increase in welfare amounts to 0.86 billion rupees, or 0.03% of total household income.

The positive producer surplus arising from the elimination of production tax is not significant enough to offset the loss in consumer surplus resulting from the elimination of consumption subsidy. With the exception of urban households, all household groups experience net loss in welfare. The urban non-poor households gain about 1.62 billion rupees in welfare (i.e., 0.09% of income). The overall net welfare loss is 2.03 billion rupees, or 0.06% of total income.

7. SUMMARY AND POLICY IMPLICATIONS

The economy of Pakistan is dominated by the agriculture and thus the livelihood of majority of the people depends on the farm income. This sector directly employs nearly 42%of the country's total labor force. The export earnings in Pakistan are largely based on the surplus generated in the agriculture sector. The performance of this sector over the last four decades remained quite satisfactory with an average growth rate of 3.4% per annum higher than the population growth rate in the country. Still the country is far behind in its efforts to provide an acceptable level of dietary requirement to its people even at the aggregate level and the daily average availability of calories per person in the

country is lower by about 10 and 26% than that available respectively in other developing and developed nations.

The change in diet composition overtime shows a squeezing share of wheat (cereals as well) while share of intake from animal origin increased in total calories consumed. However, wheat remained the dominant source of calories and thus plays a vital role in food security and human diet in the country. Despite the fact that the daily average availability of calories per person from all sources in the country was considerably lower during the 1970s and the 1980s than its availability during the 1990s, the incidence of poverty has also been lower during the decades of 70s and 80s. It highlights that enhanced food availability at the national level does not necessarily indicate actual increased food consumption at regional or household level and/or every individual has an improved access to food in the country. Regardless of the reasonable rate of growth in agriculture sector, caloric based poverty increased during the 1990s highlighting the fact that factors determining the poverty other than the national income growth have been much stronger in pushing greater proportion of people below the poverty line. The major reasons could be the worsening income and landholdings inequality. Moreover, disparities in access to education and health may also be crucial factors leading to wide spread income inequalities. Further to note is the fact that despite significant improvement in food supply in the aggregate, malnutrition is a widespread phenomenon in Pakistan.

Food and agricultural prices are the major determinants of producers' incentives as well as real income in developing countries. In this vein, the government of Pakistan

had been pursuing interventionist policies quite actively in agricultural inputs as well as outputs markets to ensure food security. Most of these interventions have now been abolished. However, some market distortions through interventions in fixing agricultural prices and involvement of the state owned enterprises in trading still continue. Particularly, wheat marketing remained mainly in the public sector. Thus the creation of distortion free and a competitive private food marketing system remains to be dreamed of.

As regards trade policy, the government of Pakistan has also been pursuing the objective of a greater openness through liberalization with minimal tariff and non-tariff barriers and the market-based exchange rate system. The difference between the official exchange rate and in the open market has reached at a negligible level of 1.45% in 2000-01. The custom tariff, the average applied rate, fell from 56% in 1993-94 to 20.4% in 2000-01. The maximum rate of custom duty has been reduced to 25% in 2002 from 70% in 1995, and the government has completely dismantled the quantitative restrictions. Furthermore, Pakistan has removed all textile products from its negative list despite the fact that many of them are the key export products. However, the imports and exports of wheat and wheat flour are to a large extent the government of Pakistan and the domestic wheat marketing is also mainly controlled by the government.

The comparison between domestic prices with the parity prices for different crops shows that basmati rice growers are the most adversely affected by the policy disincentives followed by the wheat growers. However, IRRI rice and cotton growers are relatively better off followed by sugarcane growers. These interventions have been

resulting into immense resource transfer from agriculture to non-agriculture sectors. The major beneficiary appeared to have been the processors and the consumers at the expense of producers and the government exchequer.

The comparison of the incidentals of government-owned departments with that of the private traders shows that the private sector incidentals are relatively lower than those for the state-owned enterprises. In addition to cost difference, the corruption is pervasive in commodity marketing particularly in public sector. The rent seeking activities increase transaction costs and uncertainty, discourage marketing investment and participation, and ultimately lead to a negative fiscal impact for the government.

The results of CGE model indicate that the reduction in consumption subsidy on wheat increases the user price as well as the consumer price of wheat. This lowers the overall wheat demand. The reduction in demand reduces wheat production and moves resources out of this sector. The reduction in wheat production will result in lower prices of factors being heavily used in wheat sector. Since wheat is a major agricultural crop, agricultural wages will also drop. This effect will translate into lower labor income for households dependent on agriculture. The experiments indicate that the increase in consumer prices and the drop in income as a result of the elimination of consumption subsidy will generate a total net welfare loss of 2.961 billion rupees, representing about 0.09% of total household income.

Because of the variations in the sources of income as well as in the composition of consumption baskets of various household groups, the income and the consumer price effects vary across the groups. Some groups have larger negative income effects than

price effects, while some groups experience reinforcing negative income and price effects. However, the results indicate that urban non-poor benefits from the decline in its consumption-weighted consumer price. The decline is due to two factors: the relatively low share of wheat in its consumption basket; and the downward pressure on prices of other items in its consumption basket as a result of resource re-allocation from wheat production to other production sectors. This group experiences higher welfare gain of 1.973 billion rupees, or 0.11% of its income.

On the other hand, the elimination of production tax will benefit all household groups because of higher wheat production. The total net welfare gain is about 1 billion rupees. However, the positive producer surplus effects arising from the elimination of production tax is not significant enough to offset the loss in consumer surplus resulting from the elimination of consumption subsidy. Thus, the overall welfare effect is a net loss of 1.885 billion rupees, or 0.05% of household income.

In a nutshell, eliminating the government interventions the results of the CGE model lead us to draw four major conclusions: 1) price of wheat would turn out to be too high to be affordable to the consumers;[39] 2) Production may not increase much to compensate to bring the consumer prices down; 3) The loss in consumer surplus will be more than the producer gain; and 4) All household groups will face lower welfare except the urban non-poor: The latter may look for cheaper food substitutes.

[39] Some other empirical studies reviewed in this study also show that free market equilibrium price would too high to be affordable by the poor.

Moreover, our simplified, partial equilibrium analysis in Section 6.1 has also shown that the gain by removing production taxes would not compensate for loss in consumer welfare by eliminating consumer subsidies. However, the government expenditures going into the wheat procurement and distribution system – being just transferred to millers, can be saved.

The reader should note that these simulation results were generated using a static one-period CGE model. The dynamic long-run effects of higher incentives for wheat farmers as a result of the elimination of the implicit production tax (which may result in higher investment in medium to long run) are not considered. This effect could be larger. The dramatic increase in export volume as a result of the elimination of the implicit production tax because of the price competitiveness effect could be a source of larger dynamic effects in medium to long run.

Based on these results and conclusions, what option do we have in wheat marketing? The existing system of procurement and distribution enforced through movement restrictions on wheat grains creates also disincentives for the private sector to invest in wheat trade. However, it may not be advisable to leave the wheat economy fully at the behest of the markets owing to the importance of wheat in household consumption and production.

So what is the solution? The government should slowly step out of the food market and let the market function freely. However, to avoid extreme fluctuations in food prices the government needs to **monitor** wheat production and availability in the country.

The government has to maintain a buffer stock of optimal size for wheat purchased from the domestic market or through imports – interventions be based on market prices.

The government must develop food insecurity maps and target the extremely and moderately food insecure regions through food stamps. The huge sum of subsidies afforded by the government can be redirected to developing physical infrastructure and agricultural research aimed at high yielding varieties of crops resistant to biotic and abiotic stresses and with higher nutritional value may prove cheaper and more affective option to ensure food security.

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ANNEXURES

Annexure Table 1—Area, yield, and production of food grains and pulses in Pakistan

Year	Wheat	Rice	Maize	Other Cereals	All Cereals	Other Pulses	Gram
Area (000 hectares)							
1959-60	4878	1204	482	1479	8043	555	1142
1969-70	6229	1622	648	1279	9778	411	928
1979-80	6924	2035	701	1144	10803	422	1129
1989-90	7845	2107	863	1108	11922	461	1035
1999-00	8463	2515	962	794	12734	447	972
2000-01	8180	2376	944	859	12359	424	905
2001-02	8057	2114	942	886	11999	446	934
2002-03	8033	2225	936	798	11992	461	963
2003-04	8216	2461	947	1033	12657	474	982
Yield (kg/hectare)							
1959-60	801	826	911	396	737	409	532
1969-70	1171	1480	1031	539	1130	483	545
1979-80	1568	1581	1248	563	1443	469	278
1989-90	1825	1528	1366	538	1620	448	543
1999-00	2491	2050	1717	622	2229	532	581
2000-01	2325	2021	1740	601	2103	529	439
2001-02	2262	1836	1766	607	2026	520	388
2002-03	2388	2013	1856	605	2159	553	701
Production (000 tonnes)							
1959-60	3909	995	439	586	5929	295	608
1969-70	7294	2401	668	690	11053	471	506
1979-80	10857	3216	875	644	15592	625	313
1989-90	14316	3220	1179	596	19311	557	562
1999-00	21079	5156	1652	494	28381	827	565
2000-01	19019	4802	1643	516	25986	757	397
2001-02	18225	3881	1664	538	24310	609	362
2002-03	19183	4479	1737	483	25891	713	675
200304	19500	4848	1897	630	26875		611

Pakistan (2004 and previous issues).

Annexure Table 2—Farm Classification by Farm Size

	Numbers Farms%					Farm Area%				
	1960	**1972**	**1980**	**1990**	**2000**	**1960**	**1972**	**1980**	**1990**	**2000**
< 5	19.0	28.2	34.1	47.5	57.6	3.0	5.2	7.1	11.3	15.5
5 to < 12.5	44.3	39.9	39.4	33.4	28.1	23.6	25.2	27.3	27.5	27.9
12.5 to < 25	23.8	21.1	17.3	12.2	8.8	27.0	26.6	24.7	21.5	19.1
25 to < 50	9.0	7.7	6.5	4.7	3.9	19.0	18.8	17.8	15.8	16.3
50 to < 150	3.3	2.7	2.4	1.8	1.2	16.0	15.1	14.7	13.9	9.6
> 150	0.5	0.4	0.3	0.3	0.2	11.5	9.1	8.5	10.1	11.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Malik (2003).

Annexure Table 3—Exchange rates: Official and open market

Year	Official Rate	Market Rate	Overvaluation (%)
1960-61	4.76	7.45	56.45
1964-65	4.76	7.72	62.12
1969-70	4.76	7.87	65.27
1974-75	9.90	13.53	36.67
1979-80	9.90	13.17	33.03
1984-85	15.15	19.20	26.73
1989-90	21.45		
1990-91	22.42	23.27	3.79
1991-92	24.84	24.86	0.08
1992-93	25.96	27.56	6.16
1993-94	30.16	30.44	0.93
1994-95	30.85	31.69	2.72
1995-96	33.57	35.35	5.30
1996-97	38.99	41.03	5.23
1997-98	43.20	44.83	3.77
1998-99	50.05	54.25	8.39
1999-00	51.77	54.23	4.75
2000-01	58.44	61.25	4.81
2001-02	61.43	62.32	1.45
2003-4	57.55	57.84	0.51
2004-05	59.42	59.63	0.35

Annexure Table 4—Consumption of electricity in Pakistan and its provinces (Gwh)

Year	Pakistan	Punjab	Sindh	NWFPP	Baluch
1960	67				
1965	424				
1970	956	859	40.46	46.59	10.24
1975	1531	1311	117.19	82.94	19.77
1980	2056	1688	180.96	105.08	83.62
1985	2782	2068	308.82	148.57	257.43
1990	5004	3447	554.52	365.2	637.44
1991	5595	3867	631.93	372.09	724.72
1992	5823	4132	635.98	253.23	800.94
1993	5595	3972	598.55	228.69	795.79
1994	5742	4031	687.8	231.21	792.54
1995	6220	4240	681.98	375.08	922.9
1996	6658	4417	730.88	495.55	1014.03
1997	7019	4537	833	585	1063
1998	6956	4280	894.05	546.08	1167.64
1999	5576	3344	736.19	363.61	1131.59
2000	4512	2381	557.34	327.56	1245.68
2001	4896	2370	635.58	329.37	1560.89
2002	5581	2551	646.84	391.81	1991.93

Source: WAPDA (2003).

Annexure Table 5—Terms of Trade in Agriculture

Period	Index of Producer Prices (PPI)[a]	Index of Consumer Prices (CPI)[b]	Index of International Producer Prices (IPP)[c]	Index of Input Prices (IPI)[d]	Terms of Trade		
					TOT_{CPI} = PPI/CPI	TOT_{IPP} = PPI/IPP	TOT_{IPI} = PPI/IPI
1983-84	100	100	100	100	100.00	100.00	100.00
1984-85	102.73	105.67	104.43	113.2	97.22	98.37	90.75
1985-86	104.35	110.27	97.48	111.61	94.63	107.05	93.50
1986-87	107.29	114.24	90.35	115.77	93.92	118.75	92.68
1987-88	117.17	121.43	101.97	123.74	96.49	114.91	94.69
1988-89	129.05	134.04	129.42	132.52	96.28	99.71	97.38
1989-90	131.22	142.14	164.38	152.64	92.32	79.83	85.97
1990-91	147.47	160.13	168.68	172.57	92.09	87.43	85.46
1991-92	166.99	175.53	169.15	174.06	95.13	98.72	95.94
199293	180.16	191.78	179.2	182.43	93.94	100.54	98.76
199394	210.89	213.21	195.42	218.14	98.91	107.92	96.68
1994-95	230.37	240.76	235.46	248.35	95.68	97.84	92.76
1995-96	245.9	266.76	292.85	249.59	92.18	83.97	98.52
1996-97	290.65	298.23	357.54	294.88	97.46	81.29	98.57
1997-98	323.83	321.54	327.07	310.9	100.71	99.01	104.16
1998-99	353.37	339.96	325.48	333.32	103.94	108.57	106.02
1999-00	355.74	352.17	315.5	340.02	101.01	112.75	104.62
2000-01	355.22	367.68	342.54	358.04	96.61	103.70	99.21
2001-02	369.76	380.7	382.56	385.79	97.13	96.65	95.84
2002-03	390.96	392.5	377.81	410.93	99.61	103.48	95.14

Source: Khan and Ahmed (2005)

Note: [a)] Included commodities are wheat, rice, maize, bajra, jowar, barley, sugarcane, cotton, gram, moong, mash, masoor, onion, potato, tomato, mango, banana, apple, guava and citrus: Annual wholesale prices were used; [c)] rice, wheat, cotton, jowar, citrus fruits, banana, barley, and maize; [d)] Inputs include fertilizer, diesel oil, water, and pesticides.

Annexure Table 6—Producer tax and consumer subsidy

	Years	1996-97	1997-98	1998-99	1999-2000	Average
	Quantities million tones					
A	Total production	16.70	18.70	17.90	21.10	18.60
B	Farm home consumption 35% of A	5.85	6.55	6.27	7.39	6.51
C	Feed Seed and wastage (10% of A)	1.67	1.87	1.79	2.11	1.86
D	Sold to government (procurement)	2.70	4.00	4.10	8.60	4.85
E	Sold in open market (A-B-C-D)	6.49	6.29	5.75	3.01	5.38
F	Imports	2.38	4.11	2.33	2.35	2.79
G	Consumption purchased from the market (E+F)	8.87	10.39	8.08	5.36	8.17
H	Total available for consumption (=A-C+F)	17.41	20.94	18.44	21.34	19.53
	Prices/costs					
I	Govt. storage cost Rs/tone	1069	1399	1609	1694	1443
J	Private storage cost (90% of I)	962	1259	1448	1525	1299
K	Support Price Rs/tone (sold at procurement centers)	6000	6000	6000	7500	6375
L	Issue price Rs/tone	4850	6500	6500	8000	6463
M	Wholesale price in Lahore	5475	7415	7225	7102	6804
O	Import Parity in Lahore	8950	9100	7875	9225	8788
Q	Government adjusted price -- includes storage cost (=K+I)	7069	7399	7609	9194	7818
R	Government price of imported wheat includes 6 months of govt. storage cost (=O+I/2)	9484	9800	8680	10072	9509
	Values					
	Farmers					
S	Value of farm home consumption(=B*m)	32001	48528	45265	52449	44561
X	Value of output sold in market (E*m)	35505	46601	41508	21342	36239
Y	Value of output sold to the government (D*K)	16200	24000	24600	64500	32325
Z	Value of output kept for feed, seed or wasted (=C*M)	9143	13865	12933	14985	12732
AA	Total Value of output at domestic prices (=S+X+Y+Z)	92850	132994	124305	153276	125856
AB	Total value of output at international prices (=A*O)	149465	170170	140963	194648	163811
	Government					
AC	Cost of govt. procured wheat including storage:(=Q*D)	19085	29598	31199	79071	39738
AD	Cost of imported wheat: (R*F)	22601	40267	20258	23690	26704
AE	Govt. total cost on imported and domestic procurement: AD+AC	41686	69865	51457	102761	66442
AF	Government recovery- sold to millers: (D+F)*L	24653	52709	41821	87616	51700
AG	Government subsidy involved: (AE-AF)	17034	17156	9636	15145	14743
	Consumer					
AH	Value of consumed commodity at wholesale price: M*H	95336	155254	133258	151573	133855
AM	Value of consumed commodity at international price: H*O	155846	190545	145247	196880	172129
	Millers					
AN	Rent to the millers (=Q-L)	2219	899	1109	1194	1355
AO	Millers profit (=M-L)	625	915	725	-898	342
AP	Millers per unit gain	2844	1814	1834	296	1697
AQ	Millers total gain (D+F)*AP	14454	14710	11803	3246	11053
	Welfare gains					
AR	Consumer gain: AM-AH	60510	35291	11989	45307	38274
AS	Millers gain	14454	14710	11803	3246	11053
AT	Producer loss (AB-AA)	56615	37176	16658	41371	37955
AU	Government cost involved: (=AG)	17034	17156	9636	15145	14743
AV	Gain to the society	1315	-4331	-2502	-7963	-3370

Source: Pakistan (various issues) and Slam (2003)

Annexure Table 7—Detailed sectoral effects of elimination of subsidy on wheat, %

	Changes in Price								Changes in Volume				
	px	pl	pva	pc	pq	pd	pm	pe	x	d	q	m	e
Wheat irrigated	0.33	0.35	-1.41	28.66	0.36	0.39	0.04	-4.87	-4.07	-4.05	-3.80	-1.51	-4.87
Wheat non-irrigated	-0.47	-0.47	-0.49	-0.86	-0.86	-0.86			-3.78	-3.78	-3.78		
Paddy IRRI	-0.40	-0.40	-0.38	-0.79	-0.79	-0.79			0.15	0.15	0.15		
Paddy basmati	-0.59	-0.59	-0.69	-0.98	-0.98	-0.98			0.31	0.31	0.31		
Cotton	-0.42	-0.42	-0.41	-0.80	-0.80	-0.80			0.45	0.45	0.45		
Sugarcane	-0.45	-0.45	-0.39	-0.83	-0.83	-0.83			0.22	0.22	0.22		
Other major crops	-0.32	-0.34	-0.26	-0.71	-0.71	-0.72	-0.39	0.67	-0.47	-0.50	-0.55	-1.53	0.67
Fruits & vegetables	-0.39	-0.41	-0.39	-0.76	-0.76	-0.80	-0.39	1.41	0.71	0.69	0.62	-0.10	1.41
Livestock, cattle, dairy	0.39	0.39	-1.09	0.00	0.00	0.00	-0.39	-2.12	-0.13	-0.13	-0.12	0.66	-2.12
Poultry	0.42	0.42	-0.98	0.03	0.03	0.03	0.00	-5.66	-0.12	-0.11	-0.11	0.00	-5.66
Forestry	-0.07	-0.11	0.00	-0.47	-0.47	-0.49	-0.39	0.49	0.25	0.14	0.13	0.08	0.49
Agriculture	**0.09**	**0.09**	**-0.77**	**2.21**	**-0.26**	**-0.27**	**-0.01**	**-0.01**	**-0.28**	**-0.22**	**-0.08**	**-0.28**	**-0.32**
Fishing Industry	0.09	0.11	0.38	-0.28	-0.28	-0.28	0.49	0.06	0.13	0.15	0.16	25.00	0.06
Mining	0.06	0.08	0.21	-0.38	-0.38	-0.32	0.25	-0.17	0.06	0.10	0.26	0.29	-0.17
Vegetable oil	-0.13	-0.13	2.69	-0.49	-0.49	-0.53	3.08	-13.04	0.38	0.38	0.27	-0.07	-13.04
Wheat milling	5.43	5.53	-21.37	4.88	4.88	5.12	-25.54	-15.60	-5.32	-5.10	-4.62	6.83	-15.60
Rice milling IRRI	-0.02	-0.05	1.30	-0.44	-0.44	-0.44	1.63	0.43	0.32	0.30	0.30	0.00	0.43
Rice milling Basmati	-0.06	-0.09	1.60	-0.48	-0.48	-0.48	2.01	0.56	0.40	0.33	0.33	0.00	0.56
Sugar	-0.06	-0.06	1.03	-0.46	-0.46	-0.45	1.31	-1.16	0.28	0.28	0.27	0.25	-1.16
Other food	0.05	0.10	0.18	-0.31	-0.31	-0.30	0.20	-0.07	0.02	0.11	0.15	0.30	-0.07
Cotton lint, yarn	-0.04	-0.06	1.87	-0.45	-0.45	-0.45	2.40	0.69	0.53	0.47	0.45	0.30	0.69
Textiles	-0.04	-0.07	1.28	-0.45	-0.45	-0.46	1.72	0.60	0.44	0.34	0.32	0.07	0.60
Leather	-0.06	-0.09	1.88	-0.48	-0.48	-0.49	2.50	0.87	0.60	0.45	0.40	0.27	0.87
Wood products	-0.12	-0.12	0.45	-0.50	-0.50	-0.51	0.62	-0.47	0.19	0.18	0.14	-0.21	-0.47
Chemicals	-0.10	-0.11	0.63	-0.42	-0.42	-0.51	0.76	0.49	0.14	0.08	-0.20	-0.31	0.49
Cement, bricks	0.49	0.49	1.21	0.09	0.09	0.09	1.36	1.06	0.15	0.15	0.15	0.00	1.06
Petroleum refining	-0.10	-0.10	1.00	-0.44	-0.44	-0.50	1.31	0.00	0.31	0.31	0.19	0.08	0.00
Other manufacturing	-0.01	-0.02	1.07	-0.40	-0.40	-0.41	1.44	0.42	0.37	0.34	0.29	0.27	0.42
Energy	0.09	0.09	0.38	-0.31	-0.31	-0.31	0.45	0.00	0.07	0.07	0.07	0.00	0.00
Construction	0.00	0.00	0.23	-0.39	-0.39	-0.39	0.53	0.00	0.30	0.30	0.30	0.00	0.00
Industry	**0.38**	**0.48**	**-0.30**	**-0.06**	**-0.06**	**0.09**	**-0.39**	**0.36**	**-0.08**	**-0.19**	**-0.07**	**0.23**	**0.36**
Commerce	0.03	0.03	0.07	-0.36	-0.36	-0.36	-0.39	0.22	-0.09	-0.09	-0.09	-0.19	0.22
Transport	0.01	0.01	0.36	-0.38	-0.38	-0.38	0.00	0.17	0.18	0.18	0.18	0.00	0.17
Housing	0.40	0.40	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Private services	0.09	0.09	0.40	-0.31	-0.31	-0.30	-0.39	-5.41	0.20	0.20	0.21	0.31	-5.41
Public services	-0.06	-0.06	0.10	-0.45	-0.45	-0.45	0.00	0.00	0.41	0.41	0.41	0.00	0.00
Services	**0.05**	**0.06**	**0.26**	**-0.34**	**-0.34**	**-0.34**	**-0.39**	**0.17**	**0.15**	**0.15**	**0.15**	**0.29**	**0.17**
Overall	**0.19**	**0.21**	**-0.11**	**0.27**	**-0.21**	**-0.18**	**-0.39**	**0.31**	**-0.04**	**-0.07**	**-0.03**	**0.00**	**0.00**

pl = output price; pl = local price; pva = value added price; pc = consumer price; pq = composite price; pd = domestic price; pm = import price;
pe = export price; x = output; d = domestic demand; q = composite commodity; m = imports; and e = exports

Annexure Table 8—Detailed sectoral effects of elimination of production tax, %

	Changes in Price								Changes in Volume				
	px	pl	pva	pc	pq	pd	pm	pe	x	d	q	m	e
Wheat irrigated	0.18	-18.93	0.32	-0.02	-17.29	-18.89	0.04	58.89	-4.07	-4.05	-3.80	-1.51	-4.87
Wheat non-irrigated	0.08	0.08	0.11	0.08	0.08	0.08			-3.78	-3.78	-3.78		
Paddy IRRI	0.10	0.10	0.13	0.09	0.09	0.09			0.15	0.15	0.15		
Paddy basmati	0.12	0.12	0.15	0.11	0.11	0.11			0.31	0.31	0.31		
Cotton	0.09	0.09	0.13	0.09	0.09	0.09			0.45	0.45	0.45		
Sugarcane	0.10	0.10	0.13	0.11	0.11	0.11			0.22	0.22	0.22		
Other major crops	0.11	0.11	0.13	0.10	0.10	0.11	0.00	-0.25	-0.47	-0.50	-0.55	-1.53	0.67
Fruits & vegetables	0.12	0.11	0.13	0.10	0.10	0.11	0.00	-0.32	0.71	0.69	0.62	-0.10	1.41
Livestock, cattle, dairy	0.10	0.10	0.13	0.10	0.10	0.09	0.00	-1.33	-0.13	-0.13	-0.12	0.66	-2.12
Poultry	0.10	0.10	0.11	0.09	0.09	0.09	0.00	-5.66	-0.12	-0.11	-0.11	0.00	-5.66
Forestry	0.10	0.14	0.11	0.10	0.10	0.14	-0.01	-0.39	0.25	0.14	0.13	0.08	0.49
Agriculture	**0.11**	**-1.44**	**0.14**	**0.09**	**-1.42**	**-1.44**	**0.00**	**0.30**	**-0.28**	**-0.22**	**-0.08**	**-0.28**	**-0.32**
Fishing Industry	0.06	0.08	0.06	0.07	0.07	0.07	0.03	-0.04	0.13	0.15	0.16	25.00	0.06
Mining	0.01	0.02	-0.01	0.00	0.00	0.00	-0.05	-0.11	0.06	0.10	0.26	0.29	-0.17
Vegetable oil	0.06	0.06	0.03	0.04	0.04	0.05	0.02	-13.04	0.38	0.38	0.27	-0.07	-13.04
Wheat milling	0.06	0.06	0.23	0.05	0.05	0.06	0.26	0.03	-5.32	-5.10	-4.62	6.83	-15.60
Rice milling IRRI	0.03	0.06	-0.09	0.05	0.05	0.05	-0.15	-0.09	0.32	0.30	0.30	0.00	0.43
Rice milling Basmati	0.06	0.08	-0.05	0.07	0.07	0.07	-0.08	-0.19	0.40	0.33	0.33	0.00	0.56
Sugar	0.09	0.09	0.11	0.08	0.08	0.09	0.11	-2.30	0.28	0.28	0.27	0.25	-1.16
Other food	0.02	0.04	-0.07	0.03	0.03	0.04	-0.10	-0.07	0.02	0.11	0.15	0.30	-0.07
Cotton lint, yarn	0.01	0.01	-0.14	0.01	0.01	0.02	-0.22	-0.12	0.53	0.47	0.45	0.30	0.69
Textiles	0.02	0.04	-0.02	0.03	0.03	0.03	-0.08	-0.13	0.44	0.34	0.32	0.07	0.60
Leather	0.04	0.07	-0.38	0.06	0.06	0.07	-0.55	-0.30	0.60	0.45	0.40	0.27	0.87
Wood products	0.05	0.05	0.03	0.04	0.04	0.04	-0.01	-1.41	0.19	0.18	0.14	-0.21	-0.47
Chemicals	0.05	0.06	0.09	0.02	0.02	0.05	0.08	-0.14	0.14	0.08	-0.20	-0.31	0.49
Cement, bricks	0.07	0.08	0.11	0.06	0.06	0.06	0.10	2.15	0.15	0.15	0.15	0.00	1.06
Petroleum refining	0.04	0.04	0.03	0.01	0.01	0.02	0.00	0.00	0.31	0.31	0.19	0.08	0.00
Other manufacturing	0.02	0.02	-0.04	0.00	0.00	0.02	-0.10	-0.10	0.37	0.34	0.29	0.27	0.42
Energy	0.09	0.09	0.13	0.08	0.08	0.08	0.13	0.00	0.07	0.07	0.07	0.00	0.00
Construction	0.06	0.06	0.10	0.05	0.05	0.05	0.08	0.00	0.30	0.30	0.30	0.00	0.00
Industry	**0.04**	**0.05**	**0.03**	**0.03**	**0.03**	**0.05**	**0.00**	**-0.12**	**-0.08**	**-0.19**	**-0.07**	**0.23**	**0.36**
Commerce	0.09	0.10	0.10	0.09	0.09	0.09	-0.01	0.22	-0.09	-0.09	-0.09	-0.19	0.22
Transport	0.06	0.08	0.09	0.07	0.07	0.07	0.00	-0.06	0.18	0.18	0.18	0.00	0.17
Housing	0.08	0.08	0.09	0.07	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Private services	0.08	0.08	0.09	0.07	0.07	0.07	-0.01	-6.67	0.20	0.20	0.21	0.31	-5.41
Public services	0.08	0.08	0.10	0.08	0.08	0.08	0.00	0.00	0.41	0.41	0.41	0.00	0.00
Services	**0.08**	**0.08**	**0.10**	**0.08**	**0.08**	**0.08**	**-0.01**	**-0.07**	**0.15**	**0.15**	**0.15**	**0.29**	**0.17**
Overall	**0.07**	**-0.26**	**0.09**	**0.06**	**-0.23**	**-0.26**	**0.00**	**0.20**	**-0.04**	**-0.07**	**-0.03**	**0.00**	**0.00**

pl = output price; pl = local price; pva = value added price; pc = consumer price; pq = composite price; pd = domestic price; pm = import price

pe = export price; x = output; d = domestic demand; q = composite commodity; m = imports; and e = exports

Annexure 9—Structure of CGE model of Pakistan

The basic structure of the model is discussed in Section 6. This appendix discusses modifications to the basic structure to adequately address the issues in the paper. In particular, the agriculture module is modified to allow the use of land and water in production. The model is specified in a mixed-complementarity problem (MCP) framework.

Modifications

Agricultural Production: The basic model as described above uses equality constraints. However, this may be inadequate if applied to issues pertaining to agriculture. For example, land and water inputs may not be as substitutable as capital and labor in a well-behaved production function. Often, they are used in fixed proportions. In a numbers of instances, land and water may not be paid according to their marginal product contributions, or may not even be paid at all. Highly seasonal agriculture production results in the underutilization of land and water during certain periods of a given year. Thus, inequality constraints are more appropriate in modeling agriculture (Hazell and Norton, 1986).

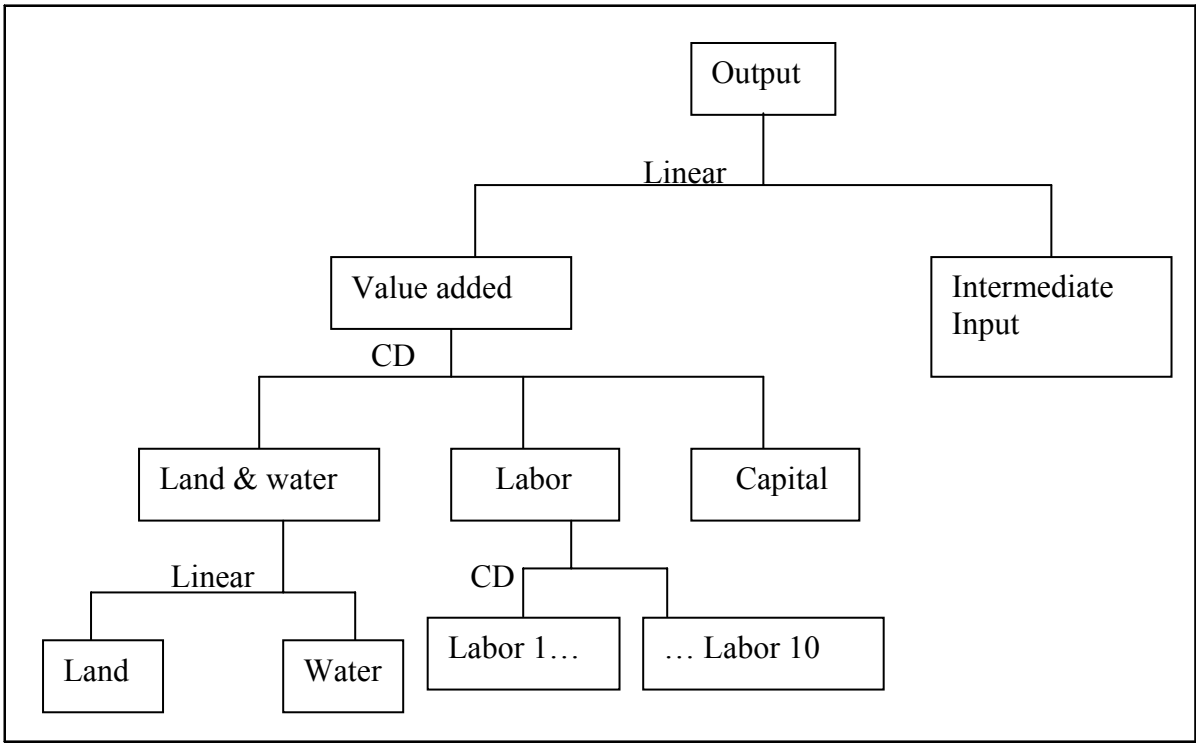
Annexure Figure 1 shows how the agricultural module of the model is re-specified. Similar to the basic model, output is a liner combination of value added and intermediate inputs using a set of fixed coefficients. However, this time added value is a CD combination of three factor inputs: aggregate capital, an aggregate labor input, and an aggregate land and water input. Capital is fixed, while labor is specified as a nested CD

function of ten labor types. Following Robinson and Gehlar (1996) and Cororaton (2004) the aggregate land and water input is specified as a nested linear combination of land and water.

Furthermore, following Lofgren and Robinson (1997), the agriculture module is formulated as MCP. Basically, a model based on MCP contains a system of simultaneous equations (linear or nonlinear), which are a mixture of strict equalities and inequalities. The system works in such a way that each of the inequalities is linked with a bounded variable in a complementary-slackness relationship (Rutherford, 1995). The basic idea is similar to the Kuhn-Tucker necessary and sufficient conditions for optimality.

The agriculture production sector module in the revised model is specified as MCP. The details are presented in Annexure Table 8a. Equation 1 is the value added (VA) CD function of three factor inputs: an aggregate labor (L), aggregate capital (K), and aggregate of land and water (LW). The scale parameter of the function is κ, while the share parameters are α, β, and γ. Equation 2 is the first-order condition for profit maximization using production function in 1, which is also the demand for aggregate labor where (pva) is price of value added, and (w) the average wage. Aggregate labor is a nested CD function of various labor types, thus Equation 3 is the first order condition in the nested aggregate labor function and the demand for each labor type, where α_n are parameters and w_n the respective wage rates.

Annexure Figure 1—Agriculture production module



Equations 4 to 11 are a set of relationships that capture the complementary slackness conditions for optimization involving land and water. In particular, the conditions involve the relationship between the overall rent for the use of land and water (rlw), and their demand and supply situation. Equation 4 is the first-order condition in the value added function for (LW), which is also the demand for the composite factor. Equations 5 and 6 are demand functions for land (LN) and water (WA), respectively, which are linearly related to (LW) using fixed coefficients (φ).

Equation 7 is the average rent for the use of (LW). It is the weighted average of the rent for land use and the rent for water use. However, both the rents for land use and

water use have two components: (rln + rln_p) for land use and (rwa + rwa_p) for water use. The variables with suffix _p will be zero if land and/or water constraints in Equations 8 and 9 are not binding. When the constraints are binding, however, the overall rent for land use is (rln + rln_p) and for water use (rwa + rwa_p). The economic interpretation for this is that when the constraint is binding, the shadow price for the use of the resource is higher. Thus, if in agriculture the supply of water is binding, the overall cost of production is higher. If the water supply is increased (e.g. improvements in irrigation are carried out), this relaxes the constraints and reduces the cost of production. Equations 10 and 11 are market equilibrium conditions for land and water.

Equation 12 is the zero-profit condition, which is required in competitive equilibrium models. Equation 13 is the market equilibrium for labor. Equation 14 alows the government give consumption subsidy, (spc), or impose a consumption tax, (tc). In the simulation exercise concerning consumption subsidy on wheat, spc was assigned a positive value while tc was set to zero.

Annexure 9a—Agriculture Production Module

(1) $VA = \kappa \times L^{-\alpha} K^{-\beta} LW^{\gamma}$: value added

(2) $L = \alpha \times (pva / w) \times VA$: demand for labor aggregate

(3) $L_n = \alpha_n \times (w / w_n) \times L$: demand for L_n labor, where n has 10 labor types

(4) $LW = \gamma \times (pva / rlw) \times VA$: demand for composite land & water

(5) $LN = \varphi_{\ln} \times LW$: demand for land

(6) $WA = \varphi_{wa} \times LW$: demand for water

(7) $rlw = \left[\frac{(r\ln + r\ln\_p) \times LN + (rwa + rwa\_p) \times WA}{LW} \right]$: return to land &water

(8) $LNS \times r\ln\_p \geq \sum_i LN_i$: land constraint

(9) $WAS \times rwa\_p \geq \sum_i WA_i$: water constraint

(10) $LNS \geq \sum_i LN_i$: land market

(11) $WAS \geq \sum_i WA_i$: water market

(12) $r \times K = Pva \times va - w \times L - (rwa + rwa\_p) \times wa - (r\ln + r\ln\_p) \times \ln$: zero-profit condition

(13) $LS_n = \sum_i (L_n)_i$: market for labor for n type

(14) $Pc = Pq \cdot (1 + tc - spc)$: user price after subsidy/consumption tax

Annexure 9b—Complete Model Specification

Core Equations	Description
$x_i = \upsilon_i \cdot va_i$	Output
$inp_i = \eta_i \cdot x_i$	Intermediate input
$id_{j,i} = a_{j,i} \cdot inp_i$	Matrix of intermediate input
$va_i = \tau_i \cdot l_i^{\alpha_i} \cdot k_i^{\beta_i} \cdot lw_i^{\gamma_i}$	Value added
$l_i \cdot w = va_i \cdot pva_i \cdot \alpha_i$	Aggregate labor
$l_i^n \cdot w_n = l_i \cdot w \cdot \alpha_i^n$	Labor type n, where n=1…10
$lw_i \cdot rlw = va_i \cdot pva_i \cdot \gamma_i$	Composite land & water
$ld_i = \varphi_i^{ld} \cdot lw_i$	Land
$wa_i = \varphi_i^{wa} \cdot lw_i$	Water
$rlw \cdot lw_i = (rld + rld\_p) \cdot ld_i + (rwa + rwa\_p) \cdot wa_i$	Return to composite land & water
$lds \cdot rld\_p \geq \sum_i ld_i$	Land constraint
$was \cdot rwa\_p \geq \sum_i wa_i$	Water constraint
$x_i = \mu_i \cdot (\theta_i \cdot e_i^{\kappa\_e_i} + (1-\theta_i) \cdot d_i^{\kappa\_e_i})^{(1/\kappa\_e_i)}$	CET: output (exports & domestic demand)
$\mathrm{e}_i = d_i \cdot \left[\frac{pe_i}{pl_i} \cdot \frac{1-\theta_i}{\theta_i} \right]^{\tau\_e_i}$	Exports
$x_i = \xi_i \cdot (\delta_i \cdot m_i^{-\rho\_m_i} + (1-\delta_i) \cdot d_i^{-\rho\_m_i})^{(-1/\rho\_m_i)}$	Armington (except for wheat)
$m_i = d_i \cdot \left[\frac{pd_i}{pm_i} \cdot \frac{1-\delta_i}{\delta_i} \right]^{\sigma\_m_i}$	Imports
$ct_h = dyh_h - savh_h$	Total consumption of each household
$ch_{i,h} \cdot pc_i = \omega_{i,h} \cdot ct_h$	Commodity demand of each household
$inv_i \cdot pc_i = \psi_i \cdot tinv$	Investment demand
$ind_i = \sum_j id_{i,j}$	Intermediate demand
$yl^n = \sum_i w^n \cdot l^n{}_i$	Type n labor income

$yld = \sum_i (rld + rld\_p) \cdot ld_i$	Land income
$ywa = \sum_i (rwa + rwa\_p) \cdot wa_i$	Water income
$yk = \sum_i r_i \cdot k_i$	Capital income
$yh_h = \sum_n (\Omega_{n,h} \cdot yl^n) + \eta_h \cdot yld + \pi_h \cdot ywa + \varepsilon_h \cdot yk + \Phi_h \cdot div + trgov_h + yfor_h \cdot er$	Household income
$dyh_h = yh_h \cdot (1 - dtxr_h)$	Disposable income
$yf = \varepsilon_f \cdot yk \cdot (1 - dtxr_f)$	Firm income
$tmrev = \sum_i tm_i \cdot m_i \cdot er \cdot pwm_i$	Tariff revenue
$itxrev = \sum_i itxr_i \cdot d_i \cdot pl_i + \sum_i itxr_i \cdot m_i \cdot pwm_i \cdot er \cdot (1 + tm_i)$	Indirect tax revenue
$dtxrev = \sum_h dtxr_h \cdot yh_h + \varepsilon_f \cdot yk \cdot dtxr_f$	Direct tax revenue
$subcd = \sum_i (tc_i - spc_i) \cdot q_i \cdot pq_i$	Consumption tax/subsidy
$yg = tmrev + itxrev + dtxrev + grant\_for \cdot er + subcd$	Government revenue
$savh_h = \sigma_h \cdot dyh_h$	Household savings
$savf = yf - div - div\_for$	Firm savings
$savg = yg - \sum_i g\_c_i \cdot pc_i - \sum_h (trgov_h) - paygv\_for$	Government savings
$pm_i = pwm_i \cdot er \cdot (1 + tm_i) \cdot (1 + itxr_i)$	Import price
$pe_i = pwe_i \cdot er$	Export price
$pq_i \cdot q_i = pd_i \cdot d_i + pm_i \cdot m_i$	Composite price
$px_i \cdot x_i = pl_i \cdot d_i + pe_i \cdot e_i$	

	Export price
$pd_i = pl_i \cdot (1 + itxr_i)$	Domestic price
$pc_i = pq_i \cdot (tc_i - spc_i) \cdot d_i$	Consumer price (for wheat $spc_i > 0$)
$pva_i \cdot va_i = px_i \cdot x_i - \sum_j id_{j,i} \cdot pc_j$	Price of value added
$r_i \cdot k_i = \text{pva}_i \cdot va_i - w \cdot l_i - (rld + rld\_p) \cdot ld_i - (rwa + rwa\_p) \cdot wa_i$	Return to capital
$q_i = \sum_h ch_{i,h} + inv_i + ind_i + g\_c_i + leon$	Product market equilibrium
$tinv = \sum_h savh_h + savf + savg + cab$	Savings-Investment
$cab = \sum_i pwm_i \cdot m_i \cdot er + div\_for + paygv\_for - \sum_i pwe_i \cdot e_i \cdot er - \sum_h yfor_h - grant\_for \cdot er$	Current account
$ls = \sum_i l_i$	Aggregate labor equilibrium
$ls^n = \sum_i l^n{}_i$	Equilibrium in n type labor
$lds = \sum_i ld_i$	Equilibrium in land
$was = \sum_i wa_i$	Equilibrium in water

Index: i, j: sectors; h: household groups; n: labor types
Note: All Greek letters are parameters

Endogenous variables:

x_i	output
va_i	value added
$id_{i,j}$	matrix of intermediate inputs
inp_i	intermediate inputs
l_i	aggregate labor
lw_i	composite land & water
ln_i	labor type n
ln_i	land
wa_i	water
d_i	domestic demand
e_i	exports
m_i	imports
q_i	composite good
ct_h	total consumption of each household group
inv_i	investment demand
ind_i	intermediate demand
g_c_i	government consumption
tinv	total investment
pc_i	consumer price
subcd	government subsidy/consumption tax revenue
yl^n	labor income of type n
yd	land income
ywa	water income
yk	capital income
yh_h	household income
dyh_h	disposable income
dtxrev	direct income tax revenue
itxrev	indirect tax revenue
tmrev	tariff rate revenue
yg	government income
$savh_h$	household savings
savf	firm savings
savg	government savings
w	average wage rate
w^n	wage rate of labor type n
rlw	return to composite land & water
rwa	return to water
rld	return to land
rld_p	premium return to land if constraint is binding
rwa_p	premium return to water if constraint is binding

pl_i	local price
pm_i	import price
pe_i	export price
pq_i	composite price
px_i	output price
pd_i	domestic price
pva_i	price of value added
r_i	return to capital
leon	walras law variable

Exogenous variables:

ls	supply of aggregate labor
ls^n	supply of labor type n
lds	supply of land
was	supply of water
k_i	capital stock
div	dividend paid to local investors
div_for	dividend paid to foreign investors
$trgov_h$	government transfers to household
y_for_h	foreign income of households
paygv_for	government payments to rest of the world
grant_for	rest of the world grant to government
pwm_i	world import price
pwe_i	world export price
er	exchange rate
cab	current account balance
gt	total government consumption
$dtxr_h$	direct income tax rate for household
dtxrf	direct income tax rate for firms
$itxr_i$	indirect tax rate
tm_i	tariff rate

Annexure 10—Welfare Measurement

This appendix discusses how we measured the change in welfare of policy experiments. The discussion is based on Robichaud, (2001).

Let $\mu(C)$ be the utility function, $\nu(P,Y)$ the indirect utility function, and $m(P,Y)$ the money metric indirect utility function. C represents the vector of consumption of goods, P the vector of prices, and Y household income. The utility function in a Cobb-Douglas (CD) form is

$$\mu^{CD}(C) = \prod_i C_i^{\alpha_i}, \qquad \text{where} \qquad \sum_i \alpha_i = 1$$

The demand functions are derived function by maximizing utility subject to the budget constraint, i.e.,

$$C_i^{CD}(P,Y) = \frac{\alpha_i Y}{P_i}$$

The indirect utility function is obtained by replacing C_i with the derived demand functions, i.e.,

$$\nu^{CD}(P,Y) = \prod_i \left(\frac{\alpha_i Y}{P_i} \right)^{\alpha_i}$$

Solving Y from the indirect utility function yields the money metric indirect utility function, i.e.,

$$m^{CD}(P,\nu) = \prod_i \left(\frac{P_i}{\alpha_i} \right)^{\alpha_i} \nu$$

Our measure of welfare is equivalent variation (EV), which is given as

$$EV = m(P_i^0, \nu(P_i^1, Y^1)) - m(P_i^0, \nu(P_i^0, Y^0)) = m(P_i^0, \nu(P_i^1, Y^1)) - Y^0$$

For the CD specification EV can be derived as

$$
\begin{aligned}
EV &= m^{CD}(P_i^0, v^{CD}(P_i^1, Y^1)) - Y^0 \\
&= \prod_i \left(\frac{P_i^0}{\alpha_i} \right)^{\alpha_i} v^{CD}(P_i^1, Y^1) - Y^0 \\
&= \prod_i \left(\frac{P_i^0}{\alpha_i} \right)^{\alpha_i} \prod_i \left(\frac{\alpha_i Y^1}{P_i^1} \right)^{\alpha_i} - Y^0 \\
&= \prod_i \left(\frac{P_i^0}{P_i^1} \right)^{\alpha_i} Y^1 - Y^0
\end{aligned}
$$