The Impact of Global Cotton Markets on Rural Poverty in Pakistan

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The incidence of rural poverty in Pakistan increased during the late 1990s after having declined during the 1980s and early 1990s. A number of structural factors have been identified as contributing to rural poverty in Pakistan. Among them are low levels of health and education spending and the unequal of farmland distribution. These structural factors help explain the levels of poverty in Pakistan, but not the increase in poverty in the late 1990s. One hypothesis is that the increase in rural poverty is the result of an adverse trend in world commodity prices, particularly cotton, a major commercial crop, and other agricultural commodities such as wheat, rice, and sugar.

The overall objective of this paper is to measure the impact of changes in world commodity prices on poverty in rural Pakistan, with particular focus on cotton prices and the main cotton producing districts of Punjab and Sindh provinces.

Global Cotton Markets

About one third of global cotton production is traded internationally. The US, Australia, Uzbekistan, Egypt, and Greece are the five main exporters of cotton, accounting for more than 60% of global cotton exports. The production of the other four major producers (the PRC, India, Pakistan, and Turkey) is destined mainly for local consumption by their own textile industries. For a number of other poor countries, cotton is an important component of their merchandise trade. The United Nations classifies about one third of cotton-producing countries as least developed countries. Cotton is the main cash crop and major source of government revenue, foreign exchange earnings, investment, and economic growth, for several countries in Central and Western Africa, considered the world's poorest regions. In these developing countries, cotton is an important aspect of the livelihoods of the poor. Around one billion people, mostly in developing countries, are either directly or indirectly involved in the production and marketing of cotton (Towsend 2004).

Traditionally Pakistan exported large quantities of raw cotton, but has now shifted to exporting value-added textile products and cotton 'made ups.' In recent years, Pakistan has participated in the world market as both an exporter and importer of cotton to meet the requirements of its domestic textile industry. International cotton prices remain an important

reference for domestic transactions in cotton lint and hence for prices of seed cotton at the farm level.

In view of various technical considerations and characteristics important in determining its quality (such as staple length, micronaire, quality of ginning, and the price received in the international market), Pakistani cotton is grouped with Index B cottons. Average annual world market prices of this group are presented in Table 1 and illustrated in Figure 1.

World cotton markets exhibit substantial annual price variability around a slight declining trend in nominal and real terms from 1990/91 to 2004/05. The price of index B cotton decreased from its peak in 1994/95 to trough in 2001/02 by 57.8% in nominal terms. In real terms, the Index B cotton price (in 2000 US dollars) declined from $107.13 per 100 lb to $37.87, a decrease of 64.7%.

Table 1: Annual Average Prices of Index B Cottons in International Markets

Year	Nominal Price (US cents/lb)	Real Price (2000 = 100) (US cents/lb)
1990/91	77.22	101.74
1991/92	57.15	64.67
1992/93	50.95	62.53
1993/94	66.44	79.18
1994/95	92.20	107.13
1995/96	81.69	92.30
1996/97	74.24	81.48
1997/98	69.94	75.04
1998/99	55.79	58.94
1999/2000	49.28	50.94
2000/01	53.70	53.70
2001/02	38.95	37.87
2002/03	52.40	50.16
2003/04	66.65	62.38
2004/05	51.20	46.67

Note: Index B is the average of the three cheapest cottons among the following: Orleans/Texas (SLM 1-1-32”); Brazilian type 5/6 (1-1-16”) Argentine Grade c-1/2, (1-1-16”); Turkish Adnast.1 white, (1-1-16”); RG Central Asian (SLM 1-1/16”); Pakistani Sindh/Punjab (SG Afzal 1-1-32”); Indian J-34 SG; and Chinese (Type 527). Prices for 2000/01 onward are based on a revised index as reported in *Cotton Outlook* 83 (25), 2005.
Sources: International Cotton Advisory Committee. *Cotton World Statistics*. Issues through 1992/93; *Cotton Outlook*. Various issues 1994/95 onward.

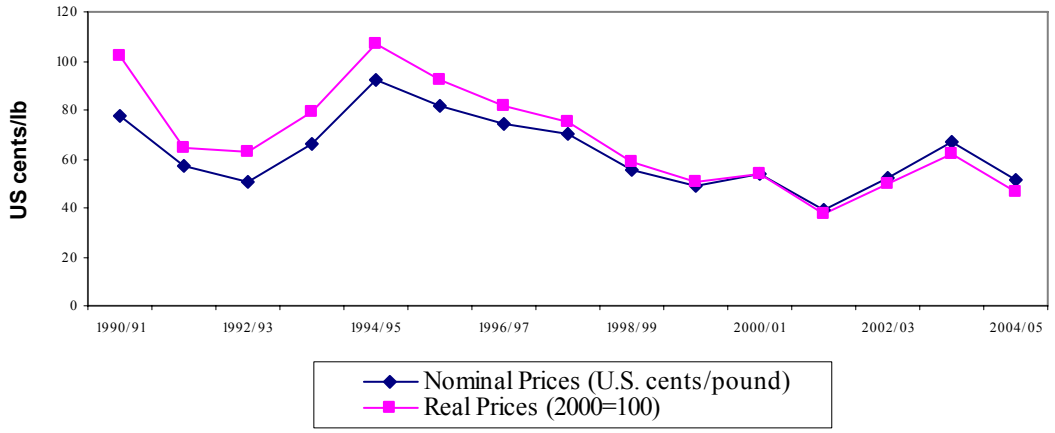

Figure 1: Annual Average Prices of Index B Cottons in International Market

Effect of Subsidies and Trade Barriers on World Cotton Prices

As for other agricultural commodities, the production and international trade of cotton in most countries has been the subject of considerable government subsidies, border protection, and other interventions. Interventions that cause market distortions include high tariffs, tariff escalation, large domestic production support, vague rules on what constitutes trade-distorting support programs, and considerable export subsidies. ICAC estimates that more than half of world cotton production benefits from direct price and income supports. On the demand side, there is a complex range of trade barriers in the form of tariffs, quotas, and other measures on raw cotton, yarns, textiles, and apparel. Aksoy and Beghin (2004) estimate that the combined support for cotton production by eight major world producers (the US, PRC, Greece, Spain, Turkey, Egypt, Brazil, and Mexico) between 1997/98 and 2001/02 ranged from $3.8 billion to $5.3 billion.

Numerous recent studies have attempted to measure the impact of cotton subsidies on world cotton prices and production. These studies have adopted several modeling frameworks, focusing on different countries to examine the impact of subsidies and other policies in recent years, and have shown a range of estimates of the effects of subsidy elimination. Table 2 provides a summary of several studies by the Food and Agriculture Organization (FAO, 2004) and several other recent studies that are not included in the FAO review.

The studies generated divergent results. This divergence reflects partly the particular structure of the models and assumed elasticities, as well as the base period, subsidies considered, and other factors. Estimates of this impact vary, with studies falling into three categories: those reporting relatively small effects (2-5%); those reporting moderate effects (10-25%), and those reporting relatively large effects (near 30% or more). The WTO panel in the Brazil/US cotton case found that US support policies damaged Brazil by depressing world prices but did not give an empirical estimate of the magnitude of this effect. The middle-range estimates receive the most support in the studies.

Table 2: Estimated Impacts of Developed Country Subsidies on World Cotton Prices

Source	Estimated World Price Without Subsidies ($/lb)	Effect of Subsidy Removal on World Price (%)	Decline in Production of Subsidizing Countries		Annual Gains to WCA Farmers[e] ($ million)
			US (%)	EU (%)	
ODI (2004)[a]					
S/U	0.675	18.0-28.0	15.2	26.6	266.5
F/U	0.688	20.0	8.3	19.8	93.8
S/D	0.700	22.0	13.6	25.2	354.5
F/D	0.732	28.0	1.5	8.9	133.5
Goreaux (2003)	0.589–0.649	2.9–13.4	2.2–14.7	10.0–48.0	37.0–254.0
ICAC (2003)[b]					
2000/01	0.742	21.0			
2001/02	0.738	72.4[d]			504.0
FAO (2004)	0.591–0.600	2.3–5.0	7.4–14.2	16.1–31.7	30.0
FAPRI (2002)		11.4	6.7	70.5	90.37
Reeves, et al. (2001)[b]	0.474	10.7	15.9		76.0
Sumner (2003)[c]	0.644	12.6	29.1		116.0
Tokarick (2003)	0.588	2.8	8.6		26.0

EU = European Union, FAO = Food and Agriculture Organization, FAPRI = Food and Agricultural Policy Research Institute, ICAC = International Cotton Advisory Committee, ODI = Overseas Development Institute, WCA = West and Central Africa.

[a] The ODI studies ran four model scenarios where S = single market, F = fragmented market, U = uniform elasticity, and D = differentiated elasticity. For the segmented market assumption, the world price is an average across segments.

[b] All studies use 2000/01 as the simulation year data except ICAC (2003) and Reeves, et al. (2001) which use 2001/02 data. The actual world price was $0.572/lb in 2000/01 and $0.418/lb in 2001/02.

[c] Removal of US support only.

[d] The value of 72% reported in ICAC (2003) is widely considered an outlier among model results.

[e] Where the gain to WCA farmers is not explicitly stated in a study, the value in the table is estimated by using a cotton supply equation for WCA to determine additional export earnings generated by the increase in world price.

Source: FAO Trade Backgrounder on issues related to the WTO negotiations on agriculture, 2004.

An Overview of Pakistan's Cotton Sector

Pakistan ranks fourth among the world's cotton-producing countries. Cotton is Pakistan's largest cash crop and second only to wheat in terms of area sown. On average, the area under cotton has hovered around 3 million ha with nearly 80% of area and production coming from Punjab and 20% from Sindh. Cotton's share in the value-added from major crops comes to 24% (GoP 2004). The textiles industry, which is Pakistan's largest industry and a major source of employment in manufacturing depends on domestic cotton production for its supply of raw material. The cotton sector's performance is crucial for not only the growth and development of agriculture and success of rural poverty alleviation efforts but also for robust growth of the overall economy. Cotton and textiles account for 65% of the country's foreign exchange earnings. Its byproduct helps reduce Pakistan's dependence on imports of edible oils and provides feed for livestock and dairy animals. The textile industry has grown significantly in recent years, expanding from 247 mills in 1990/91 to 361 in 2003/04 (GoP 2004). Cotton harvesting is a labor-intensive activity that is an important seasonal source of employment for rural women and children, providing incremental income to rural farm and nonfarm households.

In view of their importance to the economy, cotton production and trade have been subject to a number of policy initiatives and government interventions. Over time, however, direct government interventions in the cotton sector have largely been phased out. A cotton support price is still announced by the GoP for each crop year, but production, processing, marketing, and trade-related activities for cotton are concentrated in the private sector, which undertakes imports and exports of cotton in response to market requirements. The GoP's role in recent years has been limited to annual review and announcement of the support price of seed cotton and some procurement of cotton through the Trading Corporation of Pakistan (TCP).

Nominal and Real Domestic Cotton Prices

Farmers' incomes in Pakistan depend on domestic prices as well as on acreage and yield. Three factors that influence the domestic cotton price are: (i) world prices and the extent to which nominal domestic prices move in conjunction with world prices; (ii) inflation in Pakistan; and (iii) changes in the real (inflation-adjusted) exchange rate of the rupee/dollar.

Table 3 shows the harvest-season market and government support prices of seed cotton between 1990/91 and 2004/05. Nominal support prices were revised upward in 11 years, and

substantially downward once, during the reference period. The average annual growth rate of nominal seed cotton prices during 1990/91 to 2004/05 was 10% compared to the average annual increase of 7.25% in the consumer price index (CPI). Correspondingly, the real value of support prices has trended upward since 1990/91.

The nominal price of seed cotton in the domestic market during the reference period was also marked by large fluctuations. The overall mean value of the nominal domestic price of seed cotton for the period under review was PRs730/40 kg, with a coefficient of variation of 34.39%.

Table 3: Support and Market Prices of Seed Cotton

Year	Nominal Price (PRs/40 kg)		CPI	Real Price (PRs/40 kg)	
	Support Price	Market Price		Support Price	Market Price
1990/91	245	327	43.20	567	758
1991/92	280	334	47.41	591	704
1992/93	300	384	52.07	576	737
1993/94	315	497	57.94	544	858
1994/95	400	785	65.48	611	1,198
1995/96	400	754	72.60	551	1,039
1996/97	500	793	81.11	616	978
1997/98	500	843	87.45	572	964
1998/99	--	914	92.46	--	989
1999/2000	--	641	95.78	--	669
2000/01	725	900	100.00	725	900
2001/02	780	761	103.54	753	735
2002/03	800	914	106.75	749	857
2003/04	850	1,219	111.63	761	1,092
2004/05	925	885	121.99	758	725

CPI = consumer price index.
Note: Real prices are expressed in terms of 2000/01 rupees (PRs).
Sources: Market prices are an average of the prices in important producer area markets during the cotton harvest season, and are taken from various reports of the Agricultural Prices Commission and Pakistan Central Cotton Committee. Support prices are adapted from policy reports of the Agricultural Prices Commission and *Pakistan Journal of Agricultural Economics*. No support price for seed cotton was fixed for the 1998/99 and 1999/2000 crops, while that for the 2000/01 crop was announced by the federal Ministry of Commerce in its Cotton Policy. The CPI is taken from the *Pakistan Economic Survey 2004–05* and adjusted in light of the 9.28% inflation reported for 2004/05 in *Dawn* (16 August 2005).

As shown in Table 3, except in 2 recent years (2001/02 and 2004/05), market prices have been higher than support prices. In those years, as market prices fell, the GoP tried to maintain prices above the support price level by procuring cotton lint through the TCP. The TCP procured from the market 0.203 million bales in 2001/02 and 1.6 million bales in 2004/05, but

these interventions, notwithstanding their positive impact on market sentiment, failed to sustain the support price announced by the GoP as the price received by cotton growers.

In 1999/2000, no support price was agreed on and announced by the GoP; moreover, there was a change in government on 12 October 1999, the middle of the cotton season. The new government took time to design the required policy framework and institutional arrangements for market intervention. In the meantime, international prices continued to fall, exerting downward pressure on domestic prices. The textile industry, taking advantage of low international prices, arranged for substantial imports of cotton from abroad, which also depressed the domestic market price. The market price of seed cotton in the 1999/2000 crop season thus averaged only 70% of the previous year's level.

The nominal domestic market price of seed cotton can also be compared to the nominal world prices implied by the export and import parity prices (border prices) of cotton lint. As estimated from the prices of Index B cottons the import and export parity prices of seed cotton also vary considerably (Table 4 and Figure 2; see the ADB Background Paper 8 for technical discussion of the parity prices). The average value of export parity prices between 1990/91 and 2004/05 comes to PRs733/40 kg, with a coefficient of variation of 31.13%. The average value of import parity prices during this period comes to PRs976/40 kg, with a coefficient of variation of 28.59%. The average increase in nominal export parity price of seed cotton, worked back from the international price of Index B cottons and expressed in rupees, is estimated at 5.52% per year. In contrast, the nominal price of Index B cottons (in $) is estimated to have decreased by minus 2.54% per year on average for the reference period. These opposite trends illustrate the effect of substantial inflation in Pakistan on nominal seed cotton price levels.

Comparison of export parity prices with the corresponding domestic market prices of seed cotton shows that the two price series generally track closely together (Figure 2). Even so, in 7 out of 15 years, export parity prices were higher. Import parity prices areon average 25–35% higher than export parity prices (Table 4 and Figure 2). A comparison of domestic prices with import parity prices indicates that the price of imported cotton was substantially higher than the domestic price. Accordingly, the coefficient of nominal protection, estimated using the import parity price, is always less than one and by a considerable margin. Generally, years in which substantial quantities of cotton were exported are characterized by higher export and

import parity prices while those with considerable imports have been years of lower parity prices.

Table 4: Domestic and International Nominal and Real Prices of Seed Cotton

Year	Nominal Price (PRs/40 kg)				Real Price (PRs/40 kg)		
	Market Price	Export Parity Price	Import Parity Price	CPI	Market Price	Export Parity Price	Import Parity Price
1990/91	327	473	592	43.20	758	1,096	1,370
1991/92	334	408	503	47.41	704	861	1,061
1992/93	384	385	495	52.07	737	739	951
1993/94	497	527	772	57.94	858	910	1,332
1994/95	785	711	1,045	65.48	1,198	1,086	1,596
1995/96	754	875	995	72.55	1,039	1,206	1,371
1996/97	793	877	1,085	81.11	978	1,082	1,338
1997/98	843	838	1,069	87.45	964	959	1,222
1997/98	914	782	1,030	92.46	989	846	1,114
1999/2000	641	599	989	95.78	669	625	1,033
2000/01	900	981	1,184	100.00	900	981	1,184
2001/02	761	633	971	103.54	735	611	938
2002/03	914	816	1,239	106.75	857	764	1,161
2003/04	1,219	1,198	1,477	111.63	1,092	1,073	1,323
2004/05	885	886	1,180	121.99	725	726	967

CPI = consumer price index.
Note: Real prices are expressed in terms of 200/01 rupees (PRs). The export parity price is the harvest season average, and import parity price is the annual average, based on international prices of Index B cottons.
Source: *Cotton Outlook*, various issues for Index B cotton prices.

While nominal domestic prices track export parity prices relatively closely, the real price of cotton (adjusted for domestic inflation) depicts more realistically price levels affecting the purchasing power and economic well-being of cotton farmers. Real market prices of seed cotton in Pakistan and real export and import parity prices of seed cotton are compared in Table 4 and Figure 3. The real cotton price in Pakistan dropped in the late 1990s—a similar pattern to world prices in US dollars—but the decline in real prices in Pakistan was moderated by real depreciation of the rupee, which raised the value of world prices in domestic currency. In real terms (adjusted for inflation in Pakistan and the US), the rupee depreciated by 32.5% between 1994/95 and 2001/02. Due to this real depreciation, the real domestic market price of cotton declined by 38.7% between 1994/95 and 2001/02, compared to the world price decline of 64.7%

in real dollars (see Table 1). The decline in the 3-year averages of real world and domestic prices centered on the peak and trough years are less: a decline of 49.1% in world dollar prices and 19.6% in domestic rupee prices.

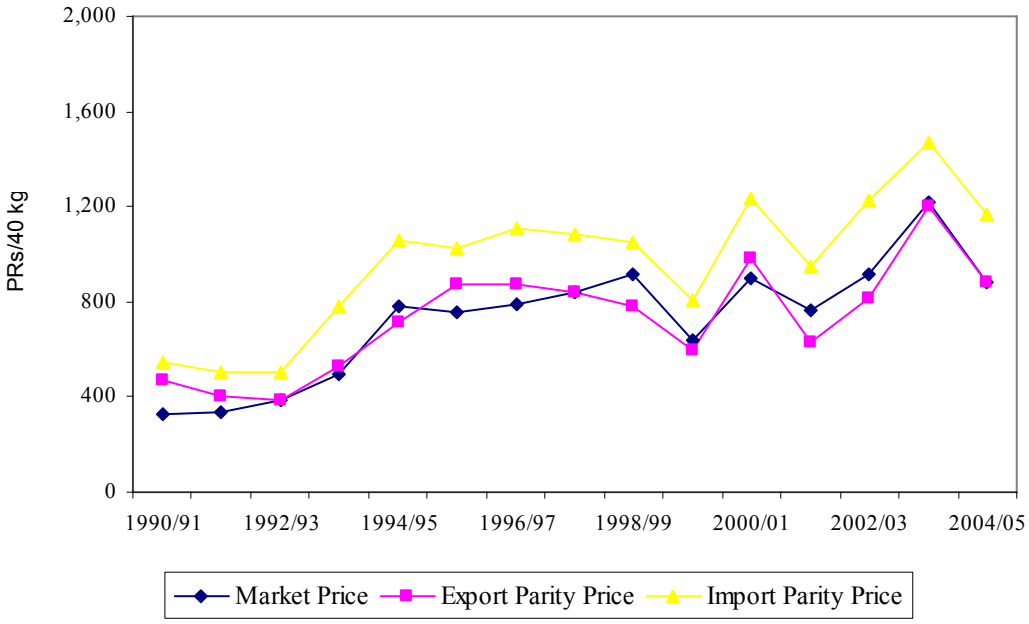

Figure 2: Market, Export, and Import Parity Nominal Prices of Seed Cotton

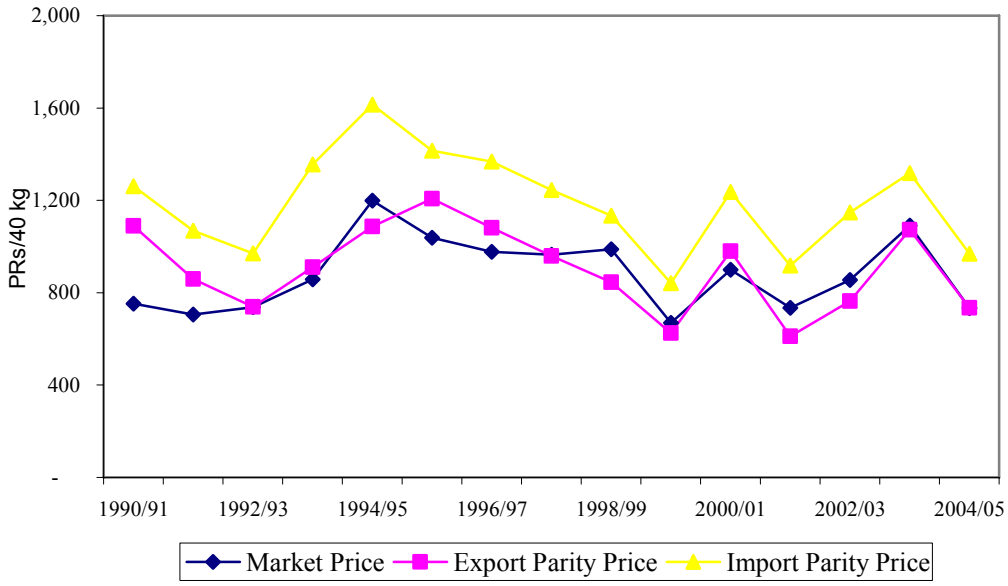

Figure 3: Market, Export, and Import Parity Real Prices of Seed Cotton

The real market price of seed cotton also fluctuated widely during the period under review. For 7 out of 14 yearly changes from 1990/91 to 2004/05, the real value of market prices was less than the preceding year. Further, in 5 of the years, the purchasing power of seed cotton was less than in 1990/91. The real value was highest in the 1995/96 crop season while the highest nominal price was observed in 2003/04. As a result of the swings in the real value of market price of seed cotton, there is no statistically significant trend during the reference period.

Effects of World Cotton Prices on Poverty in Pakistan

Pakistan's population was estimated to be 148 million in 2003. According to the World Bank's definition, Pakistan is considered a low-income country, with a gross domestic product (GDP) of $518 per capita in 2002. Overall, its economy has grown substantially during the last 4 decades at an average rate of 5.4% per annum. In 2003/04, with a growth rate of 6.5%, Pakistan stood as the second country in the region (after India) to show the most rapid economic growth.

The agriculture sector plays an important role in the Pakistan economy. It contributes nearly one quarter of the national GDP, and accounts for a higher proportion of the labor force than any other sector. The share of agricultural exports in total exports was 7.8% in 2003, about half its average contribution in the 1970s and 1980s.

The incidence of rural poverty in Pakistan, income sources, and other characteristics of poor and nonpoor households, have been carefully assessed in a recent study by Malik (2005). The next sections provide an additional overview of the income levels of nonfarm and farm households, paying particular attention to landowner and sharecropper cotton-producing households in Punjab and Sindh. Then a simulation analysis is provided of the effects of cotton prices on incomes and poverty in Pakistan.

Household Characteristics

The HIES for 2001/02 carried out by the GoP's Federal Bureau of Statistics (FBS) consists of an adjusted sample of 16,182 households within seven provinces/regions: Punjab, Sindh, the North-West Frontier Province (NWFP), Balochistan, Azad Jammu and Kashmir, the Northern Areas, and the Federally Administered Tribal Areas. For this analysis, following FBS (2003) and Malik (2005), the focus is on the four provinces, represented by a sample of 14,522 households. Table 5 provides some summary household statistics by location and agricultural

activities for the national level, the provinces of Punjab and Sindh, and the primary cotton-producing districts of both provinces. The results reported in Table 5 and in subsequent tables are nationally representative, and based on weighted sample data.

Table 5: Distribution of Households by Location and Agricultural Activity

Household	National [a]	Province		Primary Cotton-Producing Districts of [b]	
		Punjab	Sindh	Punjab [c]	Sindh [d]
		Percent of All Households			
Total Population	100.0	59.8	23.6	25.9	8.5
Nonfarmers	59.3	34.4	15.3	11.9	4.3
Farmers	40.7	25.4	8.3	14.1	4.1
Urban Population	29.4	17.0	9.8	3.7	1.9
Nonfarmers	27.5	15.9	9.4	3.2	1.6
Farmers	1.9	1.2	0.5	0.5	0.3
Rural Population	70.6	42.8	13.8	22.2	6.6
Nonfarmers	31.8	18.5	6.0	8.6	2.8
Farmers	38.8	24.2	7.8	13.6	3.8
		Percent of Farm Households			
Among Farmers	100.0	62.4	20.3	34.6	10.2
Livestock Only	23.4	17.4	4.0	9.4	1.8
Producing Crops	76.6	45.0	16.3	25.2	8.4
Landowners	55.4	35.8	7.6	19.7	3.9
Sharecroppers	13.9	4.1	8.0	2.6	4.1
Other Land Tenures [e]	7.3	5.1	0.7	2.9	0.4
Of Which Producing:					
Cotton	24.0	17.0	6.8	15.1	6.2
Landowners	16.6	13.1	3.3	11.4	2.9
Sharecroppers	5.1	1.9	3.2	1.8	3.0
Other Land Tenures [e]	2.3	2.0	0.3	1.9	0.3
Wheat, but not Cotton	42.7	24.5	6.7	8.7	1.7
Landowners	31.8	19.9	3.1	7.1	0.8
Sharecroppers	6.9	2.1	3.3	0.8	0.8
Other Land Tenures [e]	4.0	2.5	0.3	0.8	0.1
Neither Cotton nor Wheat	9.9	3.5	2.8	1.4	0.5

[a] Based on Punjab, Sindh, the North-West Frontier Province, and Balochistan.
[b] Primary cotton-producing districts are determined as districts with more than 1% of national acreage during 2001/02 to 2003/04.
[c] Includes the districts of Bahawalpur, Rahimyar Khan, Vehari, Lodhran, Rajanpur, Khanewal, M.Garh, Bahawalnagar, Multan, Dera Ghazi Khan, Sahiwal, Jhang, Toba Tek Singh, Pakpatan, Faisalabad, and Layyah.
[d] Includes the districts of Ghotki, Sanghar, Khairpur, Nawab Shah, Hyderabad, Mirpurkhas, Nowshero Feroze, and Sukkur.
[e] Includes other types of land arrangement and nonrespondents.
Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

At the national level, 29.4% of households are urban and 70.6% rural. Households engaged in farming comprise 40.7% of the total sample. Farmers are concentrated in rural areas where more than half of households engage in some farming activity. A small set of households (1.9% of all households nationally) are classified as urban and also engage in some farming activity. These households are 6.5% of urban households.

Sources of Income of Cotton-Producing Households

Table 6 provides information on the sources of income of landowner cotton-producing households by geographic area. The average income of landowner cotton-producing households is estimated to exceed the national average among rural households, while sharecroppers farm less acreage and report lower incomes (not shown in the table). Reported net incomes of landowner cotton farmers are higher in Sindh than Punjab. Among landowner cotton farmers nationally, crops account for 78.9% of average household net income and wages for 10.0%. Distributing crop production expenses in proportion to the acreage of each crop, cotton accounts for 48.9% of net crop income or 38.6% of household total net income for landowners. For sharecroppers, income from crops accounts for 77.5% of the total net income at the national level and cotton income for an estimated 57.5% of crop income and 44.6% of total income. Thus, cotton income is important to the well-being of landowner and sharecropper households.

Within Punjab, crop income accounts on average for 73.5% of total income among landowner households producing cotton, and cotton for 44.4% of crop income and 32.6% of total income. In Sindh, crops account on average for 93.7% of the total income of landowner cotton-producing households. Crop and cotton income appear to be more important for landowner and sharecropper cotton-producing households in Sindh than in Punjab. The higher proportion of net income reported from crops arises largely because of reported losses on livestock, which offset earnings from other sources.[1] Cotton accounts for 56.9% of average crop income and 53.3% of total income among landowner cotton-producing households in Sindh.

[1] Overall, cotton farmers in Sindh report average feed costs of PRs17,453 versus gross revenue from livestock of PRs12,793, resulting in negative net income reported for livestock.

Table 6: Sources of Income of Landowner Cotton-Producing Households at the National, Provincial, and Primary Cotton-Producing District Levels

Income Source	National	Province		Primary Cotton-Producing Districts of	
		Punjab	Sindh	Punjab	Sindh
	Annual Income (PRs)				
Total	**77,721**	**69,672**	**108,915**	**67,383**	**112,575**
			Percent		
Crops	78.9	73.5	93.7	75.0	93.1
Livestock	3.0	6.2	(5.5)	5.4	(5.2)
Rental	1.4	1.8	0.3	1.9	0.3
Nonfarm Business	5.1	6.5	1.6	5.1	1.8
Wages	10.0	9.8	9.9	10.0	10.3
Transfers	1.7	2.2	0.0	2.6	(0.3)
Among Crops	100.0	100.0	100.0	100.0	100.0
Cotton	48.9	44.4	56.9	45.8	57.3
Wheat	29.5	32.6	23.9	32.6	24.0
Sugarcane	8.8	6.1	14.3	5.5	14.1
Rice	1.0	1.3	0.5	1.0	0.4
Maize	0.1	0.2	0.0	0.2	0.0
Pulses	0.3	0.5	0.0	0.4	0.0
Fruits/Vegetables	2.1	2.4	1.5	2.3	1.5
Fodder	5.4	7.4	1.5	7.0	1.3
Other	3.9	5.2	1.3	5.2	1.3
Farm Size (ha)	4.7	4.2	6.7	4.2	6.9

Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

Direct Effects of Cotton Prices on Household Incomes and Poverty

To measure the linkages between global cotton prices and rural poverty in Pakistan a simulation analysis is undertaken, as in the study of the impact of lower cotton prices on rural poverty in Benin by Minot and Daniels (2005). The direct effects of changes in cotton price on incomes and poverty among cotton-producing households are assessed, assuming no change in production levels. The direct effects on the incomes of and poverty among these households are also assessed, allowing for a supply response by the farmers.

Direct effects with fixed supply: The direct effects of changes in cotton price are analyzed based on survey information on the value of cotton sales by households. For cotton farmers who own their land, per capita income derived from a price change can be calculated as

$$\Delta y_i = \frac{1}{H_i}(Q_{ci}\Delta P_c) \qquad (1)$$

where Δy_i is the change in per capita income of household i due to a change in the price of cotton; Q_{ci} is the quantity of cotton sold by household i; ΔP_c is the change in the real price of cotton; and H_i is the number of members in household i. If a household does not grow cotton, then $Q_{ci} = 0$ and the direct effect of cotton prices is zero ($\Delta y_i = 0$), but if $Q_{ci} > 0$, then a price reduction ($\Delta P_c, < 0$) implies that income will fall ($\Delta y_i < 0$). Conversely, a price increase implies that income also rises. From equation 1, the change in per capita income can be calculated for each household in the sample to provide a detailed picture of the distributional impact of lower or higher cotton prices. Sharecroppers only retain half the cotton they produce, and equation (1) is modified accordingly. This 'micro-simulation' approach makes it possible to estimate the change in income for any sample group defined by income, farm size, or other variables.

Poverty Measures: The simulated impact of price changes on poverty is evaluated using the Foster-Greer-Thorbecke (1984) measures of poverty, defined as

$$P_\alpha = \frac{1}{N}\sum_i \left[\frac{\mu - y_i}{\mu}\right]^\alpha \qquad (2)$$

where P_α is the poverty measure, N the number of households, μ the poverty line, and y_i the income or expenditure of poor household i (the summation occurs only over poor households). Different values of α ($\alpha = 0$, 1, and 2) yield different measures of poverty, giving different weights to the degree of poverty and inequality among the poor. When $\alpha = 0$, the poverty measure P0 is the incidence of poverty, i.e., the proportion of households whose income is below the poverty line. When $\alpha = 1$, the poverty measure P1 is the poverty-gap measure. The poverty gap is equal to the incidence of poverty multiplied by the average gap between the poverty line and the income of a poor household, expressed as a percentage of the poverty line. Thus, it takes into account the depth of poverty as well as the percentage of households that are poor. If $\alpha = 2$, then the poverty measure P2 takes into account the degree of inequality among poor households, as well as the depth of poverty and number of poor households. This 'poverty-gap squared' is a measure of the severity of poverty.

Supply response direct effects: To further assess the poverty impacts of changes in cotton price on cotton-producing households, the analysis takes into account the fact that farmers will, at least to some extent, substitute away from cotton and reduce input use when cotton prices fall, and substitute into cotton production and expand input use when cotton prices rise. To the extent that such substitution occurs, the supply-response direct impact on household income of a

decline in cotton prices is smaller (in absolute terms) than the direct impact with fixed supply. The supply-response impact of a cotton price increase is larger than its impact with fixed supply. The following equation describes the supply-response direct impact of the change in cotton price on landowners who grow cotton

$$\Delta y_i = \frac{1}{H_i}\left[(Q_{ci}\Delta P_c) + \left(\frac{1}{2}(\Delta P_c)^2 \varepsilon_c \frac{Q_{ci}}{P_c}\right)\right] \quad (3)$$

where ε_c is the general equilibrium supply elasticity of cotton and P_c the price of cotton. The second term is positive regardless of whether the price change is positive or negative, implying that the supply-response effect of a price change is more positive (or less negative) than the fixed-supply effect. If production alternatives are limited, the two effects will be similar. The elasticity of supply has to be estimated or assumed based on available studies. Like the impact with fixed supply, the supply-response impact of lower or higher cotton prices on rural income and rural poverty can be disaggregated by different subcategories of household.

Simulated Direct Effects of Cotton Price on Incomes and Poverty

Simulations based on the 2001/02 HIES data were carried out to evaluate the direct effects of cotton prices on incomes and poverty in Pakistan. Since the base data refers to a period of low cotton prices, the simulations incorporated a range of increases in the farm-level price of seed cotton (ΔP_c), consistent with recent historical experience. To evaluate whether or not a household was in poverty, the study compared its annual per capita (adult equivalent) consumption expenditure with a per capita poverty line based on the government-recognized level of PRs748/person/month. Additional income resulting from an increase in cotton prices was assumed to be utilized to increase household consumption.

Average annual consumption expenditures by cotton-producing households, and the effects on their incomes of 10% to 40% increases in cotton price are shown in Tables 7 and 8 for landowners and sharecroppers, respectively. Table 9 aggregates these results for all cotton farmers (landowners, sharecroppers, and other types of land tenure). Separate results are shown for Punjab, Sindh, and at the national level. Total household consumption expenditures are higher among landowners than sharecroppers. Total consumption expenditures are higher in

Sindh than Punjab despite lower per capita expenditures in Sindh (not shown in the table), where households are larger.[2]

Table 7: Simulated Effects of Increased Cotton Prices on Poverty among Landowner Cotton-Producing Households at the Provincial and National Levels

Item	Effect on Cotton-Producing Households					
	Punjab		Sindh		National	
	Fixed Supply	Supply Response	Fixed Supply	Supply Response	Fixed Supply	Supply Response
Base Expenditures (PRs)	79,015		84,835		80,376	
Net Income per 10% Cotton	4,806	4,878	11,700	11,876	6,181	6,273
Poverty Incidence (P0)	Percent (as Proportion)					
Base	0.32		0.43		0.34	
With Cotton Price Increase of:						
10%	0.28	0.28	0.29	0.29	0.28	0.28
20%	0.25	0.25	0.22	0.21	0.24	0.24
30%	0.23	0.23	0.12	0.11	0.20	0.20
40%	0.21	0.20	0.09	0.08	0.18	0.17
Poverty Gap (P1)						
Base	0.064		0.089		0.068	
With Cotton Price Increase of:						
10%	0.053	0.053	0.052	0.051	0.053	0.052
20%	0.045	0.045	0.031	0.030	0.042	0.041
30%	0.039	0.038	0.020	0.019	0.035	0.034
40%	0.033	0.032	0.014	0.013	0.029	0.028
Poverty Gap Sq. (P2)						
Base	0.019		0.028		0.020	
With Cotton Price Increase of:						
10%	0.015	0.015	0.014	0.014	0.015	0.014
20%	0.012	0.012	0.008	0.008	0.011	0.011
30%	0.010	0.010	0.005	0.005	0.009	0.009
40%	0.009	0.008	0.004	0.003	0.007	0.007

Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

[2] The average household size nationally is 7.0. Among cotton farmers, it is 7.8 nationally, 7.3 in Punjab, and 8.9 in Sindh. These estimates are based on the weighted sample data but are not adjusted to an adult-equivalent basis.

Table 8: Simulated Effects of Increased Cotton Prices on Poverty among Sharecropper Cotton-Producing Households at the Provincial and National Levels

Item	Effect on Cotton-Producing Households					
	Punjab		Sindh		National	
	Fixed Supply	Supply Response	Fixed Supply	Supply Response	Fixed Supply	Supply Response
Base Expenditures (PRs)	60,861		66,211		64,241	
Net Income per 10% Cotton	3,914	3,973	4,894	4,967	4,533	4,601
Poverty Incidence (P0)	Percent (as Proportion)					
Base	0.56		0.58		0.57	
With Cotton Price Increase of:						
10%	0.44	0.44	0.53	0.53	0.49	0.49
20%	0.38	0.38	0.45	0.44	0.42	0.42
30%	0.34	0.34	0.34	0.33	0.34	0.33
40%	0.34	0.32	0.29	0.28	0.31	0.29
Poverty Gap (P1)						
Base	0.118		0.144		0.135	
With Cotton Price Increase of:						
10%	0.090	0.089	0.110	0.110	0.103	0.102
20%	0.072	0.071	0.082	0.081	0.078	0.077
30%	0.058	0.057	0.062	0.060	0.061	0.059
40%	0.048	0.046	0.047	0.044	0.047	0.045
Poverty Gap Sq. (P2)						
Base	0.035		0.049		0.044	
With Cotton Price Increase of:						
10%	0.024	0.024	0.033	0.033	0.030	0.030
20%	0.017	0.017	0.023	0.023	0.021	0.021
30%	0.013	0.013	0.016	0.015	0.015	0.014
40%	0.010	0.009	0.011	0.010	0.011	0.010

Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

Table 9: Simulated Effects of Increased Cotton Prices on Poverty among All Cotton-Producing Households at the Provincial and National Levels

	Effect on Cotton-Producing Households					
	Punjab		Sindh		National	
	Fixed Supply	Supply Response	Fixed Supply	Supply Response	Fixed Supply	Supply Response
Base Expenditures (PRs)	75,942		75,013		75,848	
Net Income per 10% Cotton	4,857	4,930	8,305	8,430	5,839	5,927
Poverty Incidence (P0)	**Percent (as Proportion)**					
Base	0.36		0.50		0.40	
With Cotton Price Increase of:						
10%	0.31	0.31	0.39	0.39	0.33	0.33
20%	0.27	0.27	0.32	0.31	0.28	0.28
30%	0.24	0.24	0.22	0.21	0.24	0.23
40%	0.21	0.21	0.18	0.17	0.20	0.20
Poverty Gap (P1)						
Base	0.073		0.113		0.084	
With Cotton Price Increase of:						
10%	0.058	0.058	0.077	0.077	0.063	0.063
20%	0.047	0.046	0.054	0.053	0.049	0.048
30%	0.039	0.038	0.039	0.038	0.039	0.038
40%	0.032	0.031	0.029	0.027	0.031	0.030
Poverty Gap Sq. (P2)						
Base	0.021		0.036		0.025	
With Cotton Price Increase of:						
10%	0.016	0.016	0.023	0.022	0.017	0.017
20%	0.012	0.012	0.015	0.014	0.013	0.013
30%	0.010	0.009	0.010	0.010	0.010	0.009
40%	0.008	0.008	0.007	0.007	0.008	0.007

Note: Includes cotton-producing households that are landowners, sharecroppers, or subject to other land tenures. Net income per 10% cotton price increase exceeds that of landowners or sharecroppers shown in Tables 7 and 8 for Punjab because of the higher gross cotton income of cotton-producing households in the other land tenures category, which includes 11.8% of cotton-producing households in the province (see Table 5).
Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

In the simulation analysis, every 10% increase in the price of cotton raises a landowner's average household income by PRs4,806 in Punjab and PRs11,700 in Sindh, assuming fixed levels of production.[3] Among sharecroppers, every 10% increase in the price of cotton raises average household income by PRs3,914 in Punjab and PRs4,894 in Sindh. A modest supply elasticity of 0.3 is assumed for supply response simulations (a 10% increase in price raises output

[3] With production fixed, this represents an increase in gross and net income from cotton, whereas the initial net income from cotton is reported (as a percentage of net crop income) in Table 6.

by 3% with additional costs of production also incurred). This leads to slightly higher gains in household income (for example, PRs4,878 and PRs11,876 for landowners in Punjab and Sindh, respectively, for every 10% increase in cotton price).

The effects of increases in cotton price on the level, depth, and severity of poverty among cotton-producing households are shown in the lower part of Tables 7, 8, and 9. Based on an analysis of the 2001/02 HIES data, 32% of landowner cotton-producing households in Punjab are estimated to have per capita expenditures below the poverty line, with a corresponding 43% in Sindh. A 20% rise in cotton prices—such as would offset the decline in real domestic prices observed between 3-year averages centered on the peak and trough years of 1994/95 and 2001/02—is estimated to reduce the rate of poverty among landowner cotton-producing households to 25% in Punjab and 22% in Sindh. These represent 22% and 49% reductions in the poverty level among landowner cotton farmers. The depth and severity of poverty are also reduced by cotton price increases, as shown by the measures of poverty gap (P1) and poverty gap squared (P2).

Among sharecroppers, a 20% increase in cotton prices reduces initial poverty rates of 56–58% in Punjab and Sindh to 38% and 45%, respectively. These represent declines in initial poverty rate of 33% in Punjab and 23% in Sindh. Again, the depth and severity of poverty also fall. Overall, cotton prices have quite a significant effect on rural poverty among cotton-producing households. When farmers respond to a price increase by expanding cotton production, the estimated reductions in poverty are similar even though the supply response increases their average household incomes somewhat more.

The aggregated results shown in Table 9 encompass poverty reductions among all cotton-producing households. For the nation as a whole, 40% of cotton-producing households are estimated to have per capita consumption expenditures below the poverty line in 2001/02, based on the 2001/02 HIES data (FBS 2003). A 20% increase in cotton prices reduces the poverty rate among cotton-producing households to 28%. Using the population estimate of 148 million in 2002, assuming a national average household size of 7.0, and an estimated 9.8% of households producing cotton, there are an estimated 828,800 cotton-producing households below the poverty line. With a 20% increase in cotton prices, this falls to 580,160 households in poverty. Cotton-producing households have an average size of 7.8 persons, and thus a 20% increase in cotton prices is estimated to reduce poverty in Pakistan by 1.939 million people.

Effects of Farm Household Poverty on Regional Poverty Levels

While the rate and degree of poverty among households producing cotton is strongly affected by cotton prices, only a subset of farm households actually produce cotton. The broader impact on poverty levels of direct reductions in poverty among cotton farmers depends on the area of geographic aggregation, as shown in Table 10.

Table 10: Simulated Effects on Increased Cotton Prices on Poverty at the Primary Cotton-Producing District, Provincial, and National Levels

	Effect on Regional Population				
	Primary Cotton-Producing Districts of		Province		National
	Punjab	Sindh	Punjab	Sindh	
Base Expenditures (PRs)	62,268	72,939	72,919	92,392	78,561
Poverty Incidence (P0)			Percent (as Proportion)		
Base	0.45	0.43	0.34	0.32	0.33
With Cotton Price Increase of:					
10%	0.44	0.39	0.33	0.30	0.33
20%	0.43	0.37	0.33	0.29	0.32
30%	0.42	0.34	0.33	0.28	0.32
40%	0.42	0.32	0.32	0.28	0.31
Poverty Gap (P1)					
Base	0.108	0.091	0.077	0.067	0.072
With Cotton Price Increase of:					
10%	0.105	0.080	0.075	0.063	0.070
20%	0.102	0.073	0.074	0.060	0.068
30%	0.100	0.068	0.073	0.058	0.067
40%	0.098	0.066	0.072	0.057	0.067
Poverty Gap Sq. (P2)					
Base	0.037	0.028	0.026	0.021	0.023
With Cotton Price Increase of:					
10%	0.035	0.024	0.025	0.019	0.022
20%	0.034	0.022	0.025	0.018	0.021
30%	0.034	0.020	0.024	0.017	0.021
40%	0.033	0.019	0.024	0.017	0.021

Source: Based on weighted sample from 2001/02 Household Integrated Economic Survey.

Within the primary cotton-producing districts of Punjab and Sindh, cotton farmers account for 23.7% and 29.3% of households, respectively. When cotton prices rise by 20%, poverty levels within these geographic regions decrease by 2% in Punjab and 6% in Sindh because of the direct effect on incomes of cotton-producing households. Cotton farmers account for 11.6% and 11.8%, respectively, of the population of Punjab and Sindh. At the provincial level, overall poverty falls by only 1–3% as a direct effect of a 20% increase in cotton prices. At the national level, overall poverty falls by 1% and rural poverty by 2% since households producing cotton are only 9.8% of all households

Summary and Conclusions

The study calculates seed cotton prices for Pakistan implied by export and import international prices of cotton lint. Pakistan domestic seed prices are found to closely track their export parity values. Evaluation of the importance of cotton to the incomes of households is based on the 2001/02 Pakistan Household Integrated Survey (HIES).The study distinguishes between landowners and sharecroppers and results are reported separately for Punjab and Sindh, and for the primary cotton-producing districts within each province.

Poverty was found to be substantial among cotton-producing households. Among all cotton-producing households, 40% are below the poverty line based on per capita consumption expenditures. Among landowner households producing cotton, 34% are below the poverty line. Sharecropper households producing cotton are more heavily concentrated in the lower end of the national income distribution, with 57% below the poverty line.

Simulation analysis was undertaken to evaluate the effects of cotton prices on poverty. A simulated increase of low cotton prices in 2001/02 back toward the higher levels of earlier years moves a substantial number of cotton farmers out of poverty. The study examines changes of 10% to 40% with the discussion focused on a cotton price increase of 20%, which is the extent which real prices of cotton fell in Pakistan in the late 1990s and is consistent several analyses of how much world prices might increase if all subsidies and tariff barriers were removed globally.

The study estimates that an increase of real cotton prices by 20% reduces the poverty rates among landowner cotton households in Punjab and Sindh from initial levels of 32% and 43%, respectively, to 25 and 22%. Among sharecropper households producing cotton, a 20% increase in cotton prices lowers rates of poverty from 56-58% in Punjab and Sindh to 38% and

45%, respectively. At the national level, a 20% increase in cotton prices causes poverty among all cotton-producing households to fall from 40% to 28%. The study estimates that this is a reduction of poverty in Pakistan by 1.939 million people.

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