Challenges Facing the Cotton and Textile Sectors in Pakistan: An Analysis of Intersectoral Linkages and their Poverty Implications

CAESAR B. CORORATON AND DAVID ORDEN

Draft Research Report
International Food Policy Research Institute

August 2007

Caesar B. Cororaton (c.cororaton@cgiar.org) is Research Fellow, Markets, Trade and Institutions Division, International Food Policy Research Institute.

David Orden (d.orden@cgiar.org) is Senior Research Fellow, Markets, Trade and Institutions Division, International Food Policy Research Institute and Professor and Director of the Global Issues Initiative of Virginia Tech's Institute for Society, Culture and Environment, Alexandria Virginia.

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Abstract

The cotton, textile and apparel industries which are critical sectors of the Pakistan economy and important determinants of rural and urban poverty face challenges that include instability in the world prices of cotton, liberalization of multilateral trade of textiles and clothing, and strengthening of the currency arising from a surge in foreign capital inflows and remittances since 2001. Using a computable general equilibrium model (CGE) calibrated to a 2001-02 social accounting matrix (SAM) of the Pakistan economy and linked to the 2001-02 Pakistan household income and expenditure survey, this report conducts simulation experiments and analyzes the intersectoral and poverty implications of: (1) an increase in foreign savings inflows into Pakistan; (2) an increase in world prices of cotton lint and yarn, textiles, or a combination of these prices; (3) an improvement in total factor productivity (TFP) in one or more of the cotton-related sectors; and (4) a government production subsidy in one or more of these sectors.

Experiment (1) analyzes the effects on competitiveness, particularly for the cotton and textile industries, through an appreciation of the real exchange rate that results from the surge in foreign capital inflows. The results indicate that increased capital inflows raise real investment and household income and reduce poverty, but the tradable sectors, particularly the cotton and textile sectors, contract and incomes of rural farmers decline.

Experiment (2) analyzes an increase of world cotton and textile prices, where historical indicators show wide cotton lint price fluctuations and cotton fabric prices move to reflect the raw material price as well as for other reasons. Pakistani production

and exports improve under positive sectoral price shocks, with greater benefits to farmers and rural areas from an increase in cotton prices and indirect adverse intersectoral effects between cotton and textiles as a boom in either sector appreciates the exchange rate.

The recent liberalization of the world trade of textiles and clothing affects world prices and trade patterns of yarn, textiles and apparel. This will test Pakistan's ability to compete in world markets. Pakistan can best take advantage of this shift if it improves its competitiveness through higher productivity. Experiment (3) looks at cases of higher industry TFP in raw cotton, cotton lint and yarn, and textiles. If the improvement in TFP occurs in all stages of production, the results indicate expansion in production and exports, with less variation in higher incomes among household groups than in the earlier cases. Poverty is reduced. The increase in income, as well as the reduction in poverty, is lowered substantially if the TFP shock only occurs in one sector.

Finally, the textile-apparel industry is backed by a strong and powerful association that lobbies for government support and subsidies. Experiment (4) analyzes the effects of government production subsidies to the industry on the economy as a whole and those favored by the policies. Such subsidies lead to overall welfare loses and higher poverty, while they primarily benefit the owners of industrial capital.

Overall, the results of experiments (1) and (2) demonstrate the different effects arising from two largely external positive shocks—the increase in foreign savings strengthens the currency and creates a boom in the non-trade sectors versus an increase in world cotton or textile prices which improves Pakistan's terms of trade and generates a boom in these sectors in particular. An inflow of foreign savings depresses traded sectors

but stimulates investment and expanded non-traded goods production. Because of the large share of the cotton-related sectors in overall exports, an export boom in these sectors also strengthens the currency which negatively affects other tradables and the domestic currency value of household income from of any given level of foreign remittances. These different effects need to be understood by policymakers trying to assess, for example, the performance of the yarn and textile sectors and its impacts on employment and poverty under more liberalized trade rules but also in light of the capital inflow and increasing foreign remittances. Experiments (3) and (4) are relevant to policymakers who must direct limited domestic resources to capacity-building public investments but face calls for more direct support from industry lobbies.

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In the development of this report, preliminary results have been presented at two professional meetings (American Agricultural Economics Association, July 2006;

Pakistan Society of Development Economists, December 2006); at three seminars at IFPRI (January and April 2007 in Washington D.C., USA, and April 2007 in New Delhi, India), and at several policy outreach/discussion meetings with industry, academic and government representatives in Pakistan (Islamabad Club, Islamabad, December 2006; Punjab Ministry of Commerce, Lahore, December 2006). The results have also been presented at the Conference on Rural Development, hosted by PIDE, Islamabad, Pakistan, April 2007, and the World Bank Workshop on Effects of Agricultural Price Distortions on Growth, Income Distribution and Poverty, West Lafayette, Indiana, USA, June 2007. We thank Antoine Bouet and participants at these presentations and meetings for helpful suggestions and comments. Presentation of the analysis is also scheduled for a conference of the Poverty Reduction, Equity and Growth Network (PEGnet), Berlin, Germany, September 2007. Workshops are planned to be organized during the fall 2007 for audiences of industry, government and academic representatives in Islamabad, in collaboration with Innovative Development Strategies, Ltd., and in New Delhi, in collaboration with the National Council of Applied Economic Research.

1. INTRODUCTION

The cotton, textile and apparel industries which constitute the production of raw cotton, ginning, spinning, weaving, dying, printing and garments manufacturing contributed 11 percent of Pakistan's gross domestic product (GDP) in 2004-05. It captures 46 percent of the entire manufacturing sector and employs 35 percent of the industrial labor force. Cotton is Pakistan's principal industrial crop and provides critical income to rural households. Moreover, cotton-based commodities such as yarn, textiles, and clothing provide 60 percent of total export receipts of the country.

These critical sectors of the Pakistan economy face a number of challenges. In the international market, the price of cotton has been unstable around a generally declining long-term trend. In the yarn and textile sectors, multilateral trade rules have changed and there is increased competition among exporters. Given the size of the industry and the high incidence of poverty in Pakistan the implications of these developments on the poor may be significant.

Using a computable general equilibrium (CGE) model calibrated to a 2001-02 social accounting matrix (SAM), this report examines how a number of developments in the international and domestic economies may affect sectoral production with a focus on the cotton-to-apparel value chain. We examine the effects on key macroeconomic indicators, sectoral output and factor demand, output and factor prices, and household income. Furthermore, we examine the implications of these developments on poverty through a microsimulation process linking the CGE model results to disaggregated data

from the 2001-02 Pakistan Household Integrated Economic Survey (HIES) of the Federal Bureau of Statistics (2003).

The organization of the paper is as follows. There are three preliminary sections that provide the context of the analysis. Section 2 presents broad trends in the international cotton, textile and apparel markets, highlighting the share of Pakistan in these markets over time. Section 3 presents key features of the cotton, textile and apparel sectors in Pakistan and discusses major shifts in cotton and textile policies. Section 4 describes recent trends in rural and urban poverty in Pakistan.

The model and policy scenario analysis are presented in sections 5-8. Section 5 presents the specification of the CGE model and its key parameters and section 6 describes the poverty assessment microsimulations. In sections 7 and 8, four types of simulation experiments are discussed and undertaken to analyze the intersectoral and poverty implications of key economic changes that could affect the industry's competitiveness. These include (1) an increase in foreign savings inflows into Pakistan; (2) an increase in world prices of cotton lint and yarn, textiles or a combination of these prices; (3) an improvement in total factor productivity (TFP) in one or more of the cotton-related sectors (raw cotton, cotton lint and yarn, and textiles); and (4) a production subsidy in one or more of these sectors.

Experiment (1) addresses the effects on competitiveness (particularly on the textile industry) through changes in the real exchange rate resulting from the surge of more than 100 percent in foreign capital inflows to Pakistan that has occurred since 2001. Experiments (2) analyze the case of increasing world cotton and textile prices, where

historical indicators show wide fluctuations and cotton fabric prices tend to move with prices of cotton lint. The major shifts in the international trading agreements on textile and clothing include the recent lifting of import quotas in restricted markets under the Multi-fiber Agreement (MFA). The change of trade regime will potentially affect world yarn, textile and apparel prices and trade patterns. This will test Pakistan's ability to compete in non-quota markets. Pakistan can best take advantage of this shift if it improves its competitiveness through higher productivity. Experiments (3) look at the case of higher industry TFP sector by sector. Finally, the industry is backed by a strong and powerful association that lobbies for government support and subsidies. Experiments (4) analyze the effects of government subsidies to the industry on the economy as a whole and those favored by the policies.

The results of this analysis are illustrative of the forces that will shape the cotton, textile and apparel sectors in Pakistan in the coming years, and demonstrate the effects of these forces on rural and urban poverty. The largest increase in household income and reduction of poverty arise from the modeled increase of foreign savings. It also results in significant improvement in overall investment. Appreciation of the exchange rate leads to a net reduction in exports and increase in imports, but there are offsetting favorable effects on the construction-related and service sectors. There is significant movement of resources, especially labor, towards these sectors and increased prices of factors they use heavily. Thus, wages of skilled and unskilled labor improve as well as the average returns to capital. However, wages of farm labor and the average returns to land decline. All households, except rural farmers, benefit from incomes which are higher in aggregate by

1.31 percent. Both urban and rural poverty fall due to higher incomes and lower domestic prices.

Experiments (2), in contrast, focus on shocks with a sectoral origin. By itself, an increase in cotton lint and yarn or textile prices has several different effects. A 20 percent increase in the world prices of cotton lint and yarn, which is about the magnitude that would have offset the price decrease Pakistani industries experienced in the late 1990s, improves aggregate household income by 0.25 percent. Factors heavily used in raw cotton production, which are farm labor and land, receive higher prices. Rural farmers benefit from higher income, while urban households as well as rural non-farmers experience lower income. The impact on textile production is negative as the increase in the world price of cotton lint and yarn makes its export relatively attractive compared to domestic sales to the local industry. This highlights the dependence of the domestic textile industry on the availability of domestically produced raw materials. Alternatively, a 5 percent increase in the world prices of textiles, which would have offset the decrease in world prices in the late 1990s, increases total household income by 0.4 percent. There is an increase in output in the textile sector because of export growth. Because of its large share in the overall exports of the economy, this leads to a substantial appreciation of the exchange rate. The export sectors other than textiles become less competitive, including the cotton lint and yarn sector. Yarn imports increase and lower output in the cotton lint and yarn sector translates into reduced demand for raw cotton. Rural farmers end up with lower income, while the rest of the household groups benefit from higher income. Overall poverty declines, with the decrease in urban poverty relatively more than in rural poverty.

Since historically world prices of cotton lint, yarn and fabric have tended to move simultaneously, we also consider a joint scenario combining the above price movements. The results are mutually reinforcing in terms of exchange rate appreciation. Raw cotton and cotton lint and yarn output and exports again increase, but production and exports of textiles and other traded goods fall. Real factor prices all increase but at various rates. The increase in the overall household income is 0.59 percent, which is higher than the previous two scenarios. The decline in overall poverty is also higher.

In the productivity experiments (3), increasing TFP simultaneously by 5 percent in raw cotton, cotton lint and yarn, and textile improves household income by 0.35 percent. All household groups enjoy higher income with less variation among households than in the previous cases. The decline in urban poverty is slightly more than in rural poverty. The increase in income, as well as the reduction in poverty, is reduced substantially if the TFP shock occurs only in one sector. If the improvement in TFP is in textiles only, the income gain is 0.22 percent. The improvement in productivity in the textile sector only without the corresponding increase in the raw cotton and cotton lint and yarn sectors depresses domestic cotton and yarn production and real income of farmers falls. On the other hand, improvements of TFP in raw cotton and cotton lint and yarn raises farm income but overall real income by only 0.16 percent. The raw cotton sector cannot take full advantage of the export market arising from improved productivity if there are bottlenecks in the ginning and spinning processing sectors. We model TFP improvement jointly in these sectors to reflect a dependency of farmers on the processing sector that is also emphasized by industry analysts.

Finally, policy makers might respond to pressure from the textile industry for subsidies. In the experiments (4) involving a production subsidy, a general compensatory consumption tax is introduced so that government savings remain constant. The effects across household groups from the subsidy and taxes will vary depending upon their initial endowments and assets, with losers and as well as net gainers.

A production subsidy to the textile sector increases the output price of textiles and reduces the domestic market price. Owners of textile firms, which belong to the urban non-poor household group, benefit from the higher output price. But this is at the expense of lower income for urban poor and rural poor households, thus poverty rises. A production subsidy to the cotton lint and yarn sector also results in lower net (after taxes) household income. Rural farmers benefit because of the positive effect on raw cotton production but urban poor and rural non-farm poor households suffer. A production subsidy on the raw cotton sector generates zero overall household income effects. Rural farmers benefit but urban poor and rural non-farm households bear the cost.

Overall the results of experiments (1) and (2) demonstrate the different effects arising from two largely external positive shocks—the increase in foreign savings strengthens the currency and creates a boom in the non-trade sectors versus an increase in world cotton and textile prices which improves Pakistan's terms of trade and generates a boom in these sectors in particular. An inflow of foreign savings depresses traded sectors but stimulates an investment and non-traded goods boom. Because of the large share of these cotton-related sectors to the overall exports, an export boom in these sectors also strengthens the currency which negatively affects other tradables and foreign remittances

to households. These different effects need to be understood by policymakers trying to assess, for example, the performance of yarn and textile sectors under more liberalized trade rules but also in light of the capital inflow and increasing foreign remittances. Experiments (3) and (4) are relevant to policymakers who must direct limited domestic resources to capacity-building public investments but face calls for more direct support from industry lobbies.

2. THE INTERNATIONAL COTTON MARKET

This section presents broad trends in production, consumption, trade, and prices in the international market for cotton, textile and apparel and highlights some factors behind the movements in the international price of cotton as well as some major players in the market, including Pakistan and India.

2.1 Trends in Cotton Production, Consumption, and Trade

The total global area devoted to cotton production hardly changed over the period 1965-04. Its average growth is 0.2 percent (Table 2.1). However, productivity in terms of yield (kilogram per hectare) improved by an average of 1.7 percent annually. Thus, the average output growth of 1.9 percent was largely due to the improvement in yield.

Table 2.1—World cotton supply and use

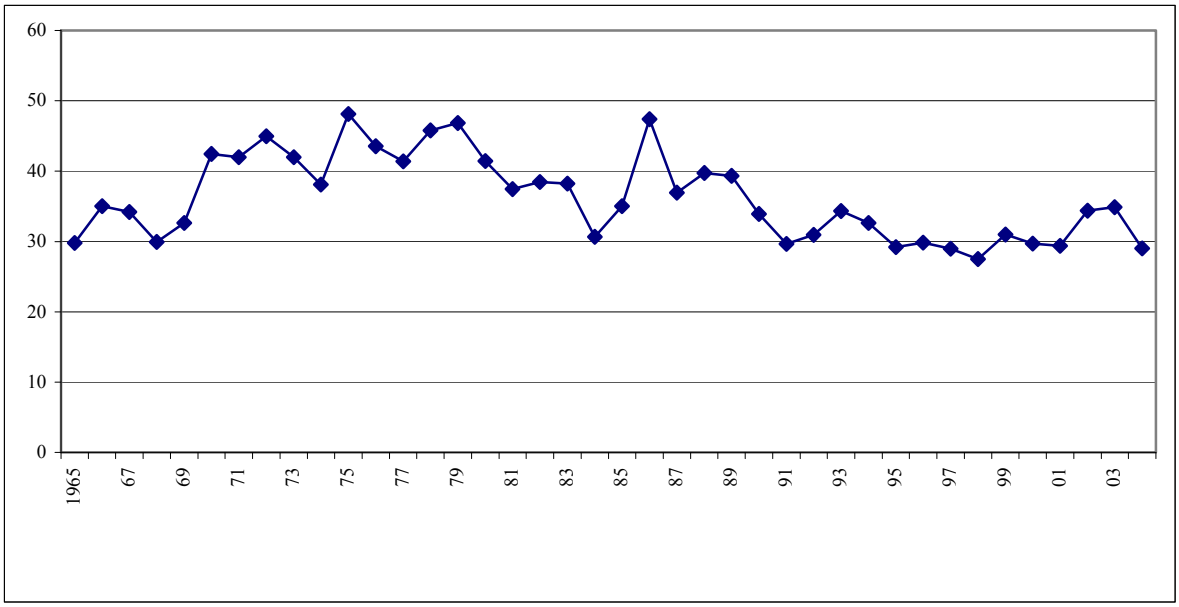
Year beginning August 1	Harvested Area (mil. ha)	Yield (kg/ha)	Supply			Use		
			Beginning Stocks	Production	Imports	Consumption	Exports	Ending Stocks
			(million 480-lb bales)					
1965	33.3	372.5	29.0	56.9	17.4	53.8	17.0	32.6
1970	31.8	380.5	22.4	55.6	24.6	57.1	23.6	21.8
1975	29.9	393.4	33.4	54.0	26.1	61.6	26.0	25.9
1980	32.4	426.3	21.2	63.4	27.3	65.0	26.3	20.6
1985	31.6	552.5	42.1	80.2	28.7	75.3	28.1	47.6
1990	33.2	572.2	25.0	87.1	30.4	85.5	29.6	27.4
1991	34.8	596.5	27.4	95.3	28.7	86.2	28.2	37.0
1992	32.6	549.0	37.0	82.3	27.0	86.3	25.5	34.4
1993	30.7	550.5	34.4	77.6	27.8	85.6	26.7	27.7
1994	32.2	583.2	27.7	86.3	30.6	84.5	28.2	31.9
1995	36.0	567.2	31.9	93.7	27.4	85.8	27.4	39.9
1996	33.7	580.9	39.9	90.0	29.0	87.8	26.9	44.3
1997	33.8	594.6	44.3	92.2	26.3	87.3	26.7	48.8
1998	32.9	565.9	48.8	85.5	25.3	84.8	23.5	51.3
1999	32.3	591.8	51.3	87.7	28.4	91.1	27.2	49.2
2000	32.0	604.0	49.2	88.9	27.3	92.2	26.4	46.8
2001	33.7	637.4	46.8	98.8	29.9	94.3	29.0	52.1
2002	30.4	631.0	52.1	88.3	30.6	98.3	30.3	42.3
2003	32.4	639.4	42.3	95.1	34.5	98.1	33.2	40.6
2004	35.8	732.7	43.1	120.4	33.4	108.8	35.0	50.8
Ave. growth,%	0.2	1.7	1.0	1.9	1.6	1.8	1.8	1.1

mil. ha.: million hectares; lb: pounds; kg: kilogram

Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

International trade is a major component of the cotton market. However, while exports and imports of cotton grew relatively faster (at an average rate of 2.2 percent) than production and consumption over the period 1965-04, the export-to-production ratio exhibits a declining trend after the mid-1970s when it reached a peak of nearly 50 percent (Figure 2.1).

Figure 2.1—Trade ratio – exports/production (%)



Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research

The largest producer of cotton is China, which captures about a quarter of world production (Table 2.2). It is followed by the U.S., with an average share of 20 percent. Their shares have been relatively stable for the past quarter century. India is become the third major contributor to world cotton production, with an average share of 13 percent in 2000-04. Over the last 35 years, the average growth in cotton production in India is 4.3 percent, which is higher than in China or the U.S. Over the same period, the average cotton production growth in Pakistan was 4.4 percent. This relatively high growth enabled Pakistan to nearly double its share in the overall world production of cotton. At present, it is the fourth major producer.

Table 2.2—Major sources of world cotton production (% share)

Period average	China	United States	India	Pakistan	Brazil	F. Soviet Union /1/	Turkey	Others
1970-74	17	19	9	5	5	18	4	23
1975-79	17	19	9	4	4	20	4	22
1980-84	26	17	10	5	5	16	3	19
1985-89	23	16	11	8	4	16	3	19
1990-94	24	20	12	9	3	12	3	17
1995-99	22	19	14	8	2	8	4	21
2000-04	24	20	13	9	5	7	4	18
Ave. production growth (1970-2004), %	2.9	2.4	4.3	4.4	2.2	-0.8	2.4	1.3

/1/ Former Soviet Union

Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

Data on harvested area and yield are presented in Table 2.3 for the four major cotton producers. Except for the variability around a flat trend, there is not much change in area devoted to cotton production in the top cotton-producing countries. The average yield for the whole period 1970-2004 in China (745 kg/ha) and in the U.S. (659 kg/ha) is higher than the world average (519 kg/ha). It is lower in India (243 kg/ha) and Pakistan (471 kg/ha). However, some catching up has occurred. Between the sub-periods 1970-74 and 2000-04, while the growth in world average yield is 62 percent, the improvement in China is 137 percent and in India 134 percent. Pakistan also performed well with a growth of 91 percent, while the U.S., with a growth of 53 percent, is below the world average.

Table 2.3—Harvested area and yield

	World		China		United States		India		Pakistan	
Period Average	Harvested area (mil. ha.)	Yield (kg/ha)	Harvested area (mil. ha.)	Yield (kg/ha)	Harvested area (mil. ha.)	Yield (kg/ha)	Harvested area (mil. ha.)	Yield (kg/ha)	Harvested area (mil. ha.)	Yield (kg/ha)
1970-74	33	400	5	459	5	527	8	147	2	330
1975-79	32	409	5	451	5	540	8	158	2	281
1980-84	32	476	6	680	4	594	8	190	2	343
1985-89	31	548	5	797	4	701	7	257	3	548
1990-94	33	570	6	773	5	741	8	288	3	594
1995-99	34	580	5	966	5	707	9	311	3	569
2000-04	33	649	5	1,085	5	806	8	346	3	633
Ave. 1970-2004		519		745		659		243		471
Growth: 1970-74 and 2000-04, %		62		137		53		135		91

mil. ha.: million hectares; kg: kilogram

Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

The major source of world cotton exports is the U.S. (Table 2.4). From an average share of 17.8 percent in 1970-74, its share increased to an average of 37.1 percent in 2000-04. The former Soviet Union used to capture a large part of cotton exports in the 1970s, but its share has dropped significantly, especially in the first half of the 2000s. Exports from the African region have improved through the years, and so with Australia. There are no sizeable cotton exports from China, India or Pakistan.

Consumption of cotton is determined largely by the size of the domestic textile industry. China, being the world's leading producer of textiles, is also the major user of cotton. At present, it consumes almost a third of world production (Table 2.5). India and Pakistan have increasingly become major users of cotton due to their relatively large textile industries. These countries put in value added by processing raw cotton into yarn, textile products, garments and textile made-ups. The U.S. share of cotton consumption vacillates in the range of 8-13 percent, while the share of the former Soviet Union has decreased substantially.

There are some years when cotton production in China does not meet domestic consumption leading to net importation. Cotton imports to China were significant 2003 and 2004 (Table 2.6). Cotton imports of the former Soviet Union, EU-25, and Japan drop steadily over time, while imports increase in Indonesia and Thailand. Cotton imports into both India and Pakistan have increased in the past 10 years. Taken together, the production, trade and consumption data highlight the growing dominance of the South Asia region in cotton output and use.

Table 2.4—Major exporters of cotton (%share)

Period Average	China	United States	India	Pakistan	Brazil	F. Soviet Union /1/	Africa /2/	Australia	Others
1970-74	0.5	17.8	0.6	2.9	3.7	37.3	2.4	0.1	34.7
1975-79	0.4	21.1	0.7	1.7	0.6	41.3	2.9	0.4	30.9
1980-84	1.4	23.6	1.4	4.2	1.3	38.4	3.5	1.8	24.5
1985-89	7.0	18.4	1.6	8.7	1.5	34.5	5.7	3.7	18.9
1990-94	2.3	25.9	1.8	3.6	0.8	32.6	8.0	6.0	19.0
1995-99	1.9	25.0	1.7	1.7	0.1	22.9	13.0	9.8	23.9
2000-04	1.2	37.1	1.0	1.1	2.5	17.5	12.4	9.3	17.9

/1/ Former Soviet Union

/2/ Includes: Benin, Burkina Faso, Cameroon, Chad, Ivory Coast, Mali, Niger, Senegal, Togo, and Central African Republic

Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

Table 2.5—Major users of cotton (% share)

Period Average	China	United States	India	Pakistan	Brazil	F. Soviet Union /1/	Turkey	Others
1970-74	19	13	9	4	3	15	2	37
1975-79	20	11	9	3	4	14	2	37
1980-84	24	8	9	3	4	12	2	36
1985-89	24	9	10	4	4	11	3	35
1990-94	24	12	11	8	4	7	4	31
1995-99	23	12	15	8	4	3	6	29
2000-04	30	8	14	9	4	4	6	25

/1/ Former Soviet Union

Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

Table 2.6—Major importers of cotton (% share)

Period Average	China	United States	India	Pakistan	Brazil	F. Soviet Union /1/	Russia	EU-25	Japan	Indonesia	South Korea	Thailand	Taiwan	Others
1970-74	4	0.2	1.6	0.0	0.0	28.2	0.0	28.6	14.2	0.9	2.4	1.1	2.8	15.7
1975-79	7	0.1	0.8	0.0	0.0	27.9	0.0	25.2	11.9	1.4	3.8	1.5	3.7	17.1
1980-84	6	0.1	0.0	0.2	0.1	25.6	0.0	25.7	12.4	2.0	3.8	1.7	4.2	18.5
1985-89	2	0.0	0.2	0.0	1.1	25.0	10.8	25.1	10.7	3.2	3.2	3.4	5.5	9.8
1990-94	6	0.0	0.7	0.7	4.5	15.7	11.7	21.2	8.0	6.6	3.5	5.4	4.6	11.3
1995-99	6	1.0	1.7	1.4	6.5	6.0	4.2	19.8	5.0	7.8	3.7	5.2	4.9	26.5
2000-02	4	0.1	5.9	2.6	1.6	7.0	5.8	15.0	3.7	8.3	3.5	6.1	4.3	31.9
2003	26	0.1	2.3	5.4	1.6	5.1	4.3	9.0	2.3	6.2	2.9	4.9	2.9	27.3
2004	19	0.1	2.4	4.2	0.6	5.1	4.3	9.0	2.4	7.2	3.0	6.8	4.0	31.7

/1/ Former Soviet Union
Source: Cotton and Wool Situation and Outlook Yearbook, Economic Research Service, USDA

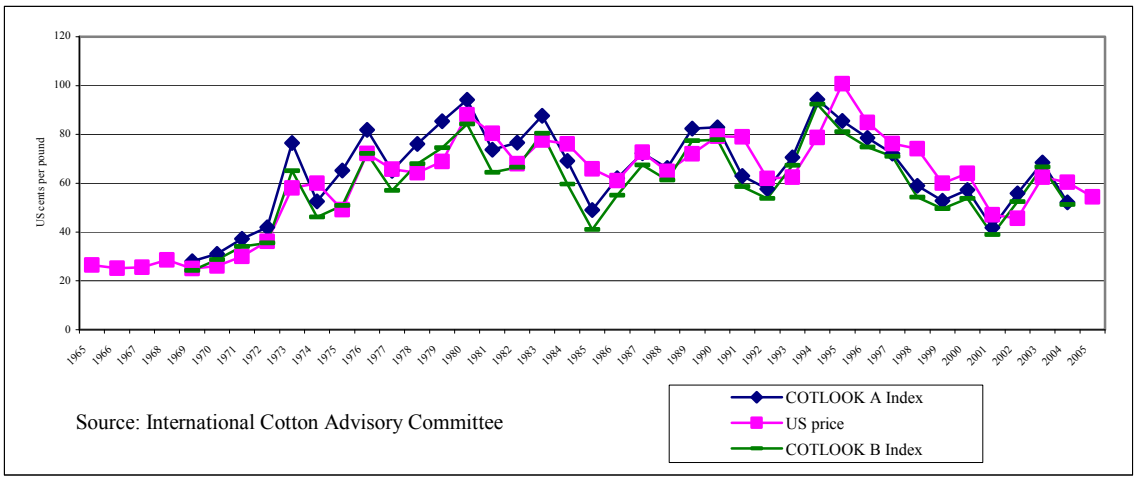
2.2 Trends in International Cotton Prices

Three indicators of international cotton prices, COTLOOK A and COTLOOK B Indices[1] and U.S. price, are presented in Figure 2.2. Together, these indices move generally in the same direction. COTLOOK A index is generally higher than COTLOOK B Index, while the U.S. price index is either below or above the two indices. Cotton from Pakistan is grouped within the B Index.

There is high degree of variability in the international price of cotton. While an increasing trend in nominal prices is observed from the second half of the 1960s through the 1970s, there is no clear direction in the 1980s. The early 1990s saw a sharp hike in cotton prices until 1994, then a significant drop is observed in the second half of the 1990s until 2001. During these years, international cotton prices (A and B indices) fell nearly 60 percent, while U.S. cotton prices fell by 40 percent. Prices recovered in 2002 and 2003, but they tend to weaken again in the next two years, 2004 and 2005.

[1] COTLOOK A Index is the average of the 5 lowest quotations of 16 styles of cotton (middling 1-3/32") traded in North European ports from the following origins: Australia, Brazil, China, Francophone Africa, Greece, India, Mexico, Pakistan, Paraguay, Spain, Syria, Tanzania, Turkey, the United States, and Uzbekistan. COTLOOK B Index is the average of the 3 lowest quotations of eight styles of coarser grades of cotton from Argentina, Brazil, China, India, Pakistan, Turkey, the United States, and Uzbekistan.

Figure 2.2—Cotton price – COTLOOK A and B indices and US price



Source: International Cotton Advisory Committee

2.3 Factors Influencing International Cotton Prices

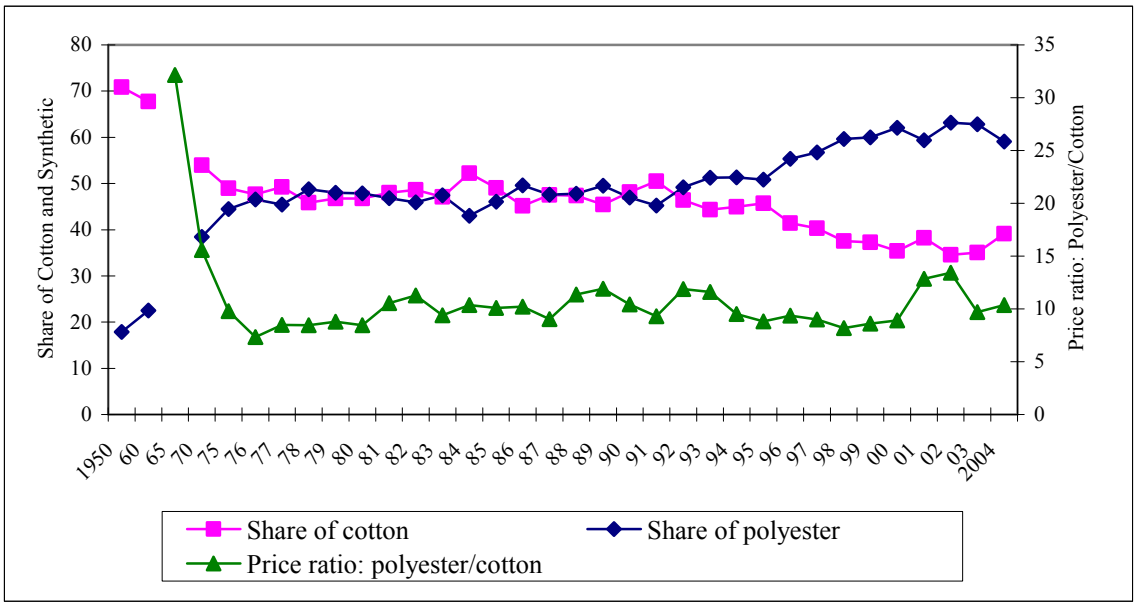
Short-term fluctuations in the international price of cotton are affected by various factors, such as expectations, production and inventories. For example, natural calamities coupled with a significant drop in stocks in China resulted in a sharp increase in prices in 2003. Lower than expected consumption and the expected bumper crop resulted in a decline in domestic price since March 2004 (Cotton Commodity Notes, 2006).

Over the long term, international prices of cotton are affected by improvements in yield due to improved inputs, such as expanded use of irrigation, fertilizers and chemicals. Other technological developments that reduce cost of production, such as the introduction of genetically modified varieties, also affect prices. Competition from substitute fibers, and trade-distorting policy shifts in major cotton-producing and exporting countries, also affect international prices.

One recent development in cotton production is the focus on cost reduction through the less intensive use of chemicals (Baffes, 2004). Contributing to this development has been the introduction of genetically modified seed technology. The technological developments of the 1990s that resulted in the introduction of Bacillus Thuringiensis (Bt) cotton present potential for reducing cost and thereby for increasing profitability. The leading cotton-producing countries that have introduced this technology include China, India, and Mexico in the Northern Hemisphere, and Argentina Australia, and South Africa in the Southern. Brazil, Indonesia, Israel, Pakistan, and Turkey are presently in the trial stage[2]. However, the largest user of Bt cotton is the U.S., where it is estimated that 70 percent of its cotton area was sown with genetically modified varieties in the 2003-04 season. In Australia, 44 percent of its cotton area was sown to such varieties in the 2002-03 season. In China, more than 20 million hectares were planted with such varieties in 2002. Indeed, the introduction of this technology is significant. At present, it is estimated that 22 percent of the world's cotton planting are now in genetically modified varieties, up from 2 percent in 1996-97 (Baffes, 2004).

[2] In Pakistan the Ministry of Food, Agriculture and Livestock (MINFAL) announced plans on January 5, 2007 to release the first home-grown insect-resistant BT cotton variety during the next sowing season in order to "to maximize the production of cotton crop for domestic needs and exports." (http://www.checkbiotech.org/blocks/dsp_document.cfm?doc_id=14159)

Figure 2.3—Cotton vs polyester fibers



Source: International Cotton Advisory Committee

Synthetic man-made fibers such as rayon and polyester are substitutes for cotton fibers. Since the early 1990s, there have been major structural shifts in the share of cotton and polyester fibers (Figure 2.3). In the 1980s, cotton and polyester shares were each around 50 percent. However, from 1992 onward, the share of polyester improved to about 60 percent, while that of cotton dropped to about 40 percent. The synthetic/cotton price ratio does not appear to be the main factor behind the shift in consumption. Over the last two decades their prices generally move in the same direction. One of the most likely reason behind the shift is the durability of polyester-based (or polyester mixed with cotton) clothing as compared to pure cotton-based.

In the early 1990s, Townsend and Guitchounts (1994) estimated that about two-thirds of cotton was produced in countries that implement some form of trade-distorting

government policies such as taxes and subsidies. Recently, the International Cotton Advisory Committee (ICAC) found that eight countries provided direct support to cotton production: Brazil, China, Egypt, Greece, Mexico, Spain, Turkey and the U.S. (Table 2.7). By far the largest direct government assistance to cotton producers is in the US, which reached nearly $4 billion in 2001-02. The government support in the U.S. comes in various policy instruments (Table 2.8).

Table 2.7—Direct government assistance to cotton producers (US $ millions)

Country	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
United States	1,163	1,946	3,432	2,148	3,964	2,620
China	2,013	2,648	1,534	1,900	1,196	750
Greece	659	660	596	537	735	718
Spain	211	204	199	179	245	239
Turkey	-	220	199	106	59	57
Brazil	29	52	44	44	10	0
Mexico	13	15	28	23	18	7
Egypt	290	-	20	14	23	33

- not available

Sources: International Cotton Advisory Committee (ICAC) 2002 and 2003, United States Department of Agriculture (USDA), and European Union

A number of studies have attempted to quantity the impact of government support on world prices and production. Orden, et al (2006) and FAO (2004) surveyed those studies and found that, generally, the elimination of the subsidies will likely improve international prices of cotton. However, the magnitude of the impact depends on the method used, such as computable general equilibrium model, partial equilibrium model, and econometric estimates of supply response.

To cite some conclusions from individual studies, the estimates of the Overseas Development Institute (2004) indicate that if the cotton market were to be liberalized,

production in the U.S. and EU would fall and world prices of cotton would increase between 18 and 28 percent. This would increase export earnings of all developing countries by $610 million. West and Central African countries could gain between $94 million and $355 million in earnings from cotton production. ICAC (2003) finds that the removal of subsidies will result in lower production in countries concerned, and will therefore increase world prices of cotton by 21 percent in 2000-01 and 73 percent in 2001-02. The study of Goreaux (2003) indicates that export earnings of West and Central Africa were reduced by $250 million because of cotton support policies. The removal of subsidies is estimated to increase world prices of cotton by 18 percent. The study of Reeves (2001) finds that the removal of production and export subsidies by the U.S. and the EU could lead to 20 percent reduction in US cotton production and 50 percent fall in U.S. cotton export. This in turn could increase prices by 10.7 percent from the observed benchmark. The study carried out by the Australian Center for International Economics (2002) indicates that the removal of subsidies would increase world cotton prices by 10.7 percent. Sumner (2003) finds that without U.S. subsidies on cotton during 1999-02, world cotton prices would have been higher by 13 percent. At the lower end of estimates, Tokkarick (2003) finds that multilateral trade liberalization across cotton and other agricultural markets will improve cotton prices only by 2.8 percent, while Poonyth, et al. (2004) find the improvement in cotton prices would range between 3.1 and 4.8 percent.

Table 2.8—Government assistance to US cotton producers (US$ millions)

Policy Instruments	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01	2001-02	2002-03
Coupled payments	3	-	28	535	1,613	563	2,507	248
PFC/DP	-	599	597	637	614	575	474	914
Emergency/CCP	-	-	-	316	613	613	524	1,264
Insurance	180	157	148	151	170	162	236	194
Step-2	34	3	390	308	422	236	196	-
Total	217	759	1,163	1,947	3,432	2,149	3,937	2,620

- not available

PFC: production flexibility contracts; DP: direct payments; CCP: countercyclical payments

Sources: United States Department of Agriculture (assistance) and International Cotton Advisory Committee (production)

From these studies the impact of trade-distorting policies in major producing and exporting countries on world cotton prices is significant, with many estimates in the range of 10-20 percent. This would have far reaching effects on rural farm households, especially in cotton-producing, developing countries. Estimates from the Food and Agriculture Organization (FAO) in 2001 indicate that as many as 100 million rural households may have been directly or indirectly involved in cotton production.

2.4 Prices of Cotton Yarn and Cotton Fabric

Cotton is processed into yarn and then fabric, which are also heavily trade internationally. Unlike the COTLOOK A and B indices, there are no similar price indices for cotton yarn and cotton fabric that are readily available.

Table 2.9—World prices of cotton, cotton yarn and cotton fabric

	COTLOOK – B	Cotton yarn /1/	Cotton fabric /2/
1990	144.9	100.8	125.8
1991	108.9	104.3	124.3
1992	100.0	116.6	111.7
1993	125.3	106.4	99.8
1994	171.9	123.4	107.0
1995	150.9	136.8	121.7
1996	139.4	125.8	124.2
1997	132.2	116.9	115.0
1998	101.1	111.7	113.3
1999	92.3	105.1	106.9
2000	100.0	100.0	100.0
2001	72.5	89.5	100.2
2002	97.6	83.8	116.0
2003	124.1	97.5	111.1
2004	95.3	101.9	118.4
2005	95.3	94.9	116.9
Mean	115.7	107.2	113.3
St.dev.	26.5	14.0	8.7
C.V. %	22.9	13.0	7.7
1994-2001			
Change, %	-57.8	-27.4	-6.4
Ratio /3/		0.47	0.23

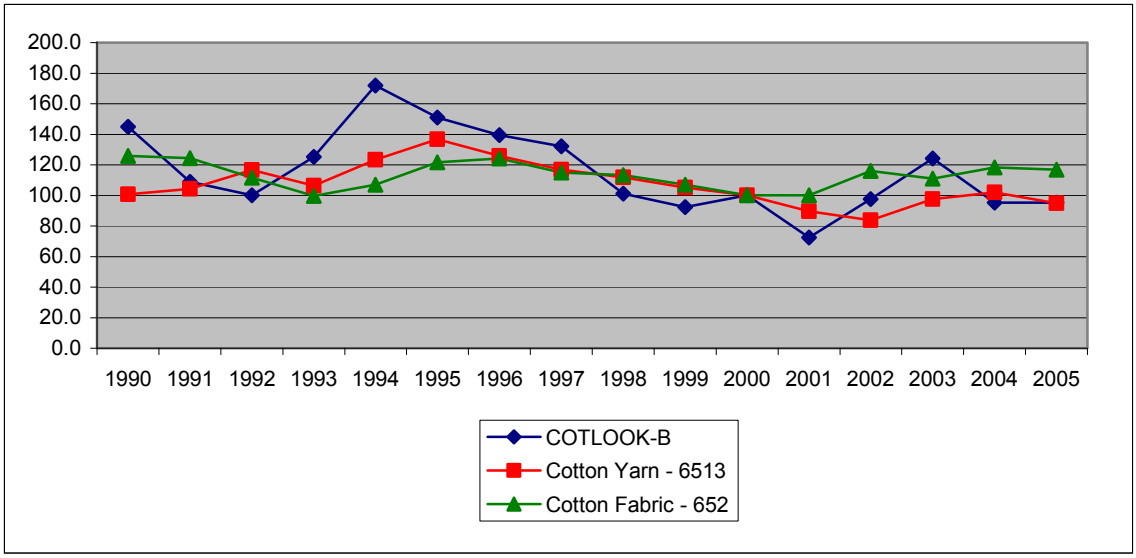
/1/ Cotton yarn - SITC REV. 3 - 6513 (Countries: China-Hong Kong-Special Administrative Region (SAR); China; India; Pakistan; United States; and Italy)
/2/ Cotton fabric, woven - SITC REV. 3 - 652 (Countries: China-Hong Kong-SAR; China; India; Pakistan; United States; Italy; Germany, Japan, France, Rep of Korea, Belgium, Netherlands and United Kingdom)
/3/ For cotton yarn: change in the price of cotton yarn over change in COTLOOK - B;
For cotton fabric: change in the price of cotton fabric over change in the price of cotton yarn
SITC REV. 3 is Standard International Trade Classification Revision 3.
C.V.: coefficient of variation; St. Dev. : standard deviation
Sources: United Nations Commodity Trade Statistics and International Cotton Advisory Committee

To provide an idea of how world prices of cotton yarn and fabric move with the world prices of cotton, we derived the traded-price indices of these cotton products using data from the United Nations Commodity Trade Statistics. We selected major world exporters of cotton yarn and track their data on value and quantity traded from 1990 to

2005. Similarly, we track the data on value and quantity traded of cotton fabric of major exporters. Price series were computed for these products and are expressed, including the COTLOOK B, with index 2000=100 in Table 2.9. For the period 1990-2005, the coefficient of variation of COTLOOK B is 22.9 percent, while cotton yarn is 13 percent and cotton fabric 7.7 percent. Figure 2.4 also shows that COTLOOK B is more volatile compared to cotton yarn prices and cotton fabric prices.

The period 1994-2001 saw a drop in COTLOOK B of 57.8 percent. Over this period, the price of cotton yarn dropped by 27.4 percent. The drop of the price of cotton fabric is not as dramatic at 6.4 percent over the same period. Using these reduced-form relationships, the "elasticity" between COTLOOK B and the price of cotton yarn is 0.47, and between the price of cotton yarn and the price of cotton fabric is 0.23 during this period.

Figure 2.4—World prices of cotton, cotton yarn, and cotton fabric



Source: Table 2.9

2.5 Global Trends in Markets for Textile and Clothing

This subsection presents trends in the world markets for textiles and clothing, the position of Pakistan and India in these markets, and some information on Pakistan's world exports of textiles and sources of its imports.

In 2005, the size of the world market for textiles was $203 billion (Table 2.10). It has grown strongly in the past 15 years. In the 1990s, the average annual growth of the market was about 5 percent. In 2003 and 2004, its annual growth was more than 10 percent, slowing in 2005 to 3.9 percent.

Table 2.10—Textile exports of selected economies

	1990	2000	2003	2004	2005
World (billion $)	104.4	157.1	173.7	195.4	203.0
(ave. annual growth, %)		5.1	10.6	12.5	3.9
			% World		
EU (25)	-	35.9	37.4	37.0	33.5
intra-exports	-	24.9	25.2	24.5	21.9
extra-exports	-	14.7	9.7	7.4	11.6
China	6.9	10.3	15.5	17.1	20.2
Hong Kong	7.9	8.6	7.5	7.3	6.8
re-exports	5.8	7.8	7.1	7.0	6.5
USA	4.8	7.0	6.3	6.1	6.1
Rep Korea	5.8	8.1	6.2	5.5	5.1
Taipei, China	5.9	7.6	5.4	5.1	4.8
India	2.1	3.8	3.9	3.6	3.9
Pakistan	2.6	2.9	3.5	3.1	3.5
Turkey	1.4	2.3	3.0	3.3	3.5
Japan	5.6	4.5	3.7	3.7	3.4
Indonesia	1.2	2.2	1.7	1.6	1.7

Textile - SITC REV. 3 - 65
SITC REV. 3 is Standard International Trade Classification Revision 3.
Source: International Trade Statistics, 2006

The European Union (EU-25) captures a third of the total world export of textiles. This is mainly intra-EU trade. Its textile trade with the rest of the world accounts for less than 12 percent of the total. China has a rapidly growing share in the world textile market. In 1990, China accounted for 6.9 percent of the world export of textiles. Its exports surge after 2000. By 2005, China had a share of 20.2 percent of the world market. The shares of the other major producers of textile are generally stable, implying falling shares for diverse other countries. Hong Kong's share, which is mostly due to re-exporting, is about 7 percent, with about the same level for the United States. The share of India is about 4 percent in 2005 and Pakistan 3.5 percent.

Table 2.11 presents the structure of the world market for clothing. In 2005, the total world exports of clothing amounted to $275.6 billion, somewhat larger than the world market for textiles. It is also growing strongly, with an average growth of 8.3 percent in the 1990s, rising to 17.6 percent in 2003 and 11.4 percent in 2004, and then slowing to 6.4 percent in 2005.

Similar to the world market structure for textiles, the EU has the largest share in the world market for clothing and again this is mostly intra-EU trade. There is remarkable growth in China's exports of clothing with its share of the world market increasing from 8.9 percent in 1990 to 26.9 percent in 2005. India's share is stable at about 3 percent. The share of Pakistan is also stable at about 1 percent.

Table 2.11—Clothing exports of selected economies

	1990	2000	2003	2004	2005
World (billion $)	108.1	197.8	232.6	259.1	275.6
(ave. annual growth, %)		8.3	17.6	11.4	6.4
			% of World		
EU (25)		26.9	29.4	29.7	29.2
intra-exports		20.1	22.0	2.2	20.9
extra-exports		6.8	7.4	7.4	8.2
China	8.9	18.2	22.4	23.9	26.9
Hong Kong, China	14.2	12.2	10.1	9.7	9.9
re-export	5.7	7.2	6.4	6.5	7.3
Turkey	3.1	3.3	4.3	4.3	4.3
India	2.3	3.1	2.8	2.6	3.0
Mexico	0.5	4.4	3.2	2.9	2.6
Bangladesh	0.6	2.0	2.1	2.2	2.3
Indonesia	1.5	2.4	1.8	1.7	1.9
USA	2.4	4.4	2.4	2.0	1.8
Romania	0.3	1.2	1.7	1.8	1.7
Thailand	2.6	1.9	1.6	1.5	1.5
Pakistan	0.9	1.1	1.2	1.2	1.3
Sri Lanka	0.6	1.4	1.1	1.1	1.0
Rep Korea	7.3	2.5	1.6	1.3	0.9
Malaysia	1.2	1.1	0.9	0.9	0.9
Philippines	1.6	1.3	1.0	0.8	0.8

Clothing - SITC REV. 3 - 84
SITC REV. 3 is Standard International Trade Classification Revision 3.
Source: International Trade Statistics, 2006

2.6 Liberalization of International Trade in Textiles and Clothing

The have been three major shifts in the rules that govern the international trade of textiles and clothing during the last 30 years. From 1974 to 1994, the rules set in the MFA provided the parameters for bilateral negotiations of how quotas on textile and clothing trade were determined. Under the MFA, discriminatory quotas were allowed in areas where the increase in imports had the potential to cause domestic market

disruptions. The EU, Austria, Canada, Finland, Norway and the U.S. applied quotas exclusively to developing country exports.

With the advent of the World Trade Organization (WTO) in 1995, the MFA was replaced by the WTO Agreement on Textiles and Clothing (ATC), which was designed to provide a transitional phase between the MFA and the full integration of the textile and clothing industry into the multilateral trading system. Under the ATC, Canada, the EU, Norway, and the U.S. retained some quota restrictions until January 1, 2005 when the quotas on textile and clothing trade were lifted and replaced by tariffs only.

Prior to the lifting of the quotas, a number of studies estimated the potential effects of liberalized international trade of textiles and clothing. To cite a few of these studies, Nordias (2004) argued that China and India would come to dominate world trade. The share of China alone was predicted to reach more than 50 percent during the post-ATC period. Tables 2.10 and 2.11 indicate the rapid increase in the world share of China in both textiles and clothing. But the world share of India has not shown significant enlargement so far.

Martin (2004) examined the possible effects of quota elimination on Pakistan. He argues that improvement in productivity is the key issue if Pakistan is to gain shares in the world markets. This is because the international markets will be more price responsive after the abolition of the quota. This will present opportunities for suppliers with high productivity, while suppliers that lose competitiveness can expect to suffer losses in market shares. Thus, for Pakistan, Martin concludes that “raising productivity—

either by improving the efficiency of the production process or the range and the quality of the products produced—is key to reaping the benefit from the abolition of the MFA."

The fear that the abolition of the MFA may reduce Pakistan's the market share in the previously quota-restricted markets has not been borne out so far. In the data presented in Table 2.12, the share of Pakistan's exports of textile fibers that go to markets of the EU, U.S., Canada and Norway has declined from 34.4 percent in 2002 to 20.7 percent in 2006. This is due to Pakistan's efforts to increase value added by processing fibers into yarn, fabric, garments, and textile made-ups as discussed in the next section. However, the shares of "Textile Yarn, Fabric, Etc." and "Clothing and Accessories" remain high. The combined ratio increased from 52.9 percent in 1990 to 70 percent in 2005 and 68.6 percent in 2006. This indicates that Pakistan remains particularly competitive in some specific textile product lines.

Table 2.12—Pakistan exports of textiles and clothing to restricted markets /1/ (%)

	Textile Fibers /2/	Textile Yarn, Fabric, etc /3/	Clothing and Accessories /4/	Combined /5/
1990	28.9	43.9	88.4	52.9
1995	22.4	37.6	89.9	50.8
2000	24.9	49.6	90.1	61.4
2002	34.4	54.5	84.5	63.6
2004	16.1	55.9	86.7	65.1
2005	19.8	63.7	85.1	70.1
2006	20.7	58.7	88.7	68.6

/1/ Restricted markets include: EU, US, Canada and Norway
/2/ SITC REV. 3 - 26. This is the ratio of Pakistan exports of textile fibers to these markets and the overall Pakistan exports of textile fibers
/3/ SITC REV. 3 - 65. This is the ratio of Pakistan exports of textile yarn, fabric, etc to these markets and the overall Pakistan exports of textile yarn, fabric, etc
/4/ SITC REV. 3 - 84. This is the ratio of Pakistan exports of clothing and accessories to these markets and the overall Pakistan exports of clothing and accessories.
/5/ This is the ratio of Pakistan exports of fibers, textile, and clothing to these markets and the overall Pakistan exports of fibers, textile, and clothing.
SITC REV. 3 is Standard International Trade Classification Revision 3.
Sources: United Nations Commodity Trade Statistics

3. COTTON-TEXTILE INDUSTRY IN PAKISTAN

This section describes the structure of the cotton, textile and apparel industries in Pakistan. The first stage of the process is the production of raw cotton, which is part of agriculture. The ginning sector comes next where cotton lint/fibers are produced. The textile industry starts at the spinning process where cotton fibers are spun into yarn. Yarn is weaved into fabrics. Fabrics are in various forms which are used in the making of clothing and garments and in the production of textile made-ups such as towels, bed wear, etc. In each of these stages, output is either exported to the international market or sold domestically to other sectors for further processing or to the household sector for final consumption. There have been major shifts in the structure of each of these segments of the industry over time. This section highlights these changes including the shifts Pakistan's policies on cotton and textiles.

3.1 Structure of Exports of Cotton Products

The cotton-to-apparel value chain is the major source of foreign exchange for Pakistan. Over the period 1990-2005, the average share of export receipts from these items to the overall exports of Pakistan is more than 60 percent (Table 3.1). Output in each step of the value chain is exportable. But there are significant changes in the structure of exports of these items over time. The average share of exports of raw cotton, which includes cotton waste, to the total export receipts of all cotton products declined from 13.1 percent in 1990-92 to 3.3 percent in 2003-05. The average share of manufactured cotton increased from 86.9 percent to 96.7 percent over the same period.

Within manufactured cotton, major shifts are taking place. The share of export of cotton yarn to the total export of cotton-based commodities declined from an average share of 29.7 percent in 1990-92 to 13.5 percent in 2003-05. The share of cotton cloth/fabric is above 20 percent. But the share of bed wear exports increased from 6.7 percent in 1990-92 to 17.5 percent in 2003-05. Also, over the same period, the export share of hosiery increased from 9.5 percent to 19.1 percent. There are also noticeable improvements in the export share of towels and other made-ups. These shifts in the structure of exports indicate that there is value addition in cotton processing that is taking place within the industry. This presents an encouraging trend. However, while this may be positive, the entire industry faces a set of major challenges for it to move forward.

Table 3.1—Share of cotton product exports to total Pakistan exports

	ave. 1990-92	ave. 1995-97	ave. 2003-05
Exports of All Cotton Products/Total Pakistan Exports	61.1	62.6	60.9
Exports of Raw Cotton/Exports of All Cotton Products /1/	13.1	5.8	3.3
Exports of Cotton Manufactures/Exports of All Cotton Products /1/	86.9	94.2	96.7
Cotton Yarn	29.7	27.7	13.5
Cotton Cloth	18.7	23.8	22.0
Tents & Canvas	1.7	0.7	0.9
Cotton Bags	0.7	0.5	
Towels	3.3	3.5	5.7
Bed Wear	6.7	8.3	17.5
Other Made-up	2.8	3.7	5.2
Garments	13.9	13.0	12.8
Hosiery	9.5	13.1	19.1

/1/ Will add up to 100%

Source: Textile Commission's Organization

3.2 Performance of Cotton Production

The average annual growth of cotton production between 1990-91 and 2004-05 is 1.4 percent in Pakistan (Table 3.2). A large part of the growth comes from the increase in land area (0.8 percent). The increase in yield is only 0.6 percent, in contrast to more rapid yield growth during the 1970s and 1980s. The overall low growth performance of cotton production is mainly due to the poor production performance in Punjab Province where 80 percent of cotton is produced. Production in the province expanded marginally by 0.1 percent over the period. The growth of Punjab land area for cotton production is 0.5 percent. Thus, the low production growth in Punjab is largely attributed to the 0.4 percent decline in yield.

There was significant drop in production in Punjab in 1993-94 because of the outbreak of the cotton leaf curl virus that devastated cotton production. Because of this the government launched programs of preventive and curative measures, but still production is susceptible to severe pest infestation. The erratic and low cotton production in the 1990s in the province is largely due to this factor and unfavorable whether conditions during the period. However, the production performance of Sindh Province (which produces 20 percent of Pakistan's cotton) is relatively better. The average production growth of 6.8 percent in Sindh over the period is due mainly to the improvement in yield which rose by an average of 5.4 percent. The expansion in land area is only 1.4 percent. Unlike Punjab, the province of Sindh was not as badly hit by pest infestations.

Table 3.2—Area, production and yield of cotton in Pakistan

	All Pakistan			Punjab			Sindh		
	Area (000 ha.)	Production (000 bales)	Yield (kg/ha)	Area (000 ha.)	Production (000 bales)	Yield (kg/ha)	Area (000 ha.)	Production (000 bales)	Yield (kg/ha)
1990-91	2,662	9,628	615	2,125	8,501	680	537	1,125	356
1991-92	2,836	12,822	769	2,287	11,417	849	548	1,403	435
1992-93	2,836	9,054	543	2,438	8,237	574	397	816	349
1993-94	2,805	8,041	487	2,249	6,523	493	555	1,517	465
1994-95	2,653	8,697	557	2,244	7,410	561	406	1,282	537
1995-96	2,997	10,595	601	2,463	8,720	602	529	1,862	598
1996-97	3,149	9,374	506	2,540	7,103	475	601	2,250	636
1997-98	2,960	9,184	527	2,348	6,817	494	600	2,336	662
1998-99	2,923	9,790	569	2,283	6,628	494	630	2,134	576
1999-00	2,983	11,240	641	2,329	8,804	643	634	2,377	637
2000-01	2,928	10,732	623	2,386	8,540	608	524	2,141	695
2001-02	3,116	10,613	579	2,526	8,046	541	547	2,443	759
2002-03	2,794	10,211	621	2,208	7,664	590	543	2,412	755
2003-04	2,991	10,048	571	2,387	7,702	549	561	2,243	680
2004-05	3,229	14,600	769	2,518	11,149	753	635	3,017	808
Mean	2,924	10,309	599	2,355	8,217	594	550	1,957	597
St.dev.	166	1,652	82	125	1,451	104	71	602	143
C.V. %	5.7	16.0	13.7	5.3	17.7	17.5	13.0	30.8	24.0
Trend Gr. %	0.8	1.4	0.6	0.5	0.1	-0.4	1.4	6.8	5.4
T. Stat.	2.9	1.7	0.8	1.6	0.1	-0.3	1.8	5.8	7.8
Minimum	2,653	8,041	487	2,125	6,523	475	397	816	349
Maximum	3,229	14,600	769	2,540	11,417	849	635	3,017	808

Growth rates calculated using ln Y= a+ bt,where Y is the variable and t is year; C.V.: coefficient of variation; St. Dev.: is standard deviation; T. Stat.: T-statistics; ha: hectare; kg: kilogram

Sources: Agricultural Statistics of Pakistan; Agricultural Price Commission; Federal Bureau of Statistics

Based on these developments, Salam (2007) argues that one of the major challenges facing Pakistan with regard to cotton production is how to control cotton virus attack and other pests. While he acknowledges that there are no simple solutions to this challenge, he proposes an integrated approach which includes: (a) cultivation of approved varieties for various zones; (b) following the recommended planting schedules; (c) uprooting the plants after the final harvest; (d) crop rotation; and (e) judicious use of chemicals. Furthermore, another potentially important factor could be the adoption of technological innovations such as the development of new cotton varieties that are tolerant of insects – in particular, the adoption of Bt cotton. Pakistan has lagged behind other major cotton-producing countries in adopting this recent development in technology.

The economic losses from pest infestations are substantial, especially to small and marginal cotton farmers which dominate cotton production in Pakistan. Table 3.3 shows the average area sown to cotton per farm is 4.9 acres (2 hectares). Farmers operating less than 5 acres devote 1.81 acres on the average to cotton production. These farms account for 48 percent of the total cotton-growing farms in the country and 18 percent of the total cotton area.

There are variations in prices of cotton dependent on its character, staple and grade. Character is dependent on diameter, strength, maturity (the ratio of mature fibers to immature ones), body and smoothness of fibers. Staple refers to the fiber length while grade refers to color, brightness and the amount of foreign matters. Table 3.4 shows the shift in the quality of cotton produced in Pakistan over time from primarily medium to medium long staple.

Table 3.3—Distribution of cotton growing farms and cotton area by farm size in Pakistan

Farm size	Cotton growing farms as % of total farms	Share (%) in total cotton farms	Ave. area under Cotton (acres)	Share (%) in total cotton area
Total Private Farms (6.62 million)	25	100	4.9	100
Farms up to 5 acres	21	48	1.8	18
Farms of 5 to 7.5 acres	28	17	3.9	13
Farms of 7.5 to 12.5 acres	29	16	5.7	19
Farms of 12.5 to 25 acres	33	12	8.7	21
Farms of 25 to 50 acres	29	5	15.6	15
Farms of 50 acres and above	25	2	40.2	14

Source: Agricultural Census 2000

Table 3.4—Staple-wise production of cotton (% distribution)

Period Average	Short under 1-3/16" (20.64mm)	Medium 1" to 1-3/16" (20.64 to 25.40 mm)	Medium Long 1-1/32" to 1-3/32"(26.19 to 27.78 mm)	Long 1-1/8" to 1-5/16" (28.57 to 33.34 mm)	Total
1947-70	13.6	82.5	7.4	0.4	100.0
1970-80	6.2	77.5	15.3	1.0	100.0
1980-90	2.7	26.4	55.4	15.5	100.0
1990-92	1.0	6.5	60.3	32.2	100.0
1995-97	1.0	45.3	52.1	1.5	100.0
2000-02	0.2	20.4	75.6	3.7	100.0

Source: Pakistan Central Cotton Committee (PCCC)

3.3 Marketing and Trade Policy

There are other factors that also have affected cotton prices in Pakistan. Foremost of these is government intervention in the price, trade and marketing system.

In 1974, the government established the Cotton Export Corporation (CEC) to control cotton exports. The CEC controls prevented the private sector from participating in international cotton trade. This control lasted until 1986-87 when the role of the CEC diminished while that of the private sector re-merged. Since 1988-89, the private sector has been able to buy cotton directly from the ginners and to both export and sell cotton domestically.

Prior to 1994, exports of cotton were subjected to an export tax. The export price system on which the export tax was based involved a minimum export price (MEP) and a benchmark price determining the upper price ceiling. The MEP was fixed daily by the Inter Agency Committee and announced by the State Bank of Pakistan. It was based on the international prices of lint, domestic price of yarn and lint, the domestic requirements of the industry and the global and local supply situation (Salam 2007). The benchmark price was determined on the basis of ex gin price of lint plus export incidentals. The difference between the MEP and the benchmark price was the basis of the export tax.

This complicated price system was designed to ensure a definite stream of export duty and prevent under invoicing. It failed in these objectives but suppressed domestic cotton prices relative to the international prices by as much as one third (Altaf, 2007). Table 3.5 still shows higher export parity price than the market price in 1990-91 and

1991-92. The pricing system resulted in a transfer of resources from cotton farmers, who received relatively low prices for their raw cotton, to the cotton processing sector, which benefited from relatively low-costs for its basic raw material. The price intervention system therefore failed to give incentives to the cotton growers.

With the abolition of the export duty on cotton in 1994, domestic prices in the 1994-95 cotton seasons came closer in line with international prices. In some years since 1994, domestic prices have averaged higher than export prices. At present, exports and imports of cotton under the private sector are practically duty free. Government intervention is now limited to the annual review of the support prices of seed cotton and limited public-sector procurements to maintain it with the intent of safeguarding the interests of farmers to an extent against falling prices.

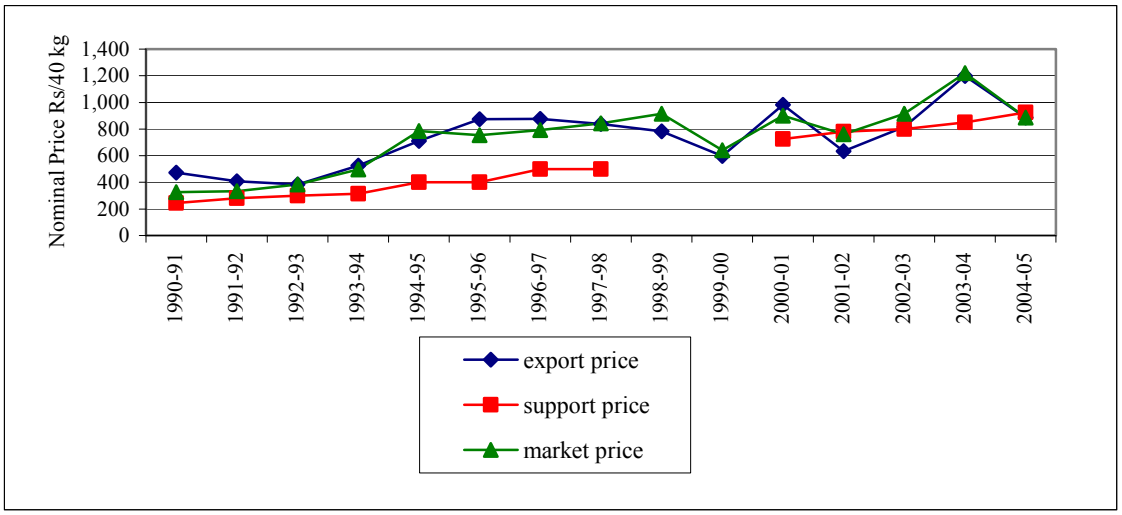
Table 3.5—Domestic and international nominal and real prices of seed cotton

	Nominal Price (Rs/40 kg)					Real Price (Rs/40 kg)			
Year	Support Price	Market	Export Parity	Import Parity	CPI	Support Price	Market	Export Parity	Import Parity
1990-91	245	327	473	592	43.2	567	758	1,096	1,370
1991-92	280	334	408	503	47.4	591	704	861	1,061
1992-93	300	384	385	495	52.1	576	737	739	951
1993-94	315	497	527	772	57.9	544	858	910	1,332
1994-95	400	785	711	1,045	65.5	611	1,198	1,086	1,596
1995-96	400	754	875	995	72.6	551	1,039	1,206	1,371
1996-97	500	793	877	1,085	81.1	616	978	1,082	1,338
1997-98	500	843	838	1,069	87.5	572	964	959	1,222
1998-99		914	782	1,030	92.5		989	846	1,114
1999-00		641	599	989	95.8		669	625	1,033
2000-01	725	900	981	1,184	100.0	725	900	981	1,184
2001-02	780	761	633	971	103.5	753	735	611	938
2002-03	800	914	816	1,239	106.8	749	857	764	1,161
2003-04	850	1,219	1,198	1,477	111.6	761	1,092	1,073	1,323
2004-05	925	885	886	1,180	122.0	758	725	726	967
Mean	540	730	733	975	83	644	880	904	1,197
St. dev.	243	251	228	277	25	89	160	185	191
C.V %	45.0	34.4	31.1	28.5	30.2	13.9	18.1	20.4	15.9
Trend Gr.%		7.5	5.5	6.1	7.2		0.3	-1.7	-1.1
T-stat		5.5	4.0	5.4	16.5		0.2	-1.4	-1.2

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). Real prices are expressed in terms of 2000-01 rupees (Rs). 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 of the *Cotton Outlook*, various issues. See Orden et al (2006) for discussions of the export and import parity price calculations.

Figure 3.1 compares the market, export and support prices of seed cotton. Except for two years (2001-02 and 2004-05) market prices are much higher than support prices. No support prices were fixed in 1998-99, and when the export and market prices fell in 1999-2000, there was no support price in effect. Altaf (2007) and Salam (2007) conclude that the benefit of the support price system seems to be more psychological than monetary.

Figure 3.1—Market export, and support prices of cotton



Source: Table 3.5

3.4 The Ginning Sector

One of the first stages in cotton processing is ginning. In Pakistan most of the early ginners were traders and their operations were never recognized as a processing industry. At present the ginning sector uses old machinery and primitive saw gins which are maintained by local mechanics. The ginning units are frequently overused and not

replaced on time, resulting in low quality of cotton lint. The productivity in the ginning sector is low (Altaf, 2007). While the international standard for productivity has reached 60 bales per hour, Pakistan is only operating at 10 to 12 bales per hour. At present, there are 1221 ginning units installed. Of these, not more than 800 units are actually working.

Low quality of cotton is also a result of contamination which occurs in various stages of the production and marketing chain. Contaminants in cotton include human/animal hair, bird feather, cotton twigs, unopened bolls and leaves. Cotton is contaminated during transportation in open trolleys and trucks. It also becomes contaminated in the open storage facilities of the ginneries. As a consequence, Pakistan cotton is rated as one of the most contaminated cotton. This negatively affects its price in the international market.

The low quality of cotton lint is also the result of mixing various cotton varieties in procurement from farmers. During picking of cotton (mostly hand-picked by female and children) and storage, the different varieties are seldom kept separate. When traders purchase cotton from farmers in small lots they seldom transport it separately based on variations in grades or standard. Mixing various lots during the marketing reduces quality.

Upgrade of technology is therefore one of the major challenges in the ginning sector. Efficiency in farm and trading management is also necessary. Standardization to reduce contamination is crucial. In a recent project ginneries located in a few districts followed procedure prescribed by the Pakistan Cotton Standards Institute to reduce contamination. The results indicate that the contamination of cotton was reduced from

1.97 grams per bale to 0.74 grams per bale (Salam, 2007). Thus, cotton standardization is a critical factor to improve cotton quality. A Cotton Standardization Ordinance was launched in 2002. But it has failed to generate significant improvement because the textile industry has not been willing to pay a premium for higher quality cotton. This has held back the progress to a large extent (Salam, 2007).

3.5 The Spinning Sector

The cotton lint produced by the ginneries goes to the spinners of yarn. In Pakistan, the spinning industry has grown from 70 units in 1958-59 to 458 units in 2004-05 (Table 3.6). Over the same period the number of installed spindles increased from 1.5 million to 10.5 million and the number of installed rotors rose from 0 to 155,000. The capacity utilization of spindles is about 80 percent. The capacity utilization of rotors is much lower.

Table 3.6—Installed and working capacity in spinning sector

		Installed Capacity (000)		Working Capacity (000)		Capacity Utilization (%)	
Year	Units	Spindles	Rotors	Spindles	Rotors	Spindles	Rotors
1958-59	70	1,581	0	1,488	0		
1979-80	187	3,781	16	2,701	14	0.90 /a/	0.59
1989-90	266	5,271	72	4,489	64	0.74 /b/	0.83
1990-91	277	5,568	75	4,827	67	0.87	0.89
1995-96	503	8,717	143	6,548	80	0.73	0.56
2003-04	456	9,592	146	8,009	66	0.83	0.47
2004-05	458	10,485	155	8,492	79	0.83	0.45

/a/ average capacity utilization for period 1958-79 (spindles and rotors)
/b/ average capacity utilization for period 1980-90 (spindles and rotors)
Source: Textile Commission's Organization

The increase in capacity in the spinning sector has resulted in significant growth in the production of yarn. Table 3.7 shows that yarn production increased from 376,000 tons in 1972-73 to 2.1 million tons in 2004-05. Furthermore, the produced yarn is increasingly used domestically for further processing. The share of yarn going to the export market declined from 49 percent in 1972-73 to 23 percent in 2004-05. This implies increased value addition in cotton processing is taking place.

Table 3.7—Production and market for Pakistan yarn

	Production	Market (%share)		
	(000 tons)	Domestic	Exports	Total
1972-73	376	51	49	100
1980-81	375	75	25	100
1990-91	1,055	53	47	100
1995-96	1,475	64	36	100
2003-04	1,939	73	27	100
2004-05	2,087	77	23	100

Source: Textile Commission's Organization

Over time there is an increasing trend towards blended yarn produced in Pakistan. In the 1970s, more than 95 percent of yarn produced was made of pure cotton (Table 3.8). In recent years, the share of yarn made of pure cotton declined dropped to 75 percent. Over these years, the share of blended yarn (polyester and cotton) increased to 18.8 percent. However, Pakistan remains behind other major textile manufacturers in its level and diversity of blended yarns and fabrics.

The spinning industry of Pakistan produces yarn of all counts[3] (Table 3.9). However, production is more of low counts, which are of relatively low price and value.

[3] Cotton count refers to a number that indicates the mass per unit length or the length per unit mass of yarn.

In the 1970s, 57 percent of cotton yarn produced was coarse count: 23.2 percent in the 20s, 16.4 percent in the 10s, and 9 percent in the 16s. There were some yarns produced within the medium count, mostly in the 21s. Except for the decline in the share in the 1980s, the share of cotton count 20s slightly increased in the 1990s and at present. The share of cotton count 30s also improved slightly over the period. However, the share of cotton count 21s declined as well as the share of cotton count 10s.

Table 3.8—Production of yarn (% distribution)

Period Average	Cotton	Cotton Waste	Blended		Total
			Polyester/ Viscose	Polyester/ Cotton	
1972-80	95.2	0.6	0.0	4.2	100
1980-90	88.2	2.1	3.7	6.1	100
1990-92	83.8	1.5	4.9	9.8	100
1995-97	80.7	1.6	6.8	10.9	100
2003-05	75.4	1.3	4.5	18.8	100

Source: Textile Commission's Organization

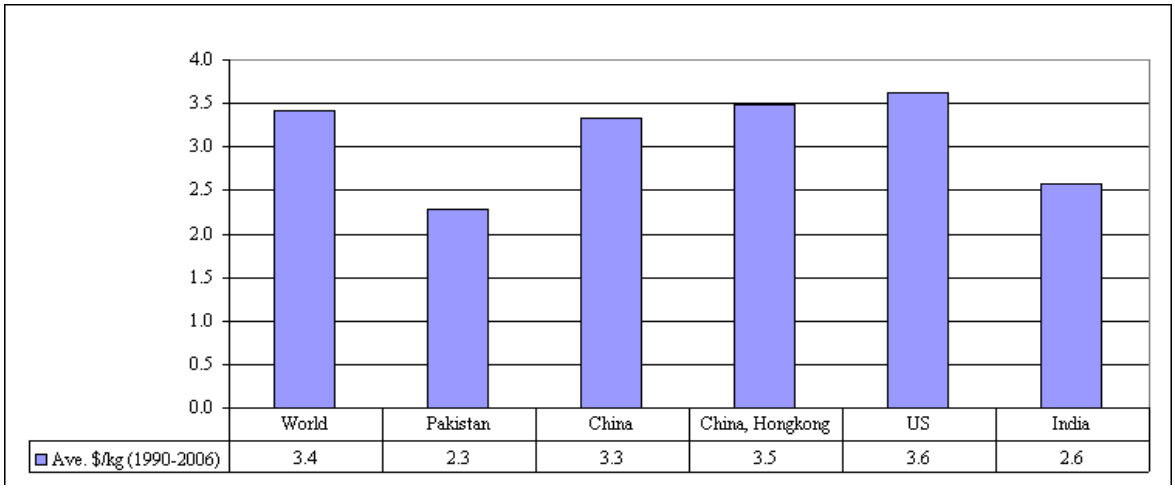
Table 3.9—Production of cotton yarn, count-wise (% distribution)

Period	Course							Medium						Fine			Supper Fine			
Average	1-9s	10s	12s	14s	16s	18s	20s	21s	24s	28s	30s	32s	34s	36s	40s	47s	48s	60s	80s	Total
1971-80		16.4	3.4	2.3	9.1	0.4	23.2	21.7	0.0	4.2	6.9	4.7	0.3	1.3	2.2	0.2	0.2	0.6	0.2	100
1981-90	3.7	11.3	4.2	4.4	7.6	3.1	8.6	22.2	5.2	5.6	7.5	5.2	4.2	1.9	1.6	1.1	0.5	1.5	0.6	100
1990-92	4.7	10.7	1.6	2.9	9.5	0.7	17.3	22.6	8.1	5.7	9.6	2.6	0.3	1.7	0.8	0.1	0.2	0.9	0.1	100
1995-97	4.6	9.3	2.3	2.4	10.6	2.1	25.7	9.6	6.3	2.6	12.5	4.2	0.8	2.5	2.2	0.2	0.4	0.6	0.9	100
2003-05	7.3	9.2	4.7	2.5	10.7	3.7	25.6	4.9	4.5	3.5	11.0	3.8	1.2	1.0	3.3	0.9	0.6	0.7	1.1	100

Source: Textile Commission's Organization

Figure 3.2 compares the average world export unit price ($/kg) among a few major yarn-producing countries including Pakistan between 1990 and 2006. The average world export unit price of yarn is $3.4/kg. The average price for Pakistan yarn ($2.3/kg) is below the world average. It is also below the average export unit price of the rest of the yarn-exporting countries included in the figure. Altaf (2007) finds a positive return on investment for production of higher quality yarn. He argues that Pakistani entrepreneurs are not moving sufficiently into higher quality production despite the profitability of yarn in higher counts. He attributes this outcome to a lack of willingness of Pakistani entrepreneurs to take risks that results from the historical origins of the industry by government fiat, its subsequent support by the government, and its reliance in the past on captive markets through the MFA, its preferential access as a supplier to East Pakistan (Bangladesh) before that region gained independence, and protection of the domestic Pakistan market from import competition.

Figure 3.2—Average export price of yarn



Source: United Nations Contracts Database

3.6 The Fabric/Cloth and Apparel Sectors

The weaving sector in Pakistan is dominated by power looms. The integrated mills which have their own spinning and dyeing facilities only produce about 10 percent of the total cloth/fabric production.

Over time, there has been significant growth in the weaving industry. Production of cloth has increased from 1,191 million square meters in 1972-73 to 6,833 million square meters in 2003-04, declining slightly to 6,481 million square meters in 2004-05 (Table 3.10). About two-thirds of production goes to the domestic market. Preliminary estimates for 2004-05 indicate a higher export share of 42.5 percent.

Table 3.10—Production and market of Pakistan cloth

	Production	Market (% share)		
	mil sq. meters	Domestic	Export	Total
1972-73	1,191	69.6 /a/	30.4	100
1980-81	1,834	66.8 /b/	33.2	100
1990-91	2,854	63.0	37.0	100
1995-96	3,706	64.3	35.7	100
2003-04	6,833	64.7	35.3	100
2004-05	6,481	57.5	42.5	100

/a/ average 1972-80; /b/ average 1980-90
Source: Textile Commission's Organization

Pakistan has only a small share in the fast growing world market for clothing (Table 3.11). One reason behind this is that production remains concentrated in grey form (Table 3.12). Although the shares of blended and dyed and printed cloth have increased, over 50 percent of total cloth/fabric production is still in the grey type. This is unprocessed cloth that has to be subjected to additional processing to become utilizable in

the product cycle. Altaf (2007) argues that the weaving industry remains in the production of unprocessed fabrics to again to avoid risks, in this case the marketing risks in more specialized markets, and because of lack of management and marketing expertise. He concludes that the textile sector's "focus on unprocessed products reflects the gap in their marketing abilities to go into more specialized products. The marketing wing of the weaving mills is very rudimentary. Any change in the amount of greige cloth would mean that the marketing of the product would have to become a specialized aspect of the organization."

Table 3.11—World export of clothing

	1996	1997	1998	1999	2000	2001	2002	2003	2004
World (billion $)		181.3	180.8	180.3	193.9	196.7	190.8	217.4	233.8
	% of World								
China	15.4	17.5	16.6	16.7	18.6	18.6	21.6	24.0	26.5
India	2.6	2.4	2.6	2.9	3.2	2.8	3.2	3.0	2.8
Bangladesh	1.4	1.5	2.1	n.a.	2.1	2.2	2.1	2.1	1.9
Pakistan	1.2	1.0	1.0	1.0	1.1	1.1	1.2	1.3	1.3

n.a.: not available
Source: International Trade Statistics

Table 3.12—Production of types of cloth (% distribution)

Period Average	Blended	Grey	Bleached	Dyed & Printed	Total
1972-80	1.5	66.3	15.8	16.5	100
1980-90	14.7	55.1	11.2	18.9	100
1990-92	20.6	53.3	5.8	20.4	100
1995-97	17.9	58.4	3.8	19.8	100
2003-05	10.2	51.3	7.7	30.9	100

Source: Textile Commission's Organization

3.7 Textile Made-ups

One of the textile products that has shown rapid growth for Pakistan in the export market is bed wear. At present, this global market is about $7 billion (Table 3.13). In 1995, 24 percent of the world market was captured by China. The market share of Pakistan than was almost 14 percent. Pakistan has improved its share and starting in 2001 surpassed the share of China in the world market. At present, Pakistan's share is 28.2 percent, while China's share is 27.1 percent.

The world market for other textile made-ups is also rapidly growing from $17 billion in 2001 to $30 billion in 2005 (Table 3.14). This market is dominated by China (34 percent share in 2005), with the market share of Pakistan at 10 percent having slightly grown over time. One of the important items in other textile made-ups is towels and cleaning cloths, which is about a $4 billion world market. While this is also dominated by China, the market share of Pakistan is growing (Table 3.15).

Table 3.13—Major exporters of bed wear

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
World (million $)	2,754	2,821	3,028	3,153	3,260	3,600	3,752	4,062	4,971	5,401	6,821
						% of World					
China	23.9	21.2	23.4	19.1	21.3	21.8	21.8	20.3	19.9	21.0	27.1
Pakistan	13.7	16.6	16.1	18.0	20.9	20.7	22.2	25.7	27.8	23.8	28.2
Portugal	11.7	11.5	11.7	12.2	11.7	10.3	9.6	8.5	7.3	7.1	5.0
Turkey	4.2	4.6	5.7	6.7	6.6	6.5	6.7	7.1	8.2	9.2	8.1
USA	3.7	3.8	4.0	4.6	3.4	2.8	1.5	2.0	1.7	1.7	1.5
France	3.9	3.7	3.6	3.9	3.9	3.4	2.8	2.6	2.8	2.8	2.2
ɛxico	3.1	4.1	4.0	4.2	2.4	1.9	1.4	1.5	1.1	1.2	1.1

Source: International Trade Statistics

Table 3.14—Exports of textile other made-ups

	2001	2002	2003	2004	2005
World (billion $)	17.4	19.1	23.5	26.4	30.2
	(% of World)				
China	21.2	22.9	26.2	29.3	33.9
Pakistan	8.6	9.2	10.0	8.9	10.1
India	6.3	6.6	6.8	6.8	7.9
Turkey	6.0	6.5	6.9	7.0	6.5
Portugal	4.5	4.1	3.5	3.2	2.5

Source: International Trade Statistics

Table 3.15—Major exporters of towels and cleaning cloths

	2002	2003	2004	2005	2006
World (million $)	3,469	3,752	5,025	4,196	3,838
	(% of World)				
China	23.0	23.1	37.8	23.6	23.8
Pakistan	7.1	8.6	6.1	8.2	9.8
Portugal	9.1	8.0	5.7	6.8	6.9
Turkey	4.3	4.6	5.0	6.5	6.5
Belgium	6.2	5.8	4.7	6.5	6.5
Germany	8.2	7.4	5.2	6.5	5.5
Brazil	4.6	4.5	3.6	3.7	4.1

Source: International Trade Statistics

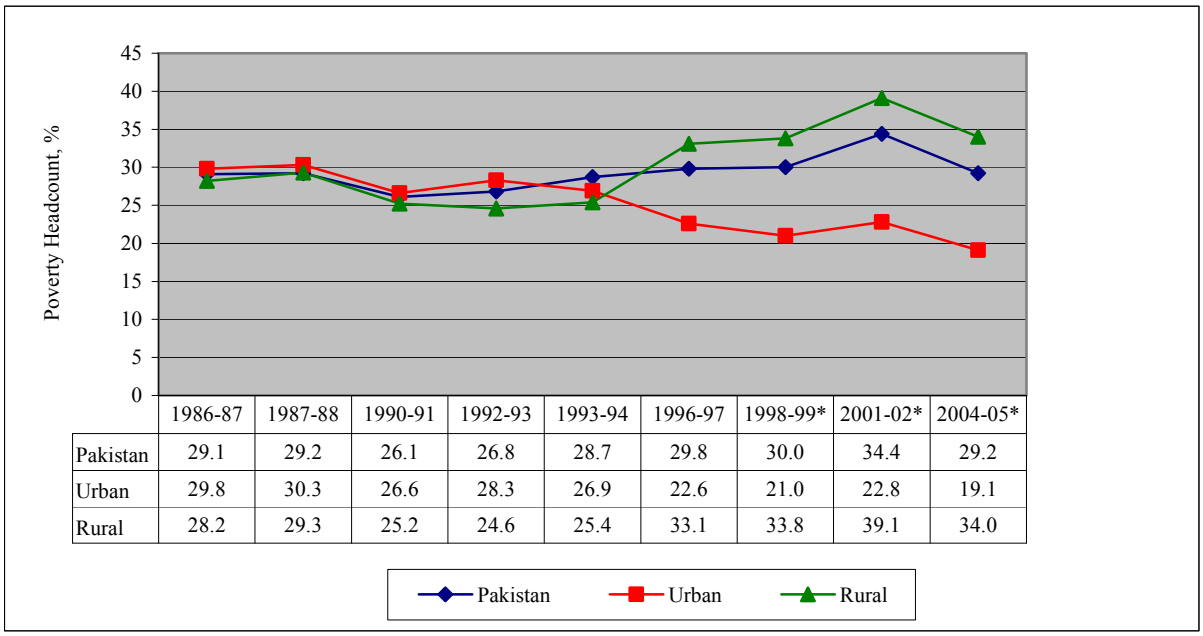
In sum, the cotton-textile industry in Pakistan faces several major challenges. The raw cotton sector is highly susceptible to pest infestation and changes in weather conditions. Cotton lint that is coming out of the ginning sector is of low quality because of outdated technology used in the sector and problems of contamination. There is an urgent need to update the ginning technology and to implement cotton standardization. The yarn that is coming out of the spinning sector is of low count. The price in the international market of low count yarn is low. There are institutional problems in this sector because yarn producers have receiving substantial support from the government and operated in protected markets. This support created disincentive to move up to higher

counts that have higher value in the market. The weaving sector is still producing primarily unprocessed, grey fabric that also commands relatively low price in the international market. The focus on low count yarn and unprocessed fabric products reflect risk aversion and the gap in the marketing abilities of firms to go into more specialized products. However, there has been good performance in textile made-ups such as bed wear, towels and cleaning cloth. There are also good prospects in hosiery.

4. POVERTY IN PAKISTAN

With its relative importance in the economy, the cotton-to-apparel sectors will have an important effect on poverty levels in Pakistan. Figure 4.1 shows the recent pattern of poverty incidence. The overall poverty rate declined from 29.1 percent in 1986-87 to 26.1 percent in 1990-91. During these years both urban and rural poverty declined. However, rural and urban poverty incidence started to move in different direction in 1993-94. Urban poverty incidence continued to decline, while rural poverty began to rise, thereby widening the gap between urban and rural poverty. The gap reached its peak in 2001-02, which was largely due to the crippling drought in 2000-01 that severely affected agricultural output, together with relatively low international agricultural commodity prices. In this particular year, overall agricultural output shrank. Since almost 70 percent of the people live in rural area and the majority of them (40 percent of all households nationally) depend on agriculture for income, rural poverty incidence increased to 39.1 percent in 2001-02. However, urban poverty was generally stable at 22.8 percent.

Figure 4.1—Poverty trends in Pakistan



	1986-87	1987-88	1990-91	1992-93	1993-94	1996-97	1998-99*	2001-02*	2004-05*
Pakistan	29.1	29.2	26.1	26.8	28.7	29.8	30.0	34.4	29.2
Urban	29.8	30.3	26.6	28.3	26.9	22.6	21.0	22.8	19.1
Rural	28.2	29.3	25.2	24.6	25.4	33.1	33.8	39.1	34.0

Source: Pakistan Economic Survey 2002-03; World Bank 2007
*From World Bank 2007 "Pakistan Promoting Rural Growth and Poverty Reduction" 2004-05 are estimates of the World Bank

There is some disagreement about more recent estimates of poverty incidence. For 2004-05, the estimates of the Planning Commission of Pakistan show overall poverty incidence declining from the peak of 34.4 percent in 2001-02 to 23.9 percent in 2004-05. The World Bank (2007) estimates a smaller decline to 29.2 percent in 2004-05. The disparity between these estimates is due primarily to the inflation factor used in computing the relevant poverty lines. However, both rural and poverty incidence decline in the most recent years in both estimates.

Cotton is often called the “silver fiber” for Pakistan. Among farmers, about one-quarter produce cotton and almost all of these farmers also produce wheat. Nearly 70 percent of the cotton farmers are land owners, while 30 percent are sharecroppers or have

other tenancy arrangements. Cotton production is concentrated in a number of primary cotton producing districts of Punjab and Sindh.

Orden et al. (2006) provide a detailed analysis of income and poverty among cotton farmers based on the 2000-01 HIES data. Consistent with the higher rural poverty rates, they find household incomes are lower for rural than urban households, about equal among farmers and non-farmers, and that among farmers those producing cotton have incomes slightly below the average. Sharecroppers are a particularly disadvantaged group, with over 65 percent of those producing cotton falling in the lowest two quintiles (40 percent) of the national income distribution. Income from cotton is quite important to the cotton-producing households, accounting for nearly 40 percent of total household income among landowners and nearly 45 percent among sharecroppers (Tables 4.1 and 4.2).

Effects on poverty among cotton-producing households of cotton prices rising by 10 percent to 40 percent from their low levels at the time of the 2001-02 HIES are evaluated by simulating the increase in net income this would generate for each household. Assuming that the additional income would be used for consumption expenditures, these direct effects are assessed using the recognized national poverty line and the Foster-Greer-Thorbecke (FGT) measures of poverty. The analysis focuses on the effects of a 20 percent increase in prices, which reflects the extent to which real cotton prices declined in Pakistan during the late 1990s.

Table 4.1—Sources of income of landowner cotton-Producing households

		Punjab		Sindh	
Sources	**National**	**All**	**Cotton-Producing Districts /1/**	**All**	**Cotton-Producing Districts /2/**
Crops	78.9	73.5	75.0	93.7	93.1
Livestock	3.0	6.2	5.4	-5.5	-5.2
Rental	1.4	1.8	1.9	0.3	0.3
Non-farm Business	5.1	6.5	5.1	1.6	1.8
Wages	10.0	9.8	10.0	9.9	10.3
Transfers	1.7	2.2	2.6	0	-0.3
Total	100.0	100	100	100	100
Among Crops					
Cotton	48.9	44.4	45.8	56.9	57.3
Wheat	29.5	32.6	32.6	23.9	24
Sugarcane	8.8	6.1	5	14.3	14.1
Rice	1	1.3	1	0.5	0.4
Maize	0.1	0.2	0.2	0	0
Pulses	0.3	0.5	0.4	0	0
Fruits/Vegetables	2.1	2.4	2.3	1.5	1.5
Fodder	5.4	7.4	7	1.5	1.3
Other	3.9	5.2	5.2	1.3	1.3
Total	100	100	100	100	100

/1/ Rahim Yar Khan, Bahawalpur, Vehari, Bahawalnagar, Lodhran, Khanewal, Muzaffargrarh, Multan Rajanpur, D.G. Khan, Pakpattan,Sahiwal, Okara, Jhang, T.T. Singh, Faisalabad, Layyah, Kasur

/2/ Sanghar, Ghotki, Khairpur, Nawabshah, Hyderabad, N. Feroze, Mirpur Khas, Ummarkot,Tharparkar, Sukkur

Source: Orden, et al (2006). Original source of data - 2001-02 Household Integrated Economic Survey

Table 4.2—Sources of income of sharecropper cotton-Producing households

		Punjab		Sindh	
Sources	**National**	**All**	**Cotton-Producing Districts**	**All**	**Cotton-Producing Districts**
Crops	77.5	59.1	58.2	90.0	90.4
Livestock	-3.4	5.0	5.5	-9.2	-9.4
Rental	1.1	2.5	2.5	0.1	0.1
Non-farm Business	7.5	15.4	15.6	2.1	2.2
Wages	15.6	13.5	13.7	17.0	16.7
Transfers	1.7	4.4	4.5	0.0	0.0
Total	100	100	100	100	100
Among Crops					
Cotton	57.5	46.9	47.9	62.2	62.7
Wheat	26.6	38.4	38.0	21.4	21.4
Sugarcane	7.6	1.4	1.4	10.4	10.7
Rice	1.0	1.3	1.2	0.8	0.2
Maize	0.0	0.1	0.1	0.0	0.0
Pulses	0.1	0.2	0.2	0.0	0.0
Fruits/Vegetables	0.1	0.4	0.4	0.0	0.0
Fodder	3.9	6.5	5.7	2.8	2.8
Other	3.1	4.9	4.9	2.3	2.3
Total	100	100	100	100	100

Source: Orden, et al (2006). Original source of data - 2001-02 Household Integrated Economic Survey

At the national level, initially 40 percent of cotton-producing households are determined to be in poverty. With a 20 percent increase in prices, this percentage declines to 28 percent and the depth (poverty gap) and intensity (poverty gap squared) also decline. In Punjab, the decrease due to a 20 percent rise in cotton prices is from 36 percent to 27 percent, while in Sindh from 50 percent to 32 percent. Among sharecropper cotton-producing households, poverty declines from 57 percent to 42 percent nationally. Orden et al. thus conclude that low cotton prices are an explanation that needs to be taken into account in designing anti-poverty strategies and are important on a regional basis, but are only one among several explanations for the overall observed increase in rural

poverty. More households produce wheat than cotton in Pakistan, but net incomes of these households are less dependent on wheat production and wheat prices affect net household income only for that portion of the crop that is sold commercially. In addition, global wheat prices did not decline as much as global cotton prices in the late 1990s. For these reasons, Orden et al. find that the effects of cotton prices on those households producing cotton are sharper than the effects of changes in wheat prices on households producing wheat during this period.

5. THE CGE MODEL

5.1 Model Specification

The CGE model constructed is static[4]. It is calibrated to a 2001-02 Social Accounting Matrix (SAM) constructed by Dorosh, Niazi and Nazli (2004). The model has 34 production sectors: 12 agricultural, 17 manufacturing and 5 in services. There are five input categories: 3 labor types (skilled labor, unskilled workers, and farm labor), capital, and land. There are 19 household categories[5], a government sector, firm sector, and rest of the world. These specifications are discussed below in further detail.

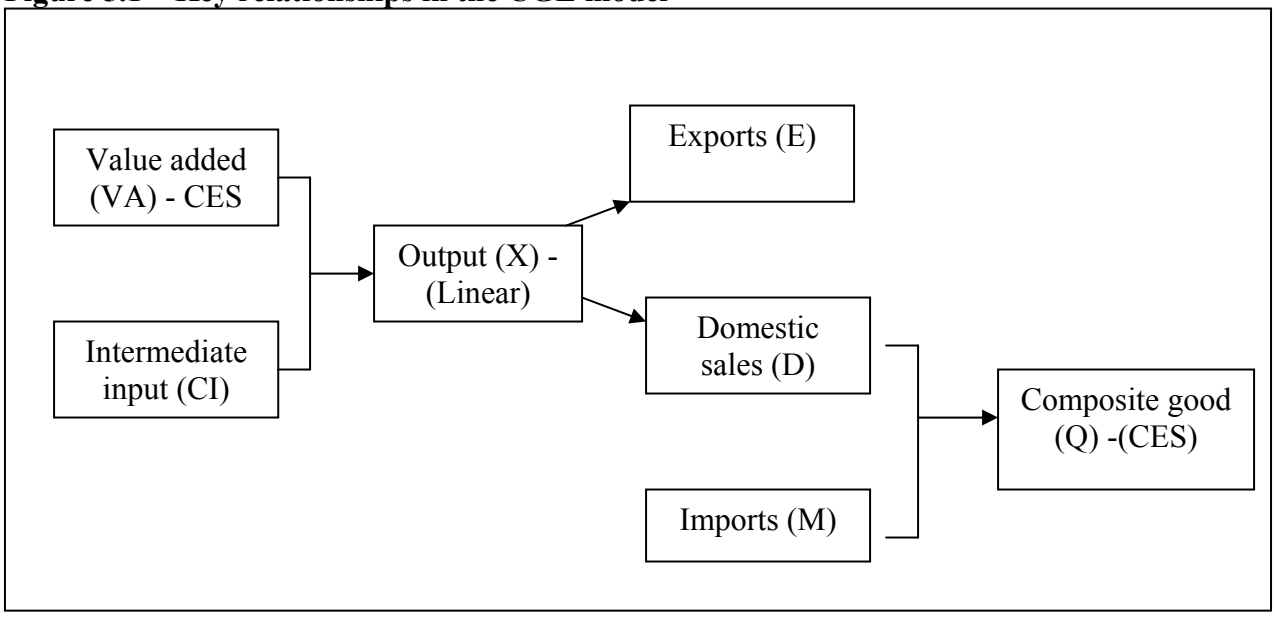
The basic relationships in the model are presented in Figure 5.1. Output (X) is a composite of value added (VA) and intermediate input. Output is sold either to the domestic market (D) or to the export market (E) or both. The model allows for some

[4] The specification of the model is generally based on a set of models called "EXTER" (Decaluwe, Dumot, Robichaud, 2000, http://www.pep-net.org/). There are other CGE specifications such as the IFPRI Standard CGE Models (Lofgren, et al. 2002)

[5] See succeeding tables for detailed listing of production sectors, factor types, and household groups.

degree of substitution between E and D through a constant elasticity of transformation (CET) function. The substitution depends upon changes in relative prices of E and D and on the substitution parameter. Supply in domestic market comes from two sources: domestic output and imports (M). The model also allows for some degree of substitution between D and M through a CES function. Similarly, the substitution depends upon changes in relative prices of D and M and on the substitution parameter. In Figure 5.2 value added is determined by skilled labor, unskilled labor, capital and land. Unskilled labor in turn is a CES function of workers and farm labor.

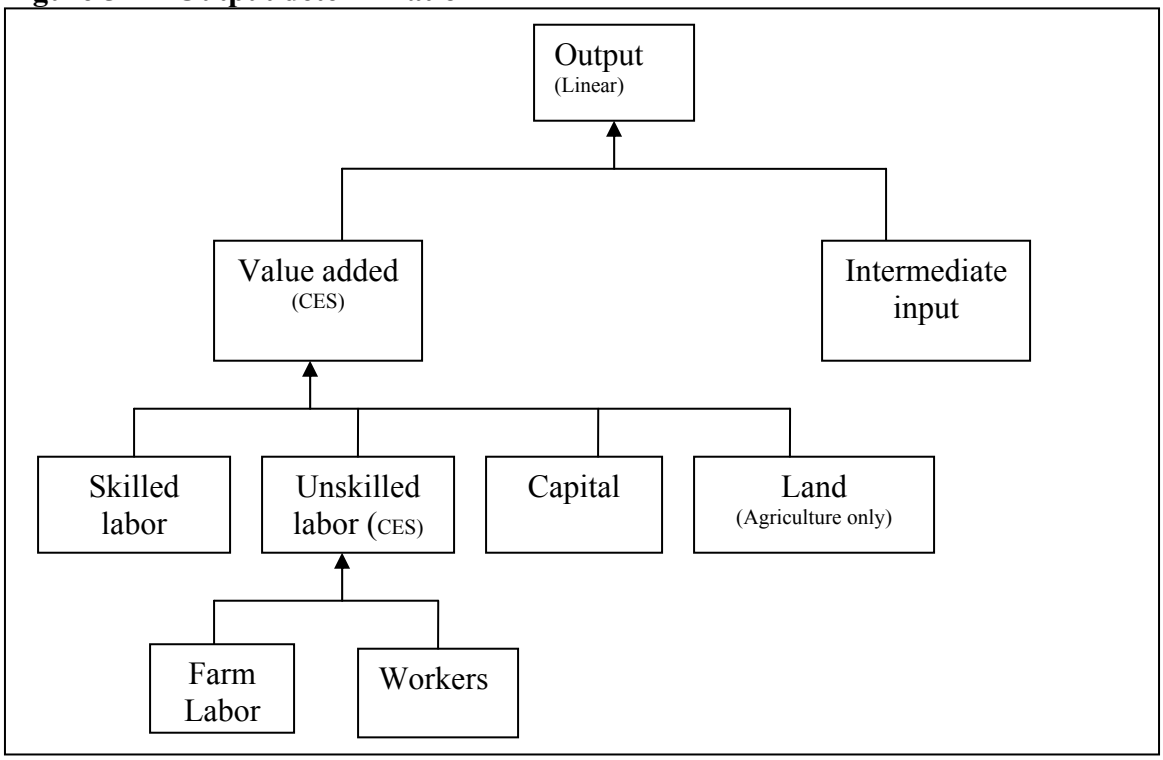
Figure 5.1—Key relationships in the CGE model



The equations of the model are given in Appendix 1. We will discuss some of the key equations. In equation 1, sectoral output has a fixed coefficient with intermediate input (CI) and value added (VA). In equation 2, value added in agriculture is a CES

function of unskilled labor (USL), capital (K), and land (LW). Value added in non-agriculture in equation 3 is a CES function of skilled labor (SL), unskilled labor, and capital. In agriculture, both capital and land are fixed while in non-agriculture capital is fixed. Thus, in both production functions, only the labor input is mobile across sectors. There is no skilled labor employed in agriculture, but there is both skilled and unskilled labor in non-agriculture. Thus, skilled labor is mobile across non-agricultural sectors only, while unskilled labor is mobile across all sectors, agriculture and non-agriculture. The demand for skilled labor is in equation 4, while for unskilled labor in equation 5. Unskilled labor in equation 6 is a CES function of farm labor and workers. Since land is fixed in agriculture, equation 8 will determine the returns to land in each of the sectors.

Figure 5 2—Output determination



The consumption function in equation 12 is specified as a linear expenditure system (LES). Equation 14 distributes total investment to the various sectors using investment shares in the SAM[6]. The price of investment which is specified in equation 45 converts total nominal investment (TINV) to total real investment (TINVR). Equation 17 is sectoral investment demand[7]. This follows the specification of Bourguignon et al. (1989) and Jung and Thorbecke (2003). This specification states that capital accumulation rate (the ratio of investment demand, IND, to capital stock, K) is an increasing function of the ratio of the rate of return to capital, r, and its user cost, u. The variable r is determined in equation 47 for agriculture and in 48 for non-agriculture. The user cost of capital is determined in equation 50. Sectoral output in equation 34 is a CET function of exports (E) and domestic demand (D). The supply of exports is determined in equation 35. It is a function of the relative price of exports (Pe) and local price (Pl)[8]. The model defines a sectoral composite good, Q, using a CES function of imports D and M in equation 36. The demand for imports is given in 37. It is a function of the relative price involving the domestic price (Pd)[9] and the import price (Pm). The current account balance in 38 is the residual between the outflow and inflow of foreign exchange. The outflow includes import payments, dividend payments to foreigners, and foreign debt-service payments, while the inflow includes export receipts, household foreign remittances, and foreign grant to the government.

[6] This is usually called investment by origin.
[7] This is also called investment by destination.
[8] Pl does not include indirect tax.
[9] Pd includes indirect tax.

Import price in domestic currency (Pm) is given in Equation 39. It is determined by the world price of imports, exchange rate, tariff rate, and indirect tax. Export price is given in 40. It is a function of the world price of exports and the exchange rate. Exports are perfect substitutes with world outputs.

The price of the composite good for each sector is denoted by Pq, which is given equation 41. The price of output in equation 42 is the weighted price of local price and export price. Note that the difference between the domestic price in equation 43 and the local price is the indirect tax, itxr. Equation 44 specifies the value added price. We define a general price variable called Pindex, which is the weighted average sectoral value added price in equation 46. The price of investment is in equation 45. Equations 47 and 48 determine the rate of return to capital as noted above. These equations also assure that zero profit condition is fulfilled.

Equilibrium in the product market is determined in equation 51. Equilibrium in the market for skilled labor is determined in equation 53, for farm labor in equation 54, and for workers in equation 55. The supply of each of these labor types is fixed. Equation 52 states that total savings, which is composed of household savings, firm savings, government savings, and foreign savings, is invested, which characterizes the model closure.

The numeriare is Pindex. The nominal exchange rate is flexible. Since we assume foreign savings in foreign currency, indicated by CAB in equation 38, is fixed, all international transactions are cleared by the nominal exchange rate variable.[10] Since the nominal exchange rate is flexible varies with changes in the exchange rate.

[10] Note that since Pindex is fixed, changes in er can be considered changes in the real exchange rate.

Government savings, SAVG, in equation 33 and government total income, YG, in equation 30 are both endogenous. However, government consumption in real terms, GT, in equation 18 is fixed. Household savings, SAVH, in equation 31, as well as household income, YH, in equation 4 are both endogenous.

Income of firms in equation 26 is a portion of total income from capital, YK. This is endogenous. However, we assume savings of firms, SAVF, in equation 32 is fixed. We assume dividend payments to domestic households, DIV_H, as endogenous. This implies that changes in income of firms will translate to changes in dividend payments to domestic households but not to changes in retained earnings of firms. This is important for our purposes because the model is static and the concern is on poverty and distributional effects.

5.2 Economic Structure and Key Parameters in the Model

Table 5.1 shows the sectoral structure of production and trade in the model based on the 2001-02 SAM. There are 12 sub-sectors in agriculture, 17 in industry, and 5 in the service sector. The CGE model specifies behavioral equation for each of these sectors. Given the production structure of the SAM, however, the cotton-textile industry is captured in the model by three sectors: raw cotton (sector 5) which is under agriculture, cotton lint and yarn (sector 20) and textile (sector 21) both of which are under industry[11].

[11]A richer model specification to capture the interactions among the cotton-related sectors should have separate behavior for cotton lint and cotton yarn. Also, the textile sector should distinguish between cotton fabrics and synthetic fabrics because of the rising share of man-made fibers. Furthermore, there should be a separate sector for garments and clothing.

Table 5.1—Elasticity parameters and production structure

	Production										Trade					
	Value-added Ratio	Value Added	Output	Capital-Labor	Employ-ment	Share of skilled	Share farmers	Share Workers	Land-output		Elasticities			Exports (%)		Imports (%)	
Sectors	va ÷ x, %	Share, %	Share, %	Ratio /1/	Share,%	labor, %	%	%	ratio, %	sig_va /2/	sig_m /3/	sig_e /4/	Share	Intensity /5/	Share	Intensity /6/
1. Wheat irrigated	50.8	1.8	1.8	0.3	1.6		81.1	18.9	27.8	0.75	0.75	1.25	0.6	3.6	0.3	2.5
2. Wheat non-irrigated	50.9	0.1	0.1	0.3	0.1		81.1	18.9	27.2	0.75						
3. Paddy, IRRI	60.2	0.2	0.2	0.5	0.1		81.2	18.8	45.4	0.75						
4. Paddy, basmati	60.2	0.5	0.4	0.5	0.1		81.1	18.9	51.3	0.75						
5. Raw cotton	61.2	1.4	1.1	0.3	1.1		81.1	18.9	36.0	0.75						
6. Sugarcane	60.0	1.0	0.8	0.7	0.3		81.1	18.9	46.7	0.75						
7. Other major crops	71.0	2.8	2.0	0.3	2.4		81.1	18.9	38.9	0.75	0.75	1.25	0.5	2.7	0.6	4.5
8. Fruits & vegetables	64.2	3.6	2.8	0.6	1.8		81.1	18.9	44.4	0.75	0.75	1.25	1.1	3.8	1.3	6.9
9. Livestock, cattle & dairy	53.2	10.3	9.7	9.0	2.6			100.0		0.75	0.75	1.25	0.1	0.1	0.7	1.1
10. Poultry	51.6	0.7	0.7	9.0	0.2			100.0		0.75	0.75	1.25	0.0	0.1	0.0	0.0
11. Forestry	82.1	0.3	0.2	0.0	0.1		81.1	18.9	65.7	0.75	0.75	1.25	0.5	31.4	0.2	25.2
12. Fishing industry	57.1	0.6	0.5	2.3	0.4			100.0		0.75	0.50	1.25	1.1	23.8	0.0	0.1
Agriculture	**57.4**	**23.2**	**20.1**		**10.7**								**3.9**	**1.9**	**3.1**	**2.4**
13. Mining	74.6	0.6	0.4	2.3	0.5	85.0		15.0		0.75	0.50	2.00	0.8	18.6	9.3	80.5
14. Vegetable oil	7.9	0.2	1.4	6.7	0.1	60.3		39.7		1.50	1.50	2.00	0.0	0.0	2.3	20.0
15. Wheat milling	21.8	1.2	2.8	4.4	0.6	64.9		35.1		1.50	1.50	2.00	0.5	1.8	0.8	4.3
16. Rice milling, IRRI	30.7	0.2	0.4	3.7	0.1	56.8		43.2		1.50		2.00	1.7	46.6	0.0	0.0
17. Rice milling, basmati	29.0	0.5	0.8	3.7	0.3	56.8		43.2		1.50		2.00	2.3	28.6	0.0	0.0
18. Sugar	32.2	1.4	2.2	3.3	0.8	70.0		30.0		1.50	1.50	2.00	0.0	0.1	0.3	1.9
19. Other food	36.9	1.7	2.3	4.7	0.8	61.6		38.4		1.50	1.50	2.00	12.1	51.5	1.1	12.4
20. Lint & yarn	21.6	1.4	3.3	3.3	0.8	85.5		14.5		1.50	1.50	2.00	9.0	27.1	0.7	4.3
21. Textiles	22.2	3.6	8.0	2.7	2.4	78.9		21.1		1.50	1.50	2.00	31.9	39.7	1.6	4.8
22. Leather	8.3	0.1	0.5	2.9	0.1	60.4		39.6		1.50	1.50	2.00	2.3	42.8	0.1	5.2
23. Wood products	36.3	0.7	0.9	1.8	0.6	68.0		32.0		0.50	1.50	2.00	0.0	0.3	0.6	8.6
24. Chemicals	28.2	0.5	0.9	3.8	0.3	55.2		44.8		0.50	0.50	2.00	1.4	15.9	11.2	69.9
25. Cement & bricks	55.0	1.4	1.3	7.4	0.4	69.0		31.0		0.50		2.00	0.0	0.2		
26. Petroleum refining	19.4	0.6	1.5	2.9	0.4	71.9		28.1		0.50	0.50				9.7	50.1

Table 5.1—Continued

27. Other manufacturing	25.4	2.6	5.0	2.6	1.7	68.0	32.0	0.50	0.50	2.00	16.6	33.2	54.0	71.0
28. Energy	60.8	3.4	2.8	4.0	1.7	80.0	20.0	0.50						
29. Construction	41.6	3.2	3.8	0.4	5.5	50.0	50.0	1.50						
Industry	**30.3**	**23.3**	**38.4**		**16.9**						**78.6**	**20.5**	**91.6**	**31.4**
30. Commerce	84.0	15.3	9.1	0.4	26.5	20.0	80.0	0.50	2.00	0.50	0.1	0.1	0.2	0.4
31. Transport	53.9	11.8	10.9	1.5	11.7	20.0	80.0	1.25		0.50	17.4	15.9		
32. Housing	81.8	4.9	3.0					1.25						
33. Private services	53.5	12.9	12.0	1.5	12.8	20.0	80.0	1.25			0.0	0.0	5.0	6.0
34. Public services	66.2	8.6	6.5		21.4	100.0		1.25	1.25	0.50				
Services	**64.3**	**53.5**	**41.5**		72.4						**17.5**	**4.2**	**5.2**	**2.0**
Total	**49.8**	**100.0**	**100.0**		**100.0**						**100.0**	**10.0**	**100.0**	**14.5**

va: value added; x: output
/2/ sig_va: substitution parameter in CES value added function
/4/ sig_e: substitution parameter CET
/6/ imports ÷ composite good
/1/ total labor ÷ total capital
/3/ sig_m: substitution parameter in CES composite good function
/5/ export ÷ output;
Source: 2001-02 Social Accounting Matrix of Pakistan

In terms of overall sectoral value added, total agriculture and industry each have 23 percent share, while the service sector has 53.5 percent. Within agriculture, the sector comprised of livestock, cattle and dairy has a 10.3 percent share. Wheat production (irrigated and non-irrigated) has 1.9 percent, while raw cotton 1.4 percent. In industry, wheat milling has 1.2 percent share, while the combined share of textile and cotton lint and yarn is 5 percent. Cotton-related sectors therefore have a combined share of 6.4 percent in the overall value added.

In terms of output, the structural pattern is generally similar. Agriculture contributes 20.1 percent while industry 38.4 percent. Within agriculture, the combined share of wheat is 1.9 percent, raw cotton 1.1 percent, livestock, cattle and dairy 9.7 percent. Within industry, wheat milling has a 4.4 percent share, rice milling (IRRI and basmati) 1.2 percent, cotton lint and yarn 3.3 percent, and textiles 8.0 percent. The cotton-yarn-apparel related sectors therefore have a combined share of 12.4 percent in the overall output.

Agriculture has a higher value added ratio of 57.4 percent than industry with 30 percent. Among major sectors, service has the highest ratio of 64.3. Within agriculture, forestry and 'other major crops' have higher ratios than the rest. Within industry, the ratios are much lower, except mining, energy and cement bricks. Industry has generally higher capital-labor ratios than agriculture, except livestock, cattle and dairy, and poultry. Sectoral employment is also indicated. About 11 percent of labor is employed in agriculture, and 17 percent in industry. Within industry, the major employer is construction (5.5 percent), followed by the textile industry (2.4 percent). Labor is mostly

employed in the service sector, with an employment share of 72 percent. Furthermore, there is no skilled labor employed in agriculture in the SAM. Farm labor accounts for 81 percent of labor in agriculture, except in livestock, poultry and fishing where only unskilled workers are also employed. The land-output ratio in agriculture varies. The highest land intensity is in forestry, followed by Paddy basmati.

Overall the foreign trade sector is not very large relative to the domestic sector. Of the total domestic output, only 10 percent goes to the export market. Of the total goods and services available in the market, only 14.5 percent is imported. However, there are large differences across sectors. For example, within agriculture, the export intensity ratio[12] of forestry is 31.4 percent and of fishing 23.8 percent. The export intensity ranges from 2.7 percent to 3.8 percent among 'other major crops', wheat irrigated, and fruits and vegetables, while it is very small for the rest of the sectors. The overall ratio for agriculture is only 1.9 percent. Within industry, 'other food' has the highest ratio of 51.5 percent, rice milling IRRI 46.6 percent, leather 42.8 percent, textile 39.7 percent, and cotton lint and yarn 27.1 percent. The textile sector dominates exports. In the SAM, textile exports have a 31.9 percent share of the total—dominant but less than indicated in the WTO data. Cotton lint and yarn has a 9 percent export share, while other food is 12.1.

Industry has the highest import intensity ratio[13] of 31.4 percent. Within industry, the highest is mining at 80.5 percent because of imports of crude oil. Other manufacturing has 71 percent and chemicals 69.9 percent. The import intensity ratio of

[12] Export intensity ratio is defined as the sector's export divided by its output.
[13] Import intensity ratio is defined as the sector's imports divided by its total domestic supply.

petroleum is also high at 50.1 percent. In terms of import shares, other manufacturing captures 54 percent of the overall imports, chemicals 11.2 percent, and mining and petroleum refining each about 9 percent.

Table 5.1 also includes values of key elasticity parameters in the model: production substitution elasticity (sig_va), import substitution elasticity (sig_m), and export transformation elasticity (sig_e)[14]. However, for raw cotton, cotton lint and yarn, and textile we alter some of these parameters based on calibrating the model to historical price movements. This is discussed in detail in Appendix 2.

How are the cotton-related sectors interrelated and linked with the rest of the economy? Table 5.2 shows the sectoral linkages. The structure of inputs indicates that 61.2 percent of the input requirements of raw cotton are primary inputs (labor, capital, land and water). Other inputs are from industries other than cotton lint and yarn and textile. In the case of cotton lint and yarn, 21.6 percent of its input requirements are primary inputs. Thus, its value added component is significantly lower than raw cotton. Furthermore, cotton lint and yarn buys 30 percent of its input requirements from the raw cotton sector, 23.2 percent from within the sector itself, and 21.6 percent from other sectors which are non-cotton related. The textile industry does not buy directly from raw cotton. Instead, it buys 22.7 percent from cotton lint and yarn, 23.8 percent from within the sector itself, and 31.4 percent from the rest of the industries. From these ratios, the

[14] Some of the parameter values were used in Robinson, et al. (1997). Annabi, Cockburn, and Decalawe (2006) provides a survey of parameter values often used in CGE models. The elasticities in Keeny and Hertel (2004), which are estimated econometrically, are a bit higher. Modifications adopted for raw cotton (sig_va) and cotton lint and yarn and textiles ((sig_va, sig_e, and eta) are described in Appendix 2.

indirect link between the textile sector and raw cotton through cotton lint and yarn is only 8 percent (i.e., 30 x 22.7). Its primary input requirement is 22.2 percent. Similar to cotton lint and yarn, its value added component is relatively smaller than raw cotton.

Table 5.2—Linkages of cotton-related sectors with rest of the economy

Structure of Input	Raw Cotton	Cotton Lint and Yarn	Textile
Intermediate input			
Raw cotton		30.0	0.0
Lint & yarn	1.6	23.2	22.7
Textile		0.5	23.8
Others	37.1	24.6	31.4
Primary input (value added)	61.2	21.6	22.2
Skilled labor		4.3	4.8
Unskilled labor	17.5	0.7	1.3
Farm labor	14.2		
Workers	3.3	0.7	1.3
Capital	5.4	16.6	16.1
Land	27.8		
Total	100.0	100.0	100.0
Household consumption/Sector's total domestic demand, %		0.4	54.8
Imports/Total Supply, %		4.3	4.8
Exports/Total Output, %		27.1	39.7

Source: 2001-02 Social Accounting Matrix

Table 5.3—Consumption share (%)

Commodities	h1	h2	H3	h4	h5	h6	h7	h8	h9	h10	h11	h12	h13	h14	h15	h16	h17	h18	h19
Wheat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paddy, IRRI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paddy, basmati	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Raw cotton	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sugarcane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other major crops	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.3	0.2	0.2	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	6.2	7.0	6.0	6.5	7.1	6.0	6.7	6.2	6.9
Livestock, cattle, & dairy	19.9	22.8	14.4	19.9	22.8	14.4	19.5	26.1	21.6	19.3	22.3	17.5	20.7	24.9	15.9	19.9	17.9	18.3	18.0
Poultry	1.1	1.2	1.7	1.1	1.2	1.7	1.1	1.0	1.4	1.0	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	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Fishing industry	1.9	0.0	0.5	1.9	0.0	0.5	2.5	0.0	0.1	2.7	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	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	3.6	3.4	3.2	3.4	3.8	3.2	3.9	2.7	3.8
Wheat milling	6.9	4.4	7.5	6.9	4.4	7.5	6.6	6.4	7.4	8.2	7.7	8.3	10.9	9.1	11.7	6.0	10.3	4.0	9.1
Rice milling IRRI	0.7	0.2	0.2	0.7	0.2	0.2	1.2	0.2	0.2	1.1	0.2	0.2	0.6	0.3	0.1	0.3	0.5	0.2	0.4
Rice milling Basmati	2.5	0.6	0.7	2.5	0.6	0.7	4.2	0.8	0.8	4.0	0.8	0.7	2.3	1.0	0.5	1.1	1.7	0.9	1.5
Sugar	5.0	3.6	5.3	5.0	3.6	5.3	4.9	4.8	7.3	5.9	5.5	8.2	8.2	5.8	9.6	5.0	7.0	3.3	5.8
Other food	1.2	0.9	1.3	1.2	0.9	1.3	1.2	1.0	1.9	1.6	1.2	1.9	1.5	1.0	2.2	1.6	1.5	1.9	1.6
Lint & yarn	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-
Textiles	5.5	6.6	4.9	5.5	6.6	4.9	6.0	6.2	5.3	6.7	6.5	5.3	6.1	6.8	5.1	5.8	6.6	5.8	6.8
Leather	0.2	0.4	0.3	0.2	0.4	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.4	0.3	0.3	0.3	0.3	0.4
Wood products	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-
Chemicals	3.0	4.3	4.9	3.0	4.3	4.9	1.9	2.2	1.8	0.5	2.1	2.3	0.4	0.9	1.2	2.9	1.3	3.5	1.4
Cement & bricks	0.9	1.2	1.4	0.9	1.2	1.4	0.5	0.6	0.5	0.1	0.6	0.6	0.1	0.3	0.3	0.8	0.4	1.0	0.4
Petroleum refining	0.5	0.5	0.6	0.5	0.5	0.6	0.5	0.6	0.8	0.7	0.7	0.8	0.6	0.6	0.8	0.8	0.8	0.9	1.0
Other manufacturing	5.8	8.4	9.6	5.8	8.4	9.6	3.7	4.4	3.5	1.0	4.0	4.4	0.8	1.8	2.2	5.7	2.5	6.9	2.7
Energy	0.6	0.7	0.7	0.6	0.7	0.7	0.6	0.7	1.0	0.9	0.8	0.9	0.8	0.7	1.0	0.9	1.0	1.1	1.2
Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Commerce	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.4	3.5	3.5	3.4	3.4	3.4	3.5	3.4	3.4	3.4
Transport	13.5	13.6	13.6	13.5	13.6	13.6	13.3	13.4	13.3	13.1	13.3	13.3	13.1	13.1	13.2	13.4	13.2	13.1	13.0
Housing	1.4	1.6	2.4	1.4	1.6	2.4	1.5	1.3	1.8	1.9	1.7	1.8	1.6	1.5	1.8	2.5	1.7	6.3	3.5

Table 5.3—Continued

Private services	14.5	14.7	14.6	14.5	14.7	14.6	14.4	14.4	14.4	14.2	14.4	14.4	14.1	14.2	14.3	14.4	14.3	14.1	14.1
Public services	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.3	3.3	3.4	3.3	3.3	3.3	3.4	3.3	3.3	3.3
	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

h1	Large Farmers, Sindh	h7	Small Farmers, Sindh	h13	Rural agricultural workers, landless, Sindh
h2	Large Farmers, Punjab	h8	Small Farmers, Punjab	h14	Rural agricultural workers, landless, Punjab
h3	Large Farmers, Other Pakistan	h9	Small Farmers, Other Pakistan	h15	Rural agricultural workers, landless, Other Pakistan
h4	Medium Farmers, Sindh	h10	Small Farm Renters, landless, Sindh	h16	Rural non-farm, non-poor
h5	Medium Farmers, Punjab	h11	Small Farm Renters, landless, Punjab	h17	Rural non-farm poor
h6	Medium Farmers, Other Pakistan	h12	Small Farm Renters, landless, Other Pakistan	h18	Urban non-poor
				h19	Urban Poor

Source: 2001-02 Social Accounting Matrix of Pakistan

There are 19 household groups in the model. The agricultural-based groups are categorized by household location (Punjab, Sindh, and other Pakistan) and size of land holdings (large, medium and small farms; landless renters, and workers). In addition, there are national aggregates of households of rural non-farm and urban poor and non-poor. The structure of consumption of each of the groups is presented in Table 5.3. Livestock, cattle and dairy has the highest share in the consumption basket, but varies across household groups from 14.4 percent in h3 and h6 to 24.9 percent in h14. The other major items in the consumption basket of households are private services (about 14 percent), transport (about 13 percent), wheat milling (from 4 percent in h18 to 11.7 percent in h15), textile (from 4.9 percent in h3 and h6 to 6.8 percent in h14 and h19), other manufacturing (from 0.8 percent in h13 to 9.6 percent in h3), sugar (from 3.3 percent in h18 to 8.2 percent in h12), and fruits and vegetables (from 4.4 percent in h2 and h5 to 7.1 percent in h15).

The sources of household income in the model are labor income, capital income, income from land and water, dividend income, and income from the rest of the world (Table 5.4). There are 10 labor types. The original SAM has four types of capital, but in the model all these are aggregated into one factor. Similarly, the original SAM has 12 categories of land, but they are aggregated into one factor in the model.

Table 5.4—Sources of household income (%)

Household	Labor										K	Land	Water	Dividend Income	Gov't Transfers	Income from Abroad
	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10						
Large Farmers, Sindh	13.2	-	-	-	-	-	-	0.1	0.2	-	31.4	37.2	12.6	-	0.00	5.31
Large Farmers, Punjab	8.6	-	-	-	-	-	-	-	0.5	-	43.3	33.5	8.7	-	0.07	5.30
Large Farmers, Other Pakistan	9.8	-	-	-	-	-	-	0.0	0.1	-	52.4	32.3	-	-	0.10	5.31
Medium Farmers, Sindh		14.5	-	-	-	-	-	0.5	2.6	-	39.6	37.4	-	-	0.04	5.30
Medium Farmers, Punjab	-	-	10.8	-	-	-	-	0.0	4.3	-	52.3	27.2	-	-	0.10	5.30
Medium Farmers, Other Pakistan	-	-	-	14.9	-	-	-	1.0	1.9	-	38.2	38.4	-	-	0.23	5.30
Small Farmers, Sindh	-	-	-	-	6.8	-	-	4.3	4.7	-	57.9	20.4	-	-	0.54	5.30
Small Farmers, Punjab	-	-		-	-	7.9	-	4.2	10.0	-	51.8	20.3	-	-	0.55	5.30
Small Farmers, Other Pakistan	-	-	-	-	-	-	6.0	3.4	8.2	-	63.6	12.5	-	-	0.95	5.30
Small Farm Renters, landless, Sindh	-	-	-	-	11.6	-	-	14.7	4.0	-	48.5	15.6	-	-	0.36	5.31
Small Farm Renters, landless, Punjab	-	-	-	-	-	9.0	-	6.1	14.3	-	48.7	16.1	-	-	0.45	5.30
Small Farm Renters, landless, Other Pakistan	-	-	-	-	-	-	10.1	2.3	12.2	-	55.0	14.7	-	-	0.35	5.32
Rural agricultural workers, landless, Sindh	-	-	-	-	-	-	-	36.0	15.1	-	42.8	-	-	-	0.89	5.30
Rural agricultural workers, landless, Punjab	-	-	-	-	-	-	-	33.6	15.7	-	45.2	-	-	-	0.20	5.30
Rural agricultural workers, landless, Other Pakistan	-	-	-	-	-	-	-	15.6	3.1	-	76.0	-	-	-	0.06	5.32
Rural non-farm, non-poor	-	-	-	-	-	-	-	-	43.0	-	49.9	-	-	-	1.86	5.30
Rural non-farm, poor	-	-	-	-	-	-	-	-	29.7	-	63.4	-	-	-	1.56	5.30
Urban non-poor	-	-	-	-	-	-	-	-	11.9	33.3	10.6	-	-	38.05	0.84	5.30
Urban Poor	-	-	-	-	-	-	-	-	76.2	-	18.0	-	-	-	0.47	5.30

L1 Own farm labor, large farm
L2 Own farm labor, medium farm, Sindh
L3 Own farm labor, medium farm, Punjab
L4 Own farm labor, medium farm, Other Pakistan
L5 Own farm labor, small farm, Sindh
L6 Own farm labor, small farm, Punjab
L7 Own farm labor, small farm, Other Pakistan
L8 Labor, agricultural wage
L9 Labor, non-agricultural wage unskilled
L10 Labor, non-agricultural wage skilled
K capital

Let us start with the sources of income of urban poor, which is listed at the bottom of the table. About 76.2 percent of their income comes from non-agricultural unskilled wage, and about 18 percent from capital, which is essentially informal capital. Major sources of income of urban non-poor households included: dividend income (38.02 percent - the only household group that receives this type of income) and non-agricultural skilled wage (33.3 percent). About 12 percent of its income comes from non-agricultural unskilled wage and about 11 percent from (non-dividend) capital. Rural non-farm households have non-agricultural unskilled wage and informal capital as major sources of their income. In particular, for rural non-farm poor 63.4 percent of their income comes from informal capital, while for rural non-farm non-poor only 50 percent. Rural agricultural landless workers source a major part of their income from agricultural wage, informal capital, and to some extent non-agricultural unskilled wage. Farm households source their income from capital informal, land and water, and own-farm labor to various degrees. Only large farms in Punjab and Sindh earn returns to water, while capital income exceeds land income (and often by a large amount) for all farm household groups but one. Labor accounts for a relatively small share of income of farm households. In the 2001-02 SAM, all household groups are assumed to source 5.3 percent of their income from foreign sources.

In the SAM, the sources of government revenue include (Table 5.5): 49.3 percent indirect tax revenue; 10.8 percent import tax revenue; 32.8 direct income tax revenue (from urban non-poor households only); and 7.2 percent other revenue, which comes from water (Table 5.5). In the model, water is considered as part of land.

Table 5.5—Sources of government revenue

	Share, %
Indirect tax revenue	49.3
Import tax revenue	10.8
Direct income tax revenue	32.8
Other revenue (water)	7.2
Total	100.0

Source: 2001-02 Social Accounting Matrix

6. MICROSIMULATIONS

There are several approaches to linking CGE models with data in a household survey to analyze poverty issues. One approach is a top-down method where the results of CGE models with representative households are applied recursively to data in the household survey grouped into these representative household categories with no feedback effects. Within the top-down method there are wide variations. An early one was to assume a lognormal distribution of income within household category where the variance is estimated from the data in the survey (De Janvry, Sadoulet, and Fargeix, 1991) [15]. In this method, the change in income of the representative household generated in the CGE model is used to estimate the change in the average income for each household category, while the variance of this income is assumed fixed. Decaluwé et al (1999) argue that a beta distribution is preferable to other distributions such as the lognormal because it can be skewed left or right and thus may better represent the types of intra-category income distributions commonly observed. Annabi et al. (2005), Emini et al. (2005), Cororaton et al. (2005), and Cockburn et al. (2006) among others apply a top-

[15] There are many papers that use various types of CGE microsimulations in poverty analysis. In this section we only cite a few of these papers.

down approach that utilizes the actual incomes from a household survey and applies the changes in incomes and consumer prices of the representative households generated in the CGE model to each individual household in that category.

The top-down method usually uses CGE models with more than one but still a limited number of representative households. One criticism of this approach is that it does not account for the heterogeneity of income sources and consumption patterns of households within each category. Intra-category income variances could be a significant part of the total income variance. That is, there is evidence that households within a given category, as well as across categories, may be affected quite differently according to their asset profiles, location, household composition, education, or other characteristics.

To address this issue an integrated CGE microsimulation allows full integration of all households in the survey into the CGE model equilibrium. As demonstrated by Cockburn (2001) and Cororaton and Cockburn (2007), although the full integration approach adds substantially to the computations in the model, it poses no particular technical difficulties because it involves constructing a standard CGE model with as many household categories as there are households in the household survey providing the base data. The fully integrated approach also has some advantages. Decaluwé, Dumont and Savard (1999), for example, constructed an integrated CGE micro-simulation model in which 150 households are directly modeled within a CGE model using fabricated data from an archetypal developing country. They construct the model to allow comparisons with the earlier approaches of multiple household categories and fixed intra-category

income distributions. They find that intra-category variations can be important in this context.

There are also recent more sophisticated microsimulation methods that link CGE models with household data to analyze poverty issues through a sophisticated treatment of the labor market transmission channel. Ganuza-Barros-Vos (2002) introduce a randomized process to simulate the effects of changes in the labor market structure. Random numbers are used to determine key parameters in the labor market such as: (i) which persons at working age change their labor force status; (ii) who will change occupational category; (iii) which employed persons obtain a different level of education; and (iv) how new mean labor incomes are assigned to individuals in the sample. The random process is repeated a number of time in a Monte Carlo fashion to construct 95-percent confidence intervals for the indices of poverty. The CGE model is used to quantify the effects of a macroeconomic shock on key labor market variables such as wages and employment, and these results are applied in the microsimulation process.

In this report we follow the straightforward top-down approach where the changes in incomes from various sources and consumer prices of the representative households as generated in the CGE model are applied to the actual distribution in the household survey. Thus, recursively, we introduce the CGE results on household incomes and consumer prices for each of the 19 household types into the 2001-2002 HIES. Table 6.1 shows the 19 households in the SAM and the corresponding household characteristics of the 19 household groups in the HIES.

Table 6.1—Household categories in SAM and HIES for Microsimulation Analysis

	2001-02 Social Accounting Matrix	2001-02 Household Integrated Economic Survey
		3 Major Provinces: a. Punjab b. Sindh c. Other Pakistan - Balochistan North West Frontier Province Azad Kashmir Northern Areas Federally Adminstered Tribal Areas Poverty threshold household income for 2001-02 = Rs 8,976
h1	Large Farmers, Sindh	Landowners with more than 50 acres
h2	Large Farmers, Punjab	
h3	Large Farmers, Other Pakistan	
h4	Medium Farmers, Sindh	Landowners with more than 12.5 acres but less than 50 acres
h5	Medium Farmers, Punjab	
h6	Medium Farmers, Other Pakistan	
h7	Small Farmers, Sindh	Landowners with more than 0 acres but less than 12.5 acres
h8	Small Farmers, Punjab	
h9	Small Farmers, Other Pakistan	
h10	Small Farm Renters, landless, Sindh	No landholdings, but rented land for farm activities
h11	Small Farm Renters, landless, Punjab	
h12	Small Farm Renters, landless, Other Pakistan	
h13	Rural agricultural workers, landless, Sindh	No landholdings, agricultural workers
h14	Rural agricultural workers, landless, Punjab	
h15	Rural agricultural workers, landless, Other Pakistan	
h16	Rural non-farm, non-poor	Rural non-poor, non-farmers and non-agricultural workers
h17	Rural non-farm poor	Rural poor, non-farmers and non-agricultural workers
h18	Urban non-poor	Urban non-poor
h19	Urban Poor	Urban poor

Source: 2001-02 Social Accounting Matrix and 2001-02 Household Integrated Economic Survey

We apply the average change in income of household h1 to h19 from the model to all households belonging to the same group to arrive at a new column of income for those households. Similarly, we apply the average change in consumer price of household h1 to h19 from the model to the poverty line to arrive at a new poverty line for the group. With the new columns of household income and poverty line, we calculated the change in the poverty index.[16]. We calculated poverty indices for all Pakistan, urban, and rural households as summary statistics.

7. DEFINITION OF POLICY SIMULATION SCENARIOS

The main objective of this report is to analyze the intersectoral and poverty implications of key international and domestic economic changes that could affect the competitiveness of the cotton, yarn and textile industries in Pakistan. In carrying out this objective we design 4 sets of simulation scenarios. The definition of each one is given below.

SIM 1 - Increase in Foreign Savings. After the 9/11 incident in the United States, Pakistan experienced a surge in foreign exchange. In the period between 2001-02 and

[16] Poverty impacts are measured by variations in Foster-Greer-Thorbecke (FGT) indices with respect to their 2001-2002 values. The FGT poverty measure is $P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^\alpha$ where n is population size, q is the number of people below poverty line, y_i is income, z is the poverty line. The poverty line is equal to the food poverty line plus the non-food poverty line, respectively representing the estimated cost of basic food and non-food requirements. Poverty headcount index, which measures the proportion of the population whose income (or consumption) falls below the poverty line, is obtained when $\alpha = 0$. When $\alpha = 1$, we obtain the poverty gap, which measures the depth of poverty, that is how far the poor are below the poverty line on average. The poverty severity index is obtained with $\alpha = 2$. This measure is sensitive to the distribution among the poor as more weight is given to the poorest below the poverty line.

2004-05, net inflows of foreign exchange increased by 111 percent (Pakistan Economic Survey). This created pressure on the exchange rate, which has appreciated by 12 percent (Table 7.1). Since the cotton-textile sectors are the major export earner, providing 60 percent of total export receipts of the country, the impact on their performance could be substantial. In this simulation, we analyze the effects of a 100 percent increase in foreign savings. We introduce this shock into the model by increasing the exogenous current account balance variable, which is CAB in Equation 38 in Appendix 1. This simulation scenario analyzes the impact of prices of tradables and non-tradables and the corresponding changes in output. Factor prices, factor income and household welfare and poverty are also assessed.

Table 7.1—Exchange rate and prices

	Pakistan			
	Change in Nominal Exchange Rate (%)	Inflation Rate (%)	United States Inflation Rate (%)	Inflation-Adjusted Change in Pakistan Exchange Rate (%)
2000-01	12.9	4.4	2.8	11.3
2001-02	5.1	3.5	1.6	3.1
2002-03	-4.8	3.1	2.3	-5.6
2003-04	-1.6	4.6	2.7	-3.5
2004-05	3.0	9.3	3.4	-2.9

Source: Pakistan Economic Survey and http://inflationdata.com (for US inflation)

SIM 2 – Increase in World Cotton and Textile Prices. As described above, world cotton prices fluctuate significantly. The sharpest and the most sustained drop in prices took place between 1994 and 2001 with COTLOOK B dropping by 57.8 percent. The declines in cotton yarn and cotton fabric prices were much less at 27.4 percent and 6.4 percent, respectively.

Instead of a price drop, this simulation scenario considers an increase in cotton prices. We assume the world price of cotton yarn to increase by 20 percent. Using the ratios in Table 2.9 computed for the period 1994-2001, this implies a 42.6 percent increase in COTLOOK B and a 4.6 percent increase in the world price of cotton fabric. However, we rounded up the increase in the world price of cotton fabric to 5 percent. Furthermore, in the analysis, we are constrained to implement this experiment by increasing the exogenous world price of cotton lint and yarn exports and imports (sector 20) using the increase in the world price of cotton yarn, and increasing the exogenous world price of textile (sector 21) using the increase in the world price of cotton fabric. We increase both the Pwm equation 39 and Pwe in equation 40 in Appendix 1 for these two sectors only. The first round impact on export supply is captured in equation 35 through Pe, the domestic price of its export in local currency. However, in the succeeding adjustments, D, domestic demand and Pl, local price, will affect export supply of cotton lint and yarn as both are endogenous variables. Similarly, the impact of higher Pwm will channel through the import price equation and the import demand function in equation 37. Furthermore, the curvature of the import demand and the export supply as indicated by the level of the elasticity of substitution, which are fixed, will affect the size of the effect.

To better understand the results of this experiment, we conduct 3 separate runs: SIM 2a where a 20 percent increase in the world price of cotton lint and yarn is simulated; SIM 2b where a 5 percent increase in the world price of textile is experimented; and SIM 2c where both price increases are introduced simultaneously.

SIM 3 – Increase in Total Factor Productivity (TFP). As reviewed earlier, Martin (2004), Salam (2007), and Altaf (2007) argue that improvement in productivity is one of the key challenges that Pakistan faces in order to be competitive in the world yarn and textile markets. These international markets are expected to be more price responsive after the abolition of the MFA quotas. This liberalized market presents opportunities for suppliers with high productivity. As Martin observes, for Pakistan raising productivity by improving the efficiency of the production process or the increasing range and the quality of the products produced is key to reaping the benefit from the abolition of the MFA.

The productivity simulations examine the effects if TFP in the cotton-textile sectors is improved. To better understand these effects, we conduct 3 separate experiments: SIM 3a where a 5 percent increase in TFP is introduced simultaneously in raw cotton (sector 5), cotton lint and yarn (sector 20) and textile (sector 21); SIM 3b where a 5 percent increase in TFP is simulated in the textile sector; and SIM 3c where a 5 percent increase TFP is introduced to both the raw cotton and the cotton lint and yarn sectors. To conduct this simulation scenario, we implement the increase in TFP through the scale parameter, κ, in the production function in Equations 2 and 3 in Appendix 1.

SIM 4 – Increase in Production Subsidy. The textile industry in Pakistan is backed by a strong industry association that lobbies for government support. Substantial resources have been channeled to the spinning and weaving industries by suppressing raw cotton prices or direct subsidies because of their strong industry association and its close relation with the government. In contrast, cotton farmers do not have such strong

representation. This simulation provides some analytics to the debate on government subsidies to the industry.

Figure 7.1 illustrates a simple economics of a production subsidy. The initial equilibrium is at point c where price is Po and output is Xo. With subsidy, output price will increase to Px, while demand price will decrease to Pd. The line segment $\overline{be}$ is the rate of subsidy. The level of output will increase to X1 and there is an increase in producer surplus which is indicated by the area $\Delta PxbcPo$. There is also an increase in consumer surplus indicated by the area $\Delta PocePd$. However, there is a deadweight loss indicated by the area Δbce.

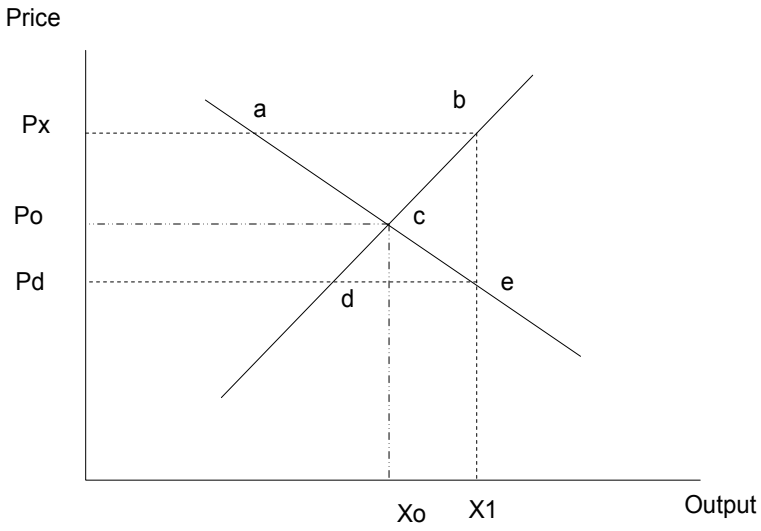
We consider production subsidy as a negative tax on output. In the model, we implement this through the output price equation 42 in Appendix 1. In particular, output price is $Px \cdot X \cdot (1 + tx) = Pl \cdot d + Pe \cdot e$, where tx (negative) is production subsidy. Since this will affect the indirect tax revenue of the government in equation 29, the following term will be added $\sum Px \cdot X \cdot tx$. The indirect tax revenue, and therefore the total income of the government, declines if tx is implemented.

We implement a production subsidy in a manner that does not have a government budget deficit implication. In particular, we impose a general compensatory consumption tax, nctx, which is applied to all commodities and solved endogenously in the model so that the overall savings of the government, SAVG, stays fixed. To implement this we

introduce nctx in equation 41 in the following way[17]:

$Pq \cdot Q = (1 + nctx) \cdot (Pd \cdot D + Pm \cdot M)$. This generates additional government revenue that will offset whatever decline in government income due to the provision of production subsidy and to other revenue reduction because of changes in the variables in the revenue function of the government. Thus the following term is added to the indirect tax revenue of the government (equation 29): $\sum nctx \cdot (Pd \cdot D + Pm \cdot M)$. Real government consumption, GT, remains fixed.

Figure 7.1—A simple economics of a production subsidy



[17] Generally, if tx is negative, nctx will be positive (or vice versa). However, they are not equal, because nctx is a general consumption tax while tx is specific to a sector. Also, nctx will accommodate changes in the other sources of government income as a result of the general equilibrium effects of implementing tx.

Since savings of firms and government are held fixed, the deadweight loss due to the subsidy in the illustration above will be reflected in the overall welfare of households through higher compensatory tax, nctx. At the household group level, there are those which would enjoy welfare gains, while there are others which would suffer welfare losses. But the overall net effect is negative.

8. RESULTS OF THE SIMULATION ANALYSIS

The organization of the discussion of results is as follows. We start with the complete set of results under SIM 1. The discussion will focus on the macroeconomic effects, sectoral effects, and household effects through changes in output and factor prices. For the rest of the simulations, we group the discussion into the three topics: (i) world price increases in cotton lint and yarn and textile, (ii) improvements in TFP in the various sectors, and (iii) increase in government subsidies. For each of simulation we present the macroeconomic effects, sectoral effects and household effects. In the sectoral analysis we emphasize the impact on the cotton, yarn and textile sectors. Effects on other sectors are relatively small for the shocks in SIM 2 through SIM 10 and are condensed in the tables in the text.

8.1 Increase in Foreign Savings

In Table 8.1, foreign savings increase by 135.67 billion rupees. This results in higher overall real investment by 23.24 percent. The significant increase in the inflow of

foreign savings results in real exchange rate appreciation[18] of 9.51 percent, which in turn depresses real exports by 11 percent and pulls real imports up by 9 percent. Overall real consumption increases by 1.33 percent. The composite price[19] declines by 1.95 percent, while the overall household consumer price index (CPI) declines by 1.69 percent, while domestic prices marginally by 0.63 percent. The overall balance of the government deteriorates by 1.45 billion rupees due to the reduction in tariff revenue because of the appreciation of the exchange rate and to the reduction in the average returns to land[20] as described below. In Table 5.5, one source of government revenue is water (7.2 percent of total revenue), which in the model is considered as a part of land.

The intersectoral results are presented in Table 8.2. The highest positive impact is on the construction sector, which is a non-tradable sector with zero exports and imports. Its overall output improves by 8.78 percent and output price by 13.47 percent. This is followed by the cement and bricks sector, which supplies heavily the material requirements of the construction sector. Its output improves by 3.74 percent and output price by 48.32 percent. Output of the private services sector also improves by 1.26 percent. However, there are negative effects on cotton, yarn, and textile. The output of the textile sector declines by 7.67 percent, cotton lint and yarn by 5.83 percent, and raw cotton by 5.13 percent. The largest drop, however, is in the leather industry, where output

[18] This is the change in the nominal exchange rate, which is also the change in the real exchange rate because the model considers Pindex (the weighted sectoral price of value added) as constant and the nominal exchange rate as variable in the closure. This is the measure of the change in the real exchange rate used in the rest of the simulations.
[19] Composite price is the weighted average of import price and domestic price. Household consumer price is the consumption-weighted composite price. Domestic price includes indirect taxes.
[20] One source of government revenue is income from water which we consider another form of land in the model.

declines by 11.37 percent. Other food sector also registers a drop of 5.0 percent. Furthermore, there are negative effects on the rice sector, both on paddy and rice milling, but there is a slight positive effect on wheat and sugar.

There is significant movement of labor across sectors. Employment of skilled and unskilled labor in the cement and bricks sector improves by 43.85 and 43.14 percent, respectively. In the construction sector, employment of skilled labor improves by 13.53 percent while unskilled by 11.87 percent. Employment also improves in the private services sector. Labor moves largely from the leather, other food, cotton, yarn, textile, and rice sectors.

Table 8.1—Macro effects - SIM 1, increase in foreign savings

	% change from base
Real consumption	1.33
Real investment	23.24
Real exports	-11.03
Real import	9.00
Real exchange rate	-9.51
Export prices	-9.51
Import prices	-9.50
Household CPI /1/	-1.69
Composite price	-1.95
Domestic price	-0.63
Price of investment	1.81
	billion rupees
Government balance	-1.45
Total government income	-1.45
Tariff revenue	-0.87
Indirect tax revenue	1.42
Direct tax revenue	0.34
Other revenue	-2.33
Total household savings	-0.47
Foreign savings	135.67
Firm savings	0.00

/1/ Composite price weighted by consumption expenditure

Table 8.2—Intersectoral effects (% change from base) - SIM 1: Increase in foreign savings

	Output		Labor			Returns to	Exports		Imports	
	Volume	Price	Skilled	Unskilled	Investment	Capital	Volume	Price	Volume	Price
Raw cotton	-5.13	-9.70		-15.33	-13.60	-13.61				
Lint & yarn	-5.83	-9.56	-23.02	-23.87	-27.68	-20.96	-4.36	-9.51	-8.37	-9.50
Textile	-7.67	-9.13	-25.41	-26.23	-31.62	-23.14	-16.85	-9.51	16.31	-9.50
Wheat irrigated	0.16	-5.80		0.47	1.43	-6.39	-4.74	-9.51	3.52	-9.51
Wheat non-irrigated	0.43	-5.46		1.25	3.54	-5.43				
Paddy, IRRI	-1.73	-12.46		-9.65	-23.59	-18.75				
Paddy, basmati	-0.88	-12.09		-8.37	-20.66	-17.21				
Sugarcane	0.52	-3.66		4.11	11.54	-1.84				
Other major crops	-0.61	-7.15		-1.74	-4.41	-9.13	-3.75	-9.51	1.46	-9.51
Fruits & vegetables	0.55	-3.51		2.82	7.89	-3.46	-7.21	-9.51	6.00	-9.51
Livestock, cattle, & dairy	0.19	0.04		1.90	23.46	3.28	-11.61	-9.51	8.02	-9.51
Poultry	0.31	0.61		3.14	27.50	4.95	-12.14	-9.51		
Forestry	-0.54	-8.38		-2.65	0.00	0.00	-2.06	-9.51	1.50	-9.51
Fishing industry	-1.74	-3.91		-5.63	0.60	-6.78	-8.84	-9.51	6.38	-9.51
Agriculture	**-0.21**	**-2.88**		**-1.25**	**20.63**	**2.02**	**-6.26**	**-9.51**	**5.02**	**-9.51**
Agriculture, excl. raw cotton	**0.08**	**-2.48**		**0.39**	**20.99**	**2.18**	**-6.26**	**-9.51**	**5.02**	**-9.51**
Mining	-0.86	-2.52	-2.71	-3.43	7.00	-3.86	-11.32	-9.51	6.08	-9.51
Vegetable oil	-0.91	-4.02	-6.35	-7.72	5.50	-4.53	-11.92	-9.51	8.25	-9.50
Wheat milling	0.61	-3.08	3.85	2.33	21.09	2.28	-12.29	-9.51	11.96	-9.50
Rice milling, IRRI	-2.80	-7.52	-12.14	-13.43	-3.11	-8.51	-6.93	-9.51		
Rice milling, basmati	-1.14	-6.41	-4.66	-6.05	8.05	-3.39	-7.56	-9.51		
Sugar	0.57	-1.03	2.91	1.40	19.62	1.66	-15.91	-9.51	15.05	-9.51
Other food	-5.05	-7.43	-26.20	-27.28	-23.21	-18.55	-9.26	-9.51	6.25	-9.50
Leather	-11.37	-2.58	-38.76	-39.66	-40.13	-28.08	-23.53	-9.51	16.37	-9.51
Wood products	0.22	-1.49	0.78	0.29	18.78	1.30	-15.42	-9.51	13.92	-9.50
Chemicals	-1.41	-6.20	-6.27	-6.73	-11.14	-12.38	-8.24	-9.51	1.98	-9.50
Cement & bricks	3.74	48.32	43.85	43.14	392.97	106.36	-61.39	-9.51		
Petroleum refining	-0.80	-4.83	-2.92	-3.40	2.27	-6.01			1.73	-9.51
Other manufacturing	0.28	-3.02	1.17	0.67	20.61	2.08	-12.69	-9.51	11.80	-9.50

Table 8.2—Continued

	Output Volume	Labor Price	Returns to Skilled	Returns to Unskilled	Exports Investment	Imports Capital	Volume	Price	Volume	Price
Construction	8.78	13.47	13.53	11.87	36.36	8.54				0.00
Industry	**-1.68**	**-2.13**	**-2.98**	**1.72**	**28.50**	**0.39**	**-12.86**	**-9.51**	**8.76**	**-9.50**
Industry, excl. yarn and textile	**0.62**	**0.87**	**3.79**	**5.08**	**45.60**	**7.03**	**-11.51**	**-9.51**	**8.76**	**-9.50**
Commerce	-0.69	-0.10	-0.59	-1.08	12.45	-1.44	-5.48	-9.51	21.06	-9.51
Transport	-0.08	-2.27	0.78	-0.45	16.59	0.36	-3.85	-9.51	0.00	0.00
Housing	0.00	5.37	0.00	0.00	27.46	4.93	0.00	0.00	0.00	0.00
Private services	1.26	0.52	4.18	2.91	22.94	3.06	-3.93	-9.51	15.47	-9.51
Public services	1.10	-1.08	1.10	0.00	0.00		0.00	0.00		0.00
Services	**0.36**	**-0.26**	**1.05**	**0.07**	**20.01**	**1.80**	**-3.86**	**-9.51**	**15.70**	**-9.51**
Total	**-0.54**	**-1.50**	**0.00**	**-0.01**	**23.24**	**1.40**	**-11.03**	**-9.51**	**9.00**	**-9.50**

Exports of all sectors decline because of the real exchange rate appreciation. The largest drop is in the cement and bricks sector because of high domestic demand. There is also a substantial drop in exports of leather. Exports of cotton lint and yarn and textile fall by 4.36 percent and 16.85 percent, respectively. Conversely, the exchange rate appreciation results in higher sectoral import demand in all sectors except cotton lint and yarn. Imports of yarn decline because output of textile, the user of yarn, falls.

Table 8.3—Factor price effects (% change from base) SIM 1, Increase in foreign savings

Factor Prices	Real /1/	Nominal
Skilled labor	1.42	-0.27
Unskilled farm labor	-6.97	-8.66
Unskilled workers	2.41	0.72
Average returns to capital	3.09	1.40
Average returns to land	-5.59	-7.27

/1/ Less household CPI

The generally negative effects on agricultural and other traded goods and the positive effects on construction-related and service sectors result in differentiated effects on factor prices. In Table 8.3, the impact on the wage of farm labor and on the average returns to land are both negative in real and nominal terms. In real terms, the wage of farm labor drops by 6.97 percent, while the average returns to land drops by 5.59 percent[21]. There is positive increase of 2.41 percent in the wage of unskilled workers, 1.42 percent in the wage of skilled labor, and 3.09 percent in the average returns to capital because construction-related and service sectors use substantial amounts of these factors.

[21] This causes government income from land (water) to drop.

Table 8.4—Real income effects - SIM 1, Increase in foreign savings

	Real Income Change, % from base	Population Distribution, %
Pakistan	1.31	
Urban	1.85	28.6
Urban poor	2.27	8.1
Rural	0.73	71.4
Farmers /1/	-0.41	34.2
Workers /2/	2.39	6.6
Other rural households /3/	2.40	30.7
Other rural poor households	2.66	16.8

/1/ Large, medium, small, and landless in Punjab, Sindh, and other Pakistan
/2/ Landless agricultural workers in Punjab, Sindh, and other Pakistan
/3/ Non-farm rural households

Originally, there are 19 household groups in the model, but in the presentation of household results we aggregate them into seven broader groups shown in Table 8.4. Overall household income improves by 1.31 percent. There are relatively more positive effects on urban households, especially on urban poor, which comprise 8.1 percent of the population, than on rural households. Among rural households, rural farmers are negatively affected. They comprise 34.2 percent of the population. These effects are largely due to the negative effects on prices of factors owned by these groups. However, there are positive income effects on both rural workers and other rural households. This is because of positive factor price effects, movement of unskilled labor across sectors, and high growth in construction-related and service sectors which employs a substantial amount of unskilled labor.

Table 8.5—Poverty effects (% change from base) SIM 1, Increase in foreign savings

	Pakistan	Urban	Rural
Poverty Headcount	-6.63	-7.41	-6.38
Poverty Gap	-8.20	-8.87	-8.01
Poverty Severity	-9.88	-10.27	-9.76

The effects on poverty evaluated through the microsimulation analysis are presented in Table 8.5. The overall poverty headcount index drops by 6.63 percent. There is a relatively higher drop in urban poverty headcount index than in rural headcount index. This is due to the negative real income effects among rural poor farmers. However, in the overall as well as in both urban and rural areas, there is higher drop in the poverty gap and severity indices. This is due to the higher increase in real income of urban poor (8.1 percent of the population), rural poor agricultural laborers (3.6 percent of the population), and rural poor non-farmers (18.1 percent of the population).

8.2 Increases in World Cotton and Textile Prices

In analyzing this scenario, we simulated separately a 20 percent increase in the world price of cotton lint and yarn (SIM 2a), a 5 percent increase in the world price of textile (SIM 2b), and a combined price increase in both products (SIM 2c). The macro results are presented in Table 8.6. In all three cases, there is real exchange rate appreciation. The exchange rate appreciates by 1.88 percent in SIM 2a and 3.24 percent in SIM 2b. Despite the higher increase in the world price of cotton yarn under SIM 2a than the world price of textile under SIM 2b, the effect of the latter is larger than the effect of the former because the textile sector has much larger share in the total export

receipts in the 2001-02 SAM (12.1 percent for yarn and 31.9 percent for textile in Table 5.1). The impact on the sector's exports is positive (e.g. 50.15 percent for cotton lint and yarn in SIM 2a and 6.8 percent for textile in SIM 2b Table 8.7, as discussed below). However, with constant foreign savings in foreign currency at the initial benchmark level in the simulations[22], real appreciation of the exchange rate decreases overall exports and increases overall imports.

Under SIM 2a, government revenue improves by 1.29 billion rupees despite the reduction in tariff revenue (due to the appreciation of the exchange rate) and the drop in direct income tax revenue (due to declining rates of return to capital, wages of skilled labor and unskilled labor that affect household income, as discussed below). This is because there is relatively higher average returns to land which is a source of government revenue. Moreover, the drop in foreign savings by 3.15 billion rupees is due to the appreciation of the exchange rate. There is also a drop of 1.12 billion rupees in household savings[23]. Thus, overall savings drops by 2.98 billion rupees. The price of investment drops by 1.18 percent.[24] Therefore, despite the drop in the overall nominal savings (nominal investment) real investment improves marginally by 0.63 percent.

[22] However, foreign savings in domestic currency drops because of the appreciation of the exchange rate.
[23] These balances are in nominal values. However, we shall see later in the analysis that the real household income effects are positive, which implies that the effect on real household savings is also positive.
[24] The price of investment is given in 45 in Appendix 1.

Table 8.6—Macro effects - SIM 2, Increase in world cotton and textile prices

	SIM 2a /1/	SIM 2b	SIM 2c
	% change from base		
Real consumption	0.25	0.43	0.62
Real investment	0.63	-0.14	0.49
Real exports	-1.62	-0.23	-1.52
Real import	0.61	0.89	1.40
Real exchange rate	-1.88	-3.24	-4.84
Export prices	-0.12	-1.70	-1.61
Import prices	-1.73	-3.16	-4.62
Household CPI /2/	-0.26	-0.57	-0.80
Composite price	0.10	-0.90	-0.74
Domestic price	0.42	-0.52	-0.07
Price of investment	-1.18	-1.98	-2.99
	billion rupees		
Government balance	1.29	-5.79	-4.02
Total government income	1.29	-5.79	-4.02
Tariff revenue	-0.02	-0.99	-0.98
Indirect tax revenue	0.34	-4.23	-3.37
Direct tax revenue	-1.40	0.33	-1.11
Other revenue	2.37	-0.89	1.44
Total household savings	-1.12	-0.08	-1.27
Foreign savings	-3.15	-5.43	-8.11
Firm savings	0.0	0.0	0.0

/1/ SIM 2a : 20% increase in world prices of cotton lint and yarn
SIM 2b : 5% increase in world prices of textile
SIM 2c : combination of SIM 2a and 2b
/2/ Composite price weighted by consumption expenditure

Under SIM 2b, because of higher appreciation of the exchange rate of 3.24 percent, there is a larger drop in tariff revenue and indirect tax revenue.[25] This leads to higher reduction in government savings. There is a relatively lower drop in nominal household savings compared to SIM 2a. Also, due to the higher appreciation of the exchange rate, foreign savings in domestic currency drops by 5.43 billion rupees. Thus,

[25] Note that in equation 29, indirect tax revenue is affected by fluctuations in the exchange rate also. This is because when imported goods enter the domestic market, they are also imposed with indirect tax similar to the domestically produced goods.

overall savings drops by 11.3 billion rupees. There is a corresponding higher drop in the price of investment by 1.98 percent. This is not enough to offset the overall drop in nominal savings (nominal investment). Thus, real investment drops marginally by 0.14 percent.

Under SIM 2c, the macro effects are larger because the 20 percent in the world price of cotton yarn and the 5 percent increase in the world price of cotton fabric are simulated simultaneously. However, the combined effects are the not the simple sum of the individual effects under SIM 2a and SIM 2b because the model is non-linear.

The increase in government deficit under SIM 2c is lower than in SIM 2b because of the increase in other revenue due to the increase in the returns to land under SIM 2a, and the lower reduction in revenue from indirect taxes despite the higher appreciation of the exchange rate because of higher import volume. Overall savings is negative in SIM 2c and higher than in SIM 2b. However, the reduction in the price of investment is higher (2.99 percent), thus the net effect on real investment is an improvement of 0.49 percent. Exports decline because of the appreciation of the exchange rate, but imports increase. The decline in the consumer price is higher.

The intersectoral effects of the price shocks are shown in Table 8.7. The export and import prices of cotton lint and yarn increase by 17.75 percent[26] under SIM 2a, which translates to 16.43 percent increase in its output price and 15.82 percent increase in its domestic price. This makes the export market relatively more profitable than the

[26]Based on $Pe=Pwe \cdot er$. In differential form, this can be expressed as $\Delta Pe = Pwe \cdot \Delta er + \Delta Pwe \cdot er + \Delta Pwe \cdot \Delta er$. Both Pwe and er are originally 1.

domestic market, thus exports increase relative to domestic sales. In the results, exports increase by 50.15 percent while domestic demand decreases by 0.55 percent. The output increase of 13.27 percent is therefore driven by the increase in exports. This higher output increases the rates of return to capital relative to the other sectors. Thus, investment in the cotton lint and yarn increases by 156.02 percent. Since the increase in domestic price for cotton lint and yarn is relatively lower than the increase in the corresponding import price (i.e. 15.82 percent versus 17.74 percent), the relative price change results in lower imports of cotton lint and yarn.

The world price shock for cotton lint and yarn has major intersectoral effects on the raw cotton and the textile sectors. The textile sector buys from the domestic yarn sector as well as purchases imported yarn. From the input side, as both sources decline, output of the textile sector drops by 8.61 percent and its capital returns by 26.16 percent. The drop in its export price (1.88 percent) is higher than the drop in its domestic price (1.33 percent). Thus there is higher decline in its exports (16.19 percent) compared to its domestic demand (3.64 percent). From the demand side the drop in the domestic demand and exports results in lower output for the textile sector.

Table 8.7—Intersectoral effects (% change from base) - SIM 2, Increase in world cotton and textile prices

	Output		Domestic Demand		Invest-	Exports		Imports		Returns to:	
	x	px	d	pd	ment	e	pe	m	pm	capital	land
	SIM 2a: 20% increase in world prices of cotton lint and yarn										
Raw Cotton	11.75	13.02	11.75	13.01	64.37					27.16	27.16
Lint & yarn	13.27	16.43	-0.55	15.82	156.20	50.15	17.75	-34.13	17.74	58.76	
Textile	-8.61	-1.54	-3.64	-1.33	-44.58	-16.19	-1.88	10.79	-1.87	-26.16	
Agriculture	0.32	2.58	0.43	2.67	2.11	-5.31	-1.88	3.23	-1.88	0.17	7.42
Excluding raw cotton	-0.35	1.97	-0.25	2.05	1.46	-5.31	-1.88	3.23	-1.88	-0.11	5.00
Industry	-0.94	0.65	-0.76	0.71	1.22	-1.72	0.36	0.46	-1.72	-1.95	
Excluding lint & yarn, and textile	-0.40	-0.64	-0.17	-0.44	-2.87	-1.82	-1.88	0.55	-1.87	-2.27	
Services	0.07	-0.96	0.08	-0.92	-0.46	-0.36	-1.88	1.63	-1.88	-1.04	
Total	-0.27	0.37	-0.12	0.42	0.63	-1.62	-0.12	0.61	-1.73	-1.06	7.42
	SIM 2b: 5% increase in world prices of textile										
Raw Cotton	-1.66	-3.32	-1.66	-3.32	-10.35					-4.79	-4.79
Lint & yarn	-1.87	-2.89	1.23	-2.78	-13.75	-10.24	-3.24	14.16	-3.24	-6.62	
Textile	3.59	1.48	1.48	1.39	25.30	6.80	1.60	-3.57	1.60	12.56	
Agriculture	-0.06	-1.09	-0.02	-1.05	-0.21	-2.00	-3.24	1.54	-3.24	0.44	-2.78
Excluding raw cotton	0.03	-0.96	0.07	-0.91	-0.11	-2.00	-3.24	1.54	-3.24	0.49	-2.53
Industry	0.19	-0.93	0.23	-0.84	-0.27	0.05	-1.28	0.69	-3.15	0.22	
Excluding lint & yarn, and textile	-0.57	-1.40	-0.14	-1.11	-4.31	-3.20	-3.24	0.66	-3.24	-1.70	
Services	-0.01	-0.14	0.04	0.00	-0.02	-1.11	-3.24	3.97	-3.24	0.54	
Total	0.06	-0.63	0.09	-0.52	-0.14	-0.23	-1.70	0.89	-3.16	0.42	-2.78
	SIM 2c: combination of SIM 2a and 2b										
Raw Cotton	10.05	9.48	10.05	9.48	49.46					21.57	21.57
Lint & yarn	11.36	13.22	1.35	12.79	126.44	38.08	14.19	-25.61	14.19	49.64	
Textile	-4.36	0.08	-1.83	0.19	-24.94	-8.22	-0.08	5.00	-0.08	-13.85	
Agriculture	0.26	1.44	0.40	1.56	2.17	-7.02	-4.84	4.63	-4.84	0.48	4.51
Excluding raw cotton	-0.32	0.96	-0.18	1.08	1.67	-7.02	-4.84	4.63	-4.84	0.26	2.43
Industry	-0.57	-0.17	-0.40	-0.04	-0.05	-1.28	-0.74	1.06	-4.60	-1.67	
Excluding lint & yarn, and textile	-0.91	-1.89	-0.28	-1.42	-5.93	-4.77	-4.84	1.20	-4.83	-3.63	
Services	0.07	-1.06	0.13	-0.90	0.09	-1.39	-4.84	5.40	-4.84	-0.52	
Total	-0.14	-0.22	0.01	-0.07	0.49	-1.52	-1.61	1.40	-4.62	-0.66	4.51

x: output; d: domestic demand ; e: exports ; m: imports; px: output price; pd: domestic price (including indirect tax); pe: export price in local currency; pm: import price in local currency;

The impact on raw cotton is different. Since the raw cotton sector does not sell to the export market and its major buyer is the domestic cotton lint and yarn sector, there is a demand pull effect coming from the 13.27 percent increase in the output of the latter. The effect on its output price is an increase of 13.02 percent, which is somewhat lower than the 16.43 percent increase in the output price of cotton lint and yarn. Output of raw cotton improves by 11.75 percent. This effect improves the returns to factors used in raw cotton production. The returns to land and capital improve by 27.16 percent. Higher returns to capital increase investment by 64.37 percent.

Under SIM 2b, a 5 percent increase in the world price of cotton fabric translates to 1.6 percent increase in domestic export and import prices of textile. Since the increase in domestic price is only 1.39 percent, this leads to increased exports by 6.8 percent. This growth is higher compared to the 1.48 percent improvement in its domestic demand that results primarily from relatively lower prices for domestic textiles compared to imports. Output of the textile sector improves by 3.59 percent largely because of higher exports. The rates of return to capital improve by 12.56 percent which increases investment by 25.3 percent.

The intersectoral impact of higher world prices of cotton fabric is different from the higher world prices of cotton yarn. Because of the appreciation of the exchange rate, the import price of yarn drops by 3.24 percent. This leads to higher imports by 14.16 percent. The increase in domestic demand of cotton lint and yarn is only 1.23 percent, not enough to meet the 3.59 percent growth of the textile industry without the increased imports.

The exchange rate appreciation also leads to lower exports of yarn by 10.24 percent. The increase of 1.23 percent in its domestic demand is not enough to offset the drop in exports. Thus the output of lint and yarn drops by 1.87 percent, which in turn results in a decline in the domestic demand for raw cotton by 1.66 percent. The output of raw cotton drops by the same amount because it does not trade internationally.

The drop in output of cotton lint and yarn decreases the rates of return to sectoral capital by 6.62 percent. Thus investment in the sector drops by 13.75 percent. Similarly, the drop in output in raw cotton leads to declining rates of return to capital and land. Thus, investment in the sector drops by 10.35 percent.

Under SIM 2c where both higher world prices of cotton lint and yarn and textile are incorporated simultaneously, whenever the results of SIM 2a and SIM 2b are of the same sign, the results under SIM 2c will be larger in magnitude. If the results are in the opposite sign under SIM 2a and SIM 2b, the results under SIM 2c carries the sign of the larger effect and the magnitude lies between the two effects. For example, output of the textile sector drops by 8.61 percent in SIM 2a but increases by 3.59 percent under SIM 2b. Since the effect under the first is larger than the result under the second, the result in SIM 2c is a drop in textile output. The rest of the intersectoral results can be read in a similar manner.

The impacts on factor prices are presented in Table 8.8. SIM 2a generates favorable effects on the wage of farm labor and the returns to land, factors used heavily in agriculture, particularly in the raw cotton sector. However, there is a decline in the wage of skilled labor, unskilled workers, and the average returns to capital. The impact

on factor prices under SIM 2b, however, is the opposite with a decline in the wage of farm labor and in the returns to land. If both world prices of yarn and textile under SIM 2c are considered, there are positive effects on all real factor prices. However, under SIM 2c the appreciation of the exchange rate is higher (4.84 percent in Table 8.6). Since households source 5.3 percent of their income from abroad (Table 5.4), as well shall discuss below this would have negative effects on them despite the higher factor prices under this scenario.

Table 8.8—Factor price effects (% change from base) SIM 2, Increase in world cotton and textile prices

Factor Prices	Real /1/	Nominal
	SIM 2a /2/	
Skilled labor	-0.45	-0.71
Unskilled farm labor	13.25	12.99
Unskilled workers	-0.26	-0.52
Average returns to capital	-0.80	-1.06
Average returns to land	7.68	7.42
	SIM 2b	
Skilled labor	1.13	0.56
Unskilled farm labor	-2.58	-3.15
Unskilled workers	0.47	-0.10
Average returns to capital	0.99	0.42
Average returns to land	-2.20	-2.78
	SIM 2c	
Skilled labor	0.56	-0.24
Unskilled farm labor	10.20	9.40
Unskilled workers	0.19	-0.61
Average returns to capital	0.13	-0.66
Average returns to land	5.31	4.51

/1/ Less household CPI

/2/ SIM 2a : 20% increase in world prices of cotton lint and yarn
SIM 2b : 5% increase in world prices of textile
SIM 2c : combination of SIM 2a and 2b

Table 8.9 shows that overall household real income improves by 0.25 percent under SIM 2a, 0.40 percent under SIM 2b, and 0.59 percent under SIM 2c. The impacts across household groups differ. In SIM 2a, urban households are negatively affected. This is because of the decline in the wage of skilled labor, unskilled workers, and the average returns to capital. Rural workers and rural non-farm households also have lower income because of lower wage of unskilled workers. However, rural farmers benefit from the increase in the wage of farm labor and the average returns to land. In SIM 2b, the decline in the wage of farm labor and the average returns to land result in lower income for farmers. The rest of the household groups realize higher income.

If both world prices of cotton lint and yarn and textile are simulated under SIM 2c, the increase in the overall household income is 0.59 percent, which is higher than the previous two scenarios. However, income of urban poor and rural non-farmers decline. This is because of the higher appreciation of the exchange rate (4.84 percent) which negatively affects their income from abroad. Although they face higher prices of factors they supply, the increase is relatively smaller and the higher appreciation of the exchange rate in this scenario has larger negative effects on their overall income.

Table 8.9—Real income effects - SIM 2, Increase in world cotton and textile P\prices

	Population	Real Income Change, % from base		
	Distribution, %	SIM 2a /1/	SIM 2b	SIM 2c
Pakistan		0.25	0.40	0.59
Urban	28.6	-0.58	0.74	0.10
Urban poor	8.1	-0.58	0.33	-0.27
Rural	71.4	1.13	0.05	1.12
Farmers /2/	34.2	2.41	-0.31	2.00
Workers /3/	6.6	-0.87	0.45	-0.42
Other rural households /4/	30.7	-0.70	0.61	-0.12
Other rural poor households	16.8	-0.90	0.60	-0.32

/1/ SIM 2a : 20% increase in world prices of cotton lint and yarn
SIM 2b : 5% increase in world prices of textile
SIM 2c : combination of SIM 2a and 2b
/2/ Large, medium, small, and landless in Punjab, Sindh, and other Pakistan
/3/ Landless agricultural workers in Punjab, Sindh, and other Pakistan
/4/ Non-farm rural households

The impact on poverty in presented in Table 8.10. Overall poverty in Pakistan declines by 0.8 percent under SIM 2a, mainly due to the drop in poverty index of rural households by 1.66 percent. The drop in rural poverty is attributed largely to the improvement in income of rural farmers. However, the smaller decline in rural poverty gap and the slight increase in rural poverty severity index are due to the decline in income of rural non-farmers, especially the poor within the group. In SIM 2b, all poverty indices decline. However, urban poverty incidence declines faster than rural poverty incidence. This is because rural farmers have declining income. Under SIM 2c overall poverty incidence drops by 2.01 percent. Rural poverty incidence declines faster than the previous two scenarios. Urban poverty incidence has not changed. Both urban poverty gap and severity indices have increased because of the decline in income of urban poor and of rural non-farmers, especially the poor within the group.

Table 8.10—Poverty effects (% change from base) SIM 2, Increase in world cotton and textile prices

	Pakistan	Urban	Rural
		SIM 2a /1/	
Poverty Headcount	-0.80	1.90	-1.66
Poverty Gap	0.23	2.42	-0.42
Poverty Severity	0.63	2.82	0.01
		SIM 2b	
Poverty Headcount	-0.96	-1.23	-0.87
Poverty Gap	-1.42	-1.32	-1.45
Poverty Severity	-1.75	-1.53	-1.81
		SIM 2c	
Poverty Headcount	-2.01	0.00	-2.65
Poverty Gap	-1.12	1.10	-1.78
Poverty Severity	-1.08	1.29	-1.76

/1/ SIM 2a : 20% increase in world prices of cotton lint and yarn
SIM 2b : 5% increase in world prices of textile
SIM 2c : combination of SIM 2a and 2b

8.3 Increase in Total Factor Productivity (TFP)

This section presents the results of increasing TFP in the cotton-textile sectors. In SIM 3a, we increase simultaneously by 5 percent the production scale parameter of the raw cotton, the cotton lint and yarn, and the textile sectors. In SIM 3b, we increase the production scale parameter of the textile sector only. In SIM 3c, we increase simultaneously the production scale parameters of both the cotton lint and yarn and the raw cotton sectors.

Table 8.11 shows the macroeconomic effects. In all cases, there is real appreciation of the exchange rate. Since there is no change in any of the world prices of exports and imports in these simulations, their prices in domestic currency decline by the same amount as the appreciation of the exchange rate. As a result, imports increase in all

cases. However, we postpone the discussion of the increase in total exports until the discussion of sectoral results below.

In all cases, there is a drop in the composite price index, which is largely due to the decline in the import prices because the drop in the aggregate domestic price is very small. Household CPI also declines, but lower then the drop in the composite price.[27]

Table 8.11—Macro effects - SIM 3, Increase in total factor productivity

	SIM 3a /1/	SIM 3b	SIM 3c
	% change from base		
Real consumption	0.35	0.22	0.15
Real investment	0.21	0.12	0.09
Real exports	1.58	1.06	0.56
Real import	1.04	0.70	0.37
Real exchange rate	-2.41	-1.48	-0.97
Export prices	-2.41	-1.48	-0.97
Import prices	-2.41	-1.48	-0.96
Household CPI /2/	-0.20	-0.14	-0.08
Composite price	-0.42	-0.24	-0.19
Domestic price	-0.08	-0.02	-0.06
Price of investment	-1.23	-0.73	-0.52
	billion rupees		
Government balance	-2.03	-1.19	-0.85
Total government income	-2.03	-1.19	-0.85
Tariff revenue	-0.59	-0.43	-0.17
Indirect tax revenue	-1.50	-0.69	-0.84
Direct tax revenue	0.32	0.27	0.05
Other revenue	-0.25	-0.34	0.10
Total household savings	0.58	0.39	0.20
Foreign savings	-4.04	-2.48	-1.63
Firm savings	0.0	0.0	0.0

/1/ SIM 3a : 5% TFP increase in raw cotton; lint & yarn; and textile
SIM 3b : 5% TFP increase in textile
SIM 3c : 5% TFP increase in raw cotton; and lint & yarn
/2/ Composite price weighted by consumption expenditure

[27] Because some goods do not enter into the consumption basket of households, their consumption weights are zero.

In all cases, there is reduction in the overall nominal savings (nominal investment) because both government savings and foreign savings in domestic currency decline. The decline in nominal foreign savings in rupees is due to the appreciation of the exchange rate. Although there is slight improvement in household savings, it is not enough to offset the decline in the two other sources of savings. However, the price of investment also drops. The decline is more than enough to offset the drop in the overall nominal savings in all cases. Thus, there is marginal improvement in real investment.

The intersectoral effects are presented in Table 8.12. In SIM 3a textile and cotton lint and yarn exports increase but, the decline in export prices in the rest of the sectors due to the appreciation of the exchange rate results in lower exports in other sectors. In these other sectors, the change in the domestic price is much lower than the decline in the corresponding export prices, so the domestic market is relatively profitable compared to the export market. However, this is not the case for textile and cotton lint and yarn.

Domestic and exported cotton lint and yarn, and also textiles are assumed to be close substitutes given the high substitution elasticity parameters in these sectors (Appendix 2). Thus, a slight change in the relative price in favor of exports will result in significant increase in export volume. The decline in domestic prices (2.53 percent for cotton lint and yarn and 2.58 percent for textile) arising from improved productivity in SIM 3a is slightly higher than the drop in export prices (2.41 percent). This results in higher exports of 6.95 percent for textile and 7.66 percent for cotton lint and yarn. Since these two commodities account for 44 percent of total exports in the 2001-02 SAM, their combined export growth more than offset the decline in exports of the rest of the sectors. Thus, overall exports improve by 1.58 percent in SIM 3a, despite real exchange rate appreciation, as shown in Table 8.11.

Table 8.12—Intersectoral effects (% change from base) - SIM 3, Increase in total factor productivity

	Output		Domestic Demand		Invest-	Exports		Imports		Return to	
	x	Px	d	pd	ment	e	pe	m	pm	capital	land
	SIM 3a: 5% TFP increase in raw cotton; lint & yarn; and textile										
Raw Cotton	4.62	-3.75	4.62	-3.75	-2.86					-0.95	-0.95
Lint & yarn	5.21	-2.50	4.30	-2.53	0.65	7.66	-2.41	1.05	-2.42	0.83	
Textile	4.22	-2.51	2.43	-2.58	-5.53	6.95	-2.41	-1.89	-2.41	-2.31	
Agriculture	0.26	-0.16	0.31	-0.12	0.75	-2.48	-2.41	1.83	-2.42	0.88	-0.79
Excluding raw cotton	0.00	0.05	0.06	0.10	0.79	-2.48	-2.41	1.83	-2.42	0.90	-0.77
Industry	1.10	-0.99	0.78	-0.63	-1.21	2.32	-2.41	0.87	-2.41	-0.20	
Excluding lint & yarn, and textile	-0.34	-0.35	0.06	-0.02	-0.49	-2.86	-2.41	0.92	-2.41	0.14	
Services	0.11	0.24	0.15	0.36	0.92	-0.84	-2.41	3.57	-2.41	0.96	
Total	0.52	-0.31	0.40	-0.08	0.21	1.58	-2.41	1.04	-2.41	0.58	-0.79
	SIM 3b: 5% TFP increase in textile										
Raw Cotton	-0.82	-1.29	-0.82	-1.29	-4.74					-2.04	-2.04
Lint & yarn	-0.92	-1.11	2.35	-0.99	-7.46	-9.75	-1.48	16.07	-1.48	-3.45	
Textile	4.96	-1.62	2.54	-1.71	-0.82	8.63	-1.48	-3.20	-1.49	-0.05	
Agriculture	-0.04	-0.20	-0.01	-0.18	0.24	-1.26	-1.48	0.92	-1.48	0.49	-1.08
Excluding raw cotton	0.01	-0.14	0.03	-0.11	0.29	-1.26	-1.48	0.92	-1.48	0.51	-0.96
Industry	0.81	-0.58	0.63	-0.35	-0.89	1.54	-1.48	0.60	-1.48	-0.13	
Excluding lint & yarn, and textile	-0.21	-0.21	0.05	0.00	-0.34	-1.77	-1.48	0.55	-1.48	0.15	
Services	0.08	0.23	0.10	0.31	0.75	-0.55	-1.48	2.25	-1.48	0.74	
Total	0.34	-0.17	0.25	-0.02	0.12	1.06	-1.48	0.70	-1.48	0.41	-1.08
	SIM 3c: 5% TFP increase in raw cotton; and lint & yarn										
Raw Cotton	5.53	-2.47	5.53	-2.47	2.16					1.20	1.20
Lint & yarn	6.24	-1.38	1.87	-1.55	9.09	17.95	-0.97	-12.03	-0.97	4.58	
Textile	-0.71	-0.93	-0.11	-0.91	-4.79	-1.63	-0.97	1.44	-0.97	-2.30	
Agriculture	0.30	0.05	0.33	0.06	0.55	-1.27	-0.97	0.92	-0.97	0.40	0.30
Excluding raw cotton	-0.01	0.19	0.02	0.22	0.53	-1.27	-0.97	0.92	-0.97	0.39	0.20
Industry	0.29	-0.43	0.15	-0.29	-0.40	0.85	-0.97	0.30	-0.96	-0.10	
Excluding lint & yarn, and textile	-0.14	-0.16	0.02	-0.03	-0.33	-1.13	-0.97	0.37	-0.96	-0.05	
Services	0.04	0.01	0.05	0.06	0.22	-0.30	-0.97	1.32	-0.97	0.24	
Total	0.19	-0.15	0.15	-0.06	0.09	0.56	-0.97	0.37	-0.96	0.17	0.30

x: output; d: domestic demand ; e: exports ; m: imports; px: output price; pd: domestic price (including indirect tax); pe: export price in local currency; pm: import price in local currency

The simultaneous increase in TFP in the cotton, lint and yarn and textile sectors leads to higher output. The sectoral output prices drop, but less than the increase in the corresponding output. With the drop in the domestic price higher than the drop in the import price households will increase their purchase of domestically produced textile. Thus, domestic demand for textile improves by 2.43 percent while imports decline by 1.89 percent.

The relatively higher growth in output of cotton lint and yarn can be attributed to its higher export growth (7.66 percent) as well as to higher domestic demand (4.3 percent) from the textile industry. The increase in import demand for cotton lint and yarn (1.05 percent) is also due to the raw material requirements of higher output in the textile industry. The increase in domestic output of raw cotton of 4.62 percent is due to the demand pull effects from the cotton lint and yarn sector.

SIM 3b involves higher TFP in the textile sector only. This increases its output by 4.96 percent. Its output price declines by 1.62 percent while its domestic price by 1.71 percent. Since the drop in its export price of 1.48 percent, due mainly to the appreciation exchange rate, is lower than the drop in its domestic price, it generates a relative price change that favors the export market. The change in the relative price results in higher export growth of 8.63 percent, given the high elasticity of substitution. Furthermore, the relative price change favors domestic demand over imports. Since the drop in the domestic price of textile (1.71 percent) is relatively higher than the drop in the import price (1.49 percent), households increase their purchases of domestically produced textile (2.54 percent). Imports of textile decline by 3.2 percent.

Because there is no TFP shock imposed on the cotton lint and yarn sector under SIM 3b, it becomes relatively uncompetitive in the export market with the appreciation of the exchange rate. Thus, its exports drop by 9.75 percent. However, it switches output toward domestic demand which increases by 2.35 percent because of the input requirement of the 4.96 percent growth in the output of the textile sector. This is not enough to offset the decline in exports. Thus, output of cotton lint and yarn drops by 0.92 percent. The improvement in the domestic demand does not fully satisfy the input requirements of the textile sector which also increases imports by 16.07 percent. The net drop in the output of the cotton lint and yarn sector results in lower demand for raw cotton by 0.82 percent.

In SIM 3c, we increase the TFP of both cotton lint and yarn and raw cotton but not textile. Since these two sectors are closely linked and since raw cotton sells only to the domestic cotton lint and yarn sector, the effects reinforce one another in these two sectors. The 2.47 percent decline in the price of raw cotton results in a 1.55 percent drop in the domestic price of cotton lint and yarn. This improves the price competitiveness of cotton lint and yarn despite the appreciation of the exchange of 0.97 percent. Thus, its exports improve by 17.95 percent. Its output improves by 6.24 percent, while its demand for materials from the raw cotton sector improves by 1.87 percent. Output of raw cotton also improves by 5.53 percent while its price declines by 2.47 percent. Since there is no improvement in TFP in the textile sector, the appreciation of the exchange rate of 0.97 percents results in a decline in its exports by 1.63 percent. There is a drop in its output by 0.71 percent.

The effects on factor prices are presented in Table 8.13. In SIM 3a and SIM 3b the TFP increases generate negative effect on the wage of farm labor and the average returns to land, particularly in the latter case. There are positive effects on the other factor prices. Under SIM 3c, factor prices in real terms improve.

Table 8.13—Factor Price Effects (% change from base) SIM 3, Increase in total factor productivity

	SIM 3a /1/		SIM 3b		SIM 3c	
Factor Prices	**Real /2/**	**Nominal**	**Real**	**Nominal**	**Real**	**Nominal**
Skilled labor	0.18	-0.02	0.16	0.02	0.05	-0.03
Unskilled farm labor	-0.45	-0.65	-1.08	-1.22	0.70	0.62
Unskilled workers	0.59	0.39	0.45	0.31	0.16	0.08
Average returns to capital	0.78	0.58	0.54	0.41	0.25	0.17
Average returns to land	-0.59	-0.79	-0.94	-1.08	0.38	0.30

/1/ SIM 3a : 5% TFP increase in raw cotton; lint & yarn; and textile
SIM 3b : 5% TFP increase in textile
SIM 3c : 5% TFP increase in raw cotton; and lint & yarn
/2/ Less household CPI

The effects on household income in real terms are presented in Table 8.14. For all household groups, SIM 3a generates the highest improvement in income (0.37 percent overall). The improvement in household income declines under SIM 3b and SIM 3c. Real income of rural farmers declines in the case where only the TFP in the textile sector is increased.

The poverty effects of improved TFP are summarized in Table 8.15. There is a reduction in poverty in all cases. The highest decline in poverty is realized in the case where TFP in the raw cotton, cotton lint and yarn, and textile sectors are increased by 5

percent simultaneously. Rural poverty falls by less than urban poverty. Except I the case of TFP improvement only in the raw cotton and lint and yarn sectors (SIM 3c).

Table 8.14—Real income effects - SIM 3, Increase in total factor productivity

	Population Distribution, %	Real Income Change, % from base		
		SIM 3a /1/	SIM 3b	SIM 3c
Pakistan		0.37	0.22	0.16
Urban	28.6	0.41	0.30	0.11
Urban poor	8.1	0.43	0.34	0.09
Rural	71.4	0.33	0.13	0.20
Farmers /2/	34.2	0.19	-0.05	0.25
Workers /3/	6.6	0.45	0.36	0.09
Other rural households /4/	30.7	0.55	0.41	0.14
Other rural poor households	16.8	0.54	0.41	0.13

/1/ SIM 3a : 5% TFP increase in raw cotton; lint & yarn; and textile
SIM 3b : 5% TFP increase in textile
SIM 3c : 5% TFP increase in raw cotton; and lint & yarn
/2/ Large, medium, small, and landless in Punjab, Sindh, and other Pakistan
/3/ Landless agricultural workers in Punjab, Sindh, and other Pakistan
/4/ Non-farm rural households

Table 8.15—Poverty effects (% change from base) SIM 3, Increase in total factor productivity

	Pakistan	Urban	Rural
		SIM 3a /1/	
Poverty Headcount	-1.67	-1.80	-1.63
Poverty Gap	-1.96	-1.73	-2.03
Poverty Severity	-2.35	-2.01	-2.45
		SIM 3b	
Poverty Headcount	-0.87	-1.42	-0.69
Poverty Gap	-1.28	-1.39	-1.25
Poverty Severity	-1.56	-1.61	-1.54
		SIM 3c	
Poverty Headcount	-0.59	-0.29	-0.69
Poverty Gap	-0.71	-0.37	-0.80
Poverty Severity	-0.82	-0.42	-0.94

/1/ SIM 3a : 5% TFP increase in raw cotton; lint & yarn; and textile
SIM 3b : 5% TFP increase in textile
SIM 3c : 5% TFP increase in raw cotton; and lint & yarn

8.4 Increase in Production Subsidy

This section discusses the effects of 5 percent production subsidies. In SIM 4a, the subsidy is given to the textile sector only. In SIM 4b, it is given to the cotton lint and yarn sector, while in SIM 4c to the raw cotton sector.

As discussed in Section 7, we introduce two changes in the macroeconomic closure of the model in analyzing production subsidies under SIM 4. We fix government savings, SAVG. In fixing this variable, we introduce a compensatory consumption tax, nctx, which is endogenously determined in the model. The tax automatically increases if government revenue declines as a result of the provision of a production subsidy. The burden of is therefore passed on to the households. Furthermore, since we originally assume savings of firms to be fixed by making dividend payments to the domestic households endogenous, the increase in income of firms as a result of a production subsidy will be passed on automatically to the household groups which own the firms. Thus, the deadweight loss of the subsidy will be reflected in the overall net welfare loss of households. But the effects across household groups will vary depending upon their initial endowments and assets. Some household groups will be worse off while others will be better off.

If the subsidy is given to the textile industry (SIM 4a), its output price increases by 2.97 percent while its domestic price decreases by 2.28 percent. Textile output improves by 5.67 percent. The relative price change that favors exports over domestic demand leads to exports of textile increasing by 10 percent. This results in a real

appreciation of the exchange rate by 2.01 percent (Table 8.16). Furthermore, because of its large share in total exports, the high export growth offsets a decline in exports of the rest of the sectors due to the real exchange rate appreciation. Thus, overall exports of the economy improve by 0.85 percent. The appreciation also results in lower prices (export price, import price, composite price, consumer price and price of investment) and lower foreign savings in domestic currency by 3.37 billion rupees. Total income of the government improves by 8.99 percent because of the compensatory consumption tax. But there is no change in the budget balance of the government. There is a marginal increase in the overall savings of households, but not enough to offset the drop in foreign savings in domestic currency. Thus, overall nominal savings of the economy declines. The decline in the price of investment of 0.39 percent is not enough to offset the drop in the overall nominal savings. Therefore, overall real investment drops by 0.17 percent.

Because of the appreciation of the exchange rate from a textile production subsidy, exports of cotton lint and yarn drop by 12.61 percent (Table 8.17). The increase in domestic demand of 2.41 percent is not enough to offset the drop in exports. Thus overall output of cotton lint and yarn drops by 1.65 percent. This in turn results in lower output of raw cotton by 1.48 percent. Higher imports of cotton lint and yarn, together with the higher domestic demand, provide the input requirements of higher output in the textile sector.

Table 8.16—Macro effects - SIM 4, Increase in production subsidy

	SIM 4a /1/	SIM 4b	SIM 4c
	% change from base		
Real consumption	0.23	0.02	0.02
Real investment	-0.17	0.00	0.00
Real exports	0.85	0.25	0.07
Real import	0.56	0.17	0.05
Real exchange rate	-2.01	-0.82	-0.25
Export prices	-2.01	-0.82	-0.25
Import prices	-2.01	-0.82	-0.24
Household CPI /2/	-0.06	-0.03	-0.02
Composite price	-0.07	-0.01	-0.06
Domestic price	-0.41	-0.10	-0.10
Price of investment	-0.39	-0.32	-0.10
	billion rupees		
Government balance	0.00	0.00	0.00
Total government income	8.99	0.92	0.24
Tariff revenue	-0.76	-0.20	-0.06
Indirect tax revenue	10.17	0.91	0.24
Direct tax revenue	0.90	-0.33	-0.10
Other revenue	-1.31	0.54	0.16
Total household savings	0.43	-0.34	-0.11
Foreign savings	-3.37	-1.37	-0.42
Firm savings	0.0	0.0	0.0

/1/ SIM 4a : 5% increase in production subsidy to the textile sector
SIM 4b : 5% increase in production subsidy to the cotton lint & yarn sector
SIM 4c : 5% increase in production subsidy to the raw cotton sector
/2/ Composite price weighted by consumption expenditure

Table 8.17—Intersectoral effects (% change from base) - SIM 4, Increase in production subsidy

	Output		Domestic Demand		Invest-	Exports		Imports		Return to	
	X	Px	d	pd	ment	e	pe	m	pm	capital	land
	SIM 4a : 5% increase in production subsidy to the textile sector										
Raw Cotton	-1.48	-3.17	-1.48	-3.17	-11.31					-5.34	-5.34
Lint & yarn	-1.65	-1.55	2.41	-1.39	-10.38	-12.61	-2.01	20.02	-2.02	-4.84	
Textile	5.67	2.97	2.77	-2.28	45.04	10.07	-2.01	-4.04	-2.01	21.05	
Agriculture	-0.18	-1.68	-0.18	-1.67	-4.48	-0.52	-2.01	0.12	-2.01	-1.77	-4.08
Excluding raw cotton	-0.11	-1.59	-0.10	-1.58	-4.41	-0.52	-2.01	0.12	-2.01	-1.73	-3.93
Industry	0.60	0.14	0.41	-0.67	4.00	1.36	-2.01	0.45	-2.01	2.11	
Excluding lint & yarn, and textile	-0.63	-0.50	-0.30	-0.26	-3.11	-2.69	-2.01	0.38	-2.01	-1.14	
Services	-0.14	0.32	-0.09	0.42	-0.96	-1.12	-2.01	2.73	-2.01	0.03	
Total	0.14	-0.15	0.06	-0.41	-0.17	0.85	-2.01	0.56	-2.01	0.29	-4.08
	SIM 4b: 5% increase in production subsidy to the cotton lint & yarn sector										
Raw Cotton	4.07	3.98	4.07	3.99	18.19					8.43	8.43
Lint & yarn	4.60	4.06	1.25	-1.28	41.66	13.58	-0.82	-9.73	-0.82	18.71	
Textile	-0.74	-0.79	-0.25	-0.77	-4.29	-1.49	-0.82	1.00	-0.82	-2.42	
Agriculture	0.07	0.50	0.11	0.53	-0.71	-1.79	-0.82	0.94	-0.82	-0.62	1.67
Excluding raw cotton	-0.16	0.30	-0.13	0.32	-0.91	-1.79	-0.82	0.94	-0.82	-0.72	0.85
Industry	0.07	0.03	-0.03	-0.31	1.21	0.48	-0.82	0.11	-0.82	0.21	
Excluding lint & yarn, and textile	-0.24	-0.21	-0.12	-0.12	-1.17	-0.97	-0.82	0.17	-0.82	-0.85	
Services	-0.05	-0.27	-0.04	-0.25	-0.48	-0.30	-0.82	0.74	-0.82	-0.50	
Total	0.02	0.00	-0.01	-0.10	0.00	0.25	-0.82	0.17	-0.82	-0.30	1.67
	SIM 4c: 5% increase in production subsidy to the raw cotton sector										
Raw Cotton	1.20	1.17	1.20	-3.89	5.14					2.46	2.46
Lint & yarn	1.36	-0.35	0.38	-0.39	11.03	3.97	-0.25	-3.09	-0.25	5.28	
Textile	-0.22	-0.24	-0.07	-0.23	-1.29	-0.44	-0.25	0.29	-0.25	-0.73	
Agriculture	0.02	0.14	0.04	-0.14	-0.09	-0.53	-0.25	0.28	-0.25	-0.13	0.49
Excluding raw cotton	-0.04	0.08	-0.03	0.08	-0.14	-0.53	-0.25	0.28	-0.25	-0.15	0.25
Industry	0.02	-0.13	-0.01	-0.10	0.26	0.14	-0.25	0.03	-0.24	0.04	
Excluding lint & yarn, and textile	-0.07	-0.07	-0.03	-0.04	-0.35	-0.29	-0.25	0.05	-0.24	-0.26	
Services	-0.02	-0.08	-0.01	-0.08	-0.14	-0.09	-0.25	0.22	-0.25	-0.15	
Total	0.01	-0.06	0.00	-0.10	0.00	0.07	-0.25	0.05	-0.24	-0.08	0.49

x: output; d: domestic demand ; e: exports ; m: imports; px: output price; pd: domestic price (including indirect tax); pe: export price in local currency; pm: import price in local currency;

Table 8.18 indicates that since raw cotton is negatively affected, the impact on the wage of farm labor and the average returns to land is negative as well. The effect on the wage of unskilled workers is also negative, but there are increases in wages of skilled labor and returns to capital that are used intensively in textile production.

Table 8.18—Factor price effects (% change from base) - SIM 4, Increase in production subsidy

	SIM 4a /1/		SIM 4b		SIM 4c	
Factor Prices	**Real /2/**	**Nominal**	**Real**	**Nominal**	**Real**	**Nominal**
Skilled labor	1.81	1.75	0.06	0.03	0.01	-0.01
Unskilled farm labor	-4.06	-4.12	3.59	3.56	1.05	1.03
Unskilled workers	-0.09	-0.15	-0.23	-0.26	-0.06	-0.08
Average returns to capital	0.35	0.29	-0.27	-0.30	-0.06	-0.08
Average returns to land	-4.02	-4.08	1.70	1.67	0.51	0.49

/1/ SIM 4a : 5% increase in production subsidy to the textile sector
SIM 4b : 5% increase in production subsidy to the cotton lint & yarn sector
SIM 4c : 5% increase in production subsidy to the raw cotton sector
/2/ Less household CPI

Overall household income in real terms declines by 0.05 percent. Income of urban non-poor improves by 0.58 percent (Table 8.19). This improvement is taken from the income of rural households (which declines by 0.71 percent) and poor urban households (which declines by 0.14 percent). As a result, a production subsidy to the textile sector raises levels of poverty. All poverty indices under SIM 4a indicate higher poverty, especially in the rural areas (Table 8.20).

Table 8.19—Real Income effects - SIM 4, Increase in production subsidy

	Population	Real Income Change, % from base		
	Distribution, %	SIM 4a /1/	SIM 4b	SIM 4c
Pakistan		-0.05	-0.01	0.00
Urban	28.6	0.58	-0.17	-0.05
Urban poor	8.1	-0.14	-0.33	-0.09
Rural	71.4	-0.71	0.16	0.05
Farmers /2/	34.2	-1.22	0.49	0.15
Workers /3/	6.6	0.00	-0.37	-0.10
Other rural households /4/	30.7	0.05	-0.31	-0.09
Other rural poor households	16.8	0.08	-0.37	-0.10

/1/ SIM 4a : 5% increase in production subsidy to the textile sector
SIM 4b : 5% increase in production subsidy to the cotton lint & yarn sector
SIM 4c : 5% increase in production subsidy to the raw cotton sector
/2/ Large, medium, small, and landless in Punjab, Sindh, and other Pakistan
/3/ Landless agricultural workers in Punjab, Sindh, and other Pakistan
/4/ Non-farm rural households

The results under SIM 4b, which involves a production subsidy to cotton lint and yarn, can be interpreted in the same way. Its output price increases by 4.06 percent, while its domestic price declines by 1.28 percent (Table 8.17). Its output improves by 4.6 percent. Its exports improve by 13.58 percent because there is higher decline in domestic price (-1.28 percent) relative to the drop in its export price (0.82 percent). Since the share of exports of cotton lint and yarn to the overall exports is smaller (about 12 percent) compared to the share textile exports, the impact on the real appreciation of the exchange rate is significantly lower. The exchange rate appreciates only by 0.82 percent. The increase in cotton lint and yarn exports is enough to offset the drop in exports of the rest of the sectors. Thus overall exports of the economy improve by 0.25 percent (Table 8.16). There is a drop in the overall nominal savings. However, the decline in the price of investment is just enough to offset the drop in nominal savings (investment). Thus overall real investment does not change.

The improvement in output of cotton lint and yarn translates to higher output and price for raw cotton. This improves the wage of farm labor and the average returns to land shown in Table 8.18. The decline in the average returns to capital and the wage of unskilled workers can be attributed to the slight decline in the output of the textile sector.

Table 8.20—Poverty Effects (% change from base) SIM 4, Increase in production subsidy

	Pakistan	Urban	Rural
		SIM 4a /1/	
Poverty Headcount	1.05	0.00	1.39
Poverty Gap	1.58	0.59	1.87
Poverty Severity	1.76	0.69	2.07
		SIM 4b	
Poverty Headcount	0.09	0.47	-0.03
Poverty Gap	0.72	1.35	0.53
Poverty Severity	0.95	1.58	0.77
		SIM 4c	
Poverty Headcount	0.11	0.19	0.09
Poverty Gap	0.19	0.38	0.13
Poverty Severity	0.24	0.45	0.19

/1/ SIM 4a : 5% increase in production subsidy to the textile sector
SIM 4b : 5% increase in production subsidy to the cotton lint & yarn sector
SIM 4c : 5% increase in production subsidy to the raw cotton sector

Overall real household income drops marginally by 0.01 percent. The drop in the output of the textile sector translates to lower income of urban non-poor households which declines by 0.17 percent. The drop in the income of urban poor is due to lower wage of unskilled workers and lower average returns to capital. Both of these are also responsible for the drop in income of rural non-farmers. However, rural farmers will benefit because of the positive effect on raw cotton.

The poverty effects under SIM 4b again show increasing poverty. But there is a very slight decline in rural poverty headcount index due to the increase in income of rural farmers.

The impacts of a production subsidy to raw cotton under SIM 4c are relatively small. It will have slightly favorable effects on the sector in terms of output and factor prices. There is zero change in the overall real income of households. But there are differential effects across household groups. Urban households and rural non-farmers are worse off, while farmers are better off. Poverty deteriorates in both urban and rural areas.

9. SUMMARY AND POLICY INSIGHTS

In this section we summarize the results generated from the various simulation scenarios and then discuss the policy implications. Table 9.1 summarizes the income and poverty effects across household groups. The highest increase in household income and reduction in poverty occurs where foreign savings increase by 100 percent (SIM 1). Investments improve significantly. The real exchange rate appreciates resulting in lower exports and higher imports. Meanwhile, production of non-tradables, such as construction, improves, and sectors that supply materials to the construction sector, such as cement and bricks, improve. There is significant movement of resources, especially labor, towards these sectors. As a result, factors heavily used in these sectors, such as skilled and unskilled labor and capital, receive higher prices. Thus, urban households and rural non-farmers benefit. Urban poverty incidence therefore declines. But the production of tradables, including the cotton lint and textile industries, contracts, and in general, the

agricultural sector declines. Wages of farm labor and the average returns to land drop. Despite the drop in the income of rural farmers, rural poverty incidence declines because rural non-farmers benefit from higher wages of unskilled workers and the improvement in the average returns to capital.

The results of SIM 2a where the world prices of cotton lint and yarn increase by 20 percent, which is about the magnitude that would have offset the price decrease Pakistani industries experienced in the late 1990s, indicate an increase in overall household income and a reduction in poverty. However, the effects vary across household groups. Rural farmers benefit from higher wages of farm labor and the average returns to land. Rural poverty declines. This is due to the demand pull effects on raw cotton production. On the other hand, the impact on textile production is negative because the increase in the world prices of cotton lint and yarn makes exports relatively profitable compared to domestic sales to the local textile industry. This highlights the dependence of the domestic textile industry on the availability of domestically produced raw materials. The decline in textile production leads to lower prices of factors used in its production such as skilled labor and capital. As a result, urban households and rural non-farmers experience lower income. Urban poverty increases.

Table 9.1—Summary

	Overall increase in income	Urban		Rural					Change in Poverty Headcount		
						Agricultural	Non-farmers				
		All	Poor	All	Farmers	Workers	All	Poor	All	Urban	Rural
SIM 1	1.31%	+	+	+	-	+	+	+	-6.63%	-7.41%	-6.38%
SIM 2a	0.25%	-	-	+	+	-	-	-	-0.80%	1.90%	-1.66%
SIM 2b	0.40%	+	+	+	-	+	+	+	-0.96%	-1.23%	-0.87%
SIM 2c	0.59%	+	-	+	+	-	-	-	-2.01%	0.00%	-2.65%
SIM 3a	0.37%	+	+	+	+	+	+	+	-1.67%	-1.80%	-1.63%
SIM 3b	0.22%	+	+	+	-	+	+	+	-0.87%	-1.42%	-0.69%
SIM 3c	0.16%	+	+	+	+	+	+	+	-0.59%	-0.29%	-0.69%
SIM 4a	-0.05%	+	-	-	-	/a/	/a/	/a/	1.05%	0.00%	1.39%
SIM 4b	-0.01%	-	-	+	+	-	-	-	0.09%	0.47%	-0.03%
SIM 4c	0.00%	-	-	+	+	-	-	-	0.11%	0.19%	0.09%

SIM 1 : Increase in Foreign Savings
SIM 2a : 20% increase in world prices of lint & yarn
SIM 2b : 5% increase in world prices of textile
SIM 2c : combination of SIM 2a and 2b
SIM 3a : 5% TFP increase in raw cotton; lint & yarn; and textile
SIM 3b : 5% TFP increase in in textile
SIM 3c : 5% TFP increase in raw cotton; and lint & yarn
SIM 4a : 5% increase in production subsidy to the textile sector
SIM 4b : 5% increase in production subsidy to the lint & yarn sector
SIM 4c : 5% increase in production subsidy to the raw cotton sector
/a/ almost zero

The impact of a 5 percent increase in the world prices of textile in SIM 2b, which would have offset the decrease in world prices in the late 1990s, indicates an improvement in the overall household income and a reduction in poverty. Textile production increases because of higher exports. The increase in production results in higher factor demand and prices of skilled labor and the average returns to capital. Thus, urban households and rural non-farmers benefit. On the other hand, the increase in textile exports results in a real exchange rate appreciation because textile is a major export commodity of Pakistan. This makes other sectors, including the cotton lint and yarn sector, less competitive. Exports of cotton lint and yarn decline while imports increase. This decreases the domestic production of cotton lint and yarn, which in turn leads to lower demand for domestically produced raw cotton. Demand for farm labor declines. Wages of farm labor decrease as well as the average returns to capital. Rural farmers therefore experience lower income.

Historically, the world prices of cotton lint fluctuate more than the world prices of yarn and fabric. But they generally move in the same direction. The impact of a joint scenario in SIM 2c combining the 20 percent increase in the world price of cotton lint and yarn and the 5 percent increase in the world price of textile is a relatively higher increase in household income and higher reduction in poverty.

Increasing TFP simultaneously by 5 percent in raw cotton, cotton lint and yarn, and textile in SIM 3a improves overall household income by 0.37 percent. All household groups experience higher income. The variation in the change in income is not as large as

in the previous cases. All poverty indicators decline. The drop in urban poverty is slightly higher than the decline in rural poverty.

The increase in income, as well as the reduction in poverty, is reduced if the TFP shock is not introduced simultaneously in all cotton-related sectors. If the increase in TFP occurs in the textile sector only in SIM 3b, overall household income improves by 0.22 percent. The increase in output of the textile sector drives strong exports. Since textiles contribute significantly to the overall exports of the country, the real exchange rate appreciates. This in turn makes the cotton lint and yarn sector as well as the rest of the tradable sectors less competitive. Exports in these sectors decline while imports increase. This leads to lower domestic production particularly in the cotton lint and yarn sector. Thus the demand for raw cotton production declines. Rural farmers experience lower income as a result of lower wages of farm labor and declining average returns to land.

The raw cotton sector cannot take full advantage of the export market arising from improved productivity if there are bottlenecks in the ginning and spinning processing sectors. Thus we increase simultaneously the TFP of both the raw cotton and the cotton lint and yarn sectors in SIM 3c. Overall household income improves by 0.16 percent, which is lower than in the previous two scenarios. The reduction in poverty is also relatively lower. The impact on rural households is relatively larger than urban households. Exports of cotton lint and yarn improve. There is a demand pull effect on raw cotton production. Because the share of cotton lint and yarn to the overall exports is much lower than the share of textiles, the real exchange rate appreciation is lower also. There is minimal decline in exports and output of the textile industry as a result.

Finally, in the analysis of production subsidies to the cotton-textile industries a general compensatory consumption tax is included to maintain the overall savings of the government constant in the analysis. The impact of the production subsidy is negative for overall household income. Poverty worsens in both urban and rural areas. In SIM 4a, a production subsidy to the textile sector increases the output price of textiles and decreases the domestic price. Owners of the textile firms, which belong to urban non-poor households, benefit from higher output price. But urban poor and rural households experience lower net income because of higher general taxes. A production subsidy to the cotton lint and yarn sector in SIM 4b also results in lower overall net income of households. Rural farmers benefit, but this comes at the expense of lower income for urban poor and rural non-farmers. A production subsidy to raw cotton in SIM 4c generates zero overall household income effect. Similar to SIM 4b, rural farmers benefit in terms of higher net income but both urban poor and rural non-farmers suffer.

The size of the entire cotton-textile-apparent industry in Pakistan is large. Therefore, as our analysis demonstrates, changes within the industry could have significant ripple effects on the rest of the economy, and vice versa. As such, it is necessary for policymakers to have a good understanding of the economic linkages between the industry and the rest of the economy because major developments are taking place within Pakistan and in the international markets. After world cotton prices fell nearly 60 percent between 1994 and 2001, they have recovered by more than 30 percent between 2001 and 2005. Pakistan experienced a surge in foreign savings of more than 100 percent after the 9/11 2001 incident in the United States. At the same time foreign

remittances to households increase from US$ 1 billion in 2001 to $4.6 billion in 2005. The textile and clothing world trade has been liberalized since January 1, 2005.

While the surge in foreign savings and the improvement in remittances are positive developments for Pakistan, they tend to strengthen the currency which has negative effects on the competitiveness of the tradable sectors, including the cotton-textile-apparel industry. These effects are important to consider because the international markets for textile and clothing is becoming more price sensitive with the liberalization. In the new international trading arrangements, suppliers that lose competitiveness can expect to suffer losses in market shares. Pakistan is competitive in the world market in a number of textile product lines such as bed wear, towels and cleaning cloths, other textile made-ups, and hosiery. Given the dominance of China in the overall market for textile and clothing and its potential for further expansion, Pakistan cannot afford to lose competitiveness or its world market shares in these product niches.

The improvement in the world prices of cotton and textile have positive effects on the industry as well as on those households that depend on the industry. Exports increase and drive up domestic production. However, because of the size of its exports relative to the overall exports of Pakistan, higher exports create pressure on the exchange rate to appreciate. This has negative effects on income of households coming from abroad. This has negative price effects on tradable sectors outside of the cotton-textile-apparel value chain and on income of households coming from abroad. Given Pakistan's limited industrial/manufacturing base, the effort to improve the base through industrial diversification could be hampered especially if the appreciation is sustained.

There is a need for Pakistan to improve productivity in all stages of the cotton-textile-apparel value chain. In raw cotton production, yield has to improve. Yield can improve if cotton virus attacks and other pest infestations are addressed and controlled. The adoption of technological innovations such as the development of new cotton varieties that are tolerant of insects, including Bt cotton, offers promise. In the experiences of India and other major cotton-producing developing countries that adopt the Bt cotton technology, cotton yield can improve substantially. Other farm management and best practices suggested by industry analysts could also potentially improve yields.

Cotton produced in Pakistan is of low quality because of contamination which occurs in various stages of the production and marketing chain. As a result, Pakistan produces one of the most contaminated cotton. This negatively affects its price in the international market. To reduce contamination and improve the quality of cotton would require standardization in the ginning sector. The ginning sector also requires upgrading of old technology and primitive saw gins.

The spinning sector produces yarn that is of lower count. This type of yarn commands lower price in the international market. The production of yarn in Pakistan with lower counts is excessive and thus its export earnings are considerably less than their potential. Furthermore, modernization in the production of yarn requires increased use of man-made fibers since the market for cotton in the international market has been volatile and there is growing demand for blended (cotton/polyester) fibers. However, the domestic man-made fiber manufacturers in Pakistan are still uncompetitive relative to the world market. Thus, the weaving sector is too dependent on cotton fibers. Pakistan is

producing less blends compared to its competitors. Although the production shares of blended and dyed and printed cloth have improved lately, Pakistan still concentrates on the production of grey cloth which is unprocessed and commands low price in the world market.

Lastly, investing in productivity improvement such as the establishment of research and development facilities which are practically non-existent in Pakistan, the development of human resources and skills which are critically needed, and the adoption of best practices at various stages of the cotton-textile-apparel value chain is far better than giving production subsidies to the industry. Improvement in productivity is income-augmenting and poverty-reducing. Production subsidies on the other hand result in welfare losses. They narrowly benefit primarily the owners of the industry.

At present, because of data constraints in the 2001-02 SAM, the analysis in the CGE model is limited to the interactions among raw cotton, cotton lint and yarn, textile, and the rest of the economy. A richer model specification would include a breakdown of cotton lint and yarn into two separate sectors of cotton lint and cotton yarn, textile into two separate sectors of cotton fabric and synthetic fabric, and a separate sector for garments and apparel. Behavioral specification for each of these sectors and the rest of the economy could provide richer insights along the lines highlighted in this report.

REFERENCES

Altaf, Z. 2007. "Challenges in the Pakistan Cotton, Yarn, Textile and Apparel sectors". Chapter 5 in "Studies of the Cotton-Textile-Apparel Industries in Pakistan and India". A Paper submitted to the World Bank.

Annabi, N., Cockburn, J., and Decalawe, B. 2006. "Functional Forms and Parameterization of CGE Models". MPIA Working Paper Series 2006-04. http://www.pep-net.org/

Annabi, N., Khonder, B., Raihan, S., Cockburn, J. and Decaluwe, B. 2005. "Implications of WTO Agreements and Unilateral Trade Policy Reforms for Poverty in Bangladesh: Short versus Long-Run Impacts" .Chapter 15 in *Poverty and the WTO: Impacts of the Doha Development Agenda.* Hertel T and L A Winters, (eds.), 2006. Palgrave Macmillan and The World Bank. pp. 375-402.

Baffes, John. 2004. "Cotton: Market Setting, Trade Policies, and Issues". Chapter 14 of "Global Agricultural Trade and Developing Countries". Aksoy, M and Beghin, J. (eds). World Bank.

Bourguignon, D. Branson, W W. H. and J. de Melo. 1989. Macroeconomic Adjustment and Income Distribution: A Macro-Micro Simulation Model. OCED, Technical Paper No. 1

Centre for International Economics (CIE). 2001. Trade Distortions and Cotton Markets: Implications for Australia Cotton Producers. Report prepared for the Cotton Research and Development Corporation, Canberra.

Cockburn, J., (2001) Trade Liberalisation and Poverty in Nepal: A Computable General Equilibrium Micro Simulation Analysis. Centre de Recherche en Économie et Finance Appliquées: Discussion Paper 01-18, Universite Laval, Quebec, Canada.

Cockburn, J. Fofana, I. Decaluwe, B., Mabugu, R. and Chitiga, M. 2006. "A Gender focused Macro-Micro Analysis of the Poverty Impacts of Trade Liberalization in South Africa" *Review of Income and Inequality*. (forthcoming)

Cororaton, C. B. and Cockburn, J., Corong, E, 2007 "Doha Scenarios, Trade Reforms, and Poverty in the Philippines: A CGE Analysis" Chapter 13 in *Poverty and the WTO: Impacts of the Doha Development Agenda.* Hertel T and L A Winters, (eds.), 2006. Palgrave Macmillan and The World Bank. pp. 375-402.

Cororaton, C. B. and Cockburn, J 2007 "Trade Reform and Poverty – Lessons from the Philippines: A CGE Microsimulation Analysis".*Journal of Policy Modeling*. (2007). Volume 29, Issue 1, pp 141-163.

Cotton Commodity Notes. 2006, http://www.fao.org/es/ESC/en/20953/22215/highlight_28507en_p.html.

De Janvry, A., Sadoulet, E., and Fargeix, A. (1991) Politically Feasible and Equitable Adjustment: Some Alternatives for Ecuador. *World Development* 19(11): 1577-1594.

Decaluwé, B., Dumot, J., Robichaud, V. 2000. "MIMAP Training Session on CGE Modeling. Volume II: Basic CGE Models". http://www.pep-net.org/

Decaluwé, B., Dumont, J. C., & Savard, L. 1999. Measuring Poverty and Inequality in a Computable General Equilibrium Model. CREFA, Université Laval: Working paper 99-20, Quebec, Canada.

Decaluwé, B., Patry, A., Savard, L., Thorbecke. 1999. "Poverty Analysis Within a General Equilibrium Framework". African Economic Research Consortium Working Paper 99-09, June.

Dorosh, P., M. K. Niazi, and Hina Nazli. 2004. A Social Accounting Matrix for Pakistan, 2001-02: Methodology and Results. South Asia Rural Development Unit of the World Bank, A Background Research Paper for the Pakistan Rural Factor Markets Study.

Economic Research Service, United States Department of Agriculture (http://www.ers.usda.gov/data/fibertextiletrade/)

Emmie, C., J. Cockburn and B. Decaluwe. 2005. "The Poverty Impacts of the Doha Round in Cameroon: The Role of Tax Policy".Chapter 12 in *Poverty and the WTO: Impacts of the Doha Development Agenda.* Hertel T and L A Winters, (eds.), 2006. Palgrave Macmillan and The World Bank. pp. 375-402.

Federal Bureau of Statistics. 2003. Household Integrated Economic Survey. Round 4: 2001–02. Islamabad: Government of Pakistan.

Food and Agriculture Organization (FAO). 2004. Cotton: Impact of Support Policies on Developing Countries, A Guide to Contemporary Analysis. Trade Policy Brief No. 1. Rome: FAO.

Foster, J., J. Greer, and E. Thorbecke. 1984. A Class of Decomposable Poverty Measures. *Econometrica* 52 (3): 761–66.

Ganuza, E., Barros, R., Vos, R. 2002. "Labor Market Adjustment, Poverty and Inequality During Liberalization' in Rob Vos, Lance Taylor and Ricardo Paes de Barros, R. (eds.) Economic Liberalization, Distribution and Poverty: Latin America in the 1990s, Cheltenham (UK) and Northampton (US): Edward Elgar Publishing, pp. 54-88.

Goreaux, Louis. 2003. Prejudice Caused by Industrialized Countries Subsidies to Cotton Sector in Western and Central Africa. Background document to the submission made by Benin, Burkina Faso, Chad, and Mali to the World Trade Organization (WTO).

Government of Pakistan. 2000. *Agriculture Census 2000*. Lahore: Agriculture Census Organization.

———. 2004. *Pakistan Economic Survey 2003–04*. Islamabad: Ministry of Finance.

International Cotton Advisory Committee (ICAC). 2003. *Production and Trade Policies Affecting the Cotton Industry*. Washington, DC: ICAC.

International Trade Statistics. http://www.intracen.org/tradstat/sitc3-3d/indexpe.htm

Jung, H. S. and Thorbecke, E. 2003. The Impact of Public Education Expenditure on Human Capital, Growth, Poverty in Tanzania and Zambia: A General Equilibrium Approach. *Journal of Policy Modeling*. 25: 701-725

Keeney, R. and T. Hertel. 2004. 'GTAP-AGR: A Framework for Assessing the Implications of Multilateral Changes in Agricultural Policies', GTAP Technical Paper No. 24, Purdue University, West Lafayette. https://www.gtap.agecon.purdue.edu/resources/tech_papers.asp

Lofgren, H., Harris, R., Robinson, S., Thomas, M., and El-Said, M. 2002. A Standard Computable General Equilibrium (CGE) Model in GAMS. International Food Policy Research Institute.

The News. January 5, 2007. http://www.checkbiotech.org/blocks/dsp_document.cfm?doc_id=14159

Martin, W. 2004. "Textile and Clothing Policy Note: Implications for Pakistan of Abolishing Textile and Clothing Export Quotas" Manuscript. World Bank.

Nordias, H. 2004. "The Global Textile and Clothing Industry Post the Agreements of Textiles and Clothing" Discussion Paper No. 5 World Trade Organization, Geneva, Switzerland.

Orden, D., Salam, A., Dewina, R., Nazli, H., and Minot, N. 2006. "The Impact of Global Cotton and Wheat markets on Rural Poverty in Pakistan". A paper submitted to the Asian Development Bank, Pakistan Resident Mission Office.

Poonyth, D., A. Sarris, R. Sharma, and S. Shui. 2004. *The Impact of Domestic and Trade Policies on The World Cotton Market*. FAO Commodity and Trade Policy Research Working Paper No. 8. Rome: FAO.

Reeves, G., D. Vincent, and D. Quirke. 2001. Trade Distortion and Cotton Market: Implications for Australian Cotton Producers. Report commissioned by the Cotton Research and Development Corporation, Canberra.

Robinson, S., El-Said, M., San, N., Hermanto, S. Swastika, D., and Bahri, S. 1997. "Rice Price Policies in Indonesia: A Computable General Equilibrium Analysis. TMD Discussion Paper No. 19. International Food Policy Research Institute.

Salam, A. 2007. "Production, Prices, and Emerging Challenges in the Pakistan Cotton Sector". Chapter 3 in "Studies of the Cotton-Textile-Apparel Industries in Pakistan and India". A Paper submitted to the World Bank.

Sumner, D. A. 2003. The Impact of U.S. Cotton Subsidies on Cotton Prices and Quantities: Simulation Analysis for WTO Disputes. Background paper prepared for the Brazil WTO Case.

Tokarick, Stephen. 2003. *Measuring the Impact of Distortions in Agricultural Trade in Partial and General Equilibrium*. International Monetary Fund (IMF) Working Paper WP/03/110. Washington, DC: IMF.

United Nations Statistics Division - Commodity Trade Statistics Database. http://www.comtrade.un.org/

World Bank. 2007."Pakistan, Promoting Rural Growth and Poverty Reduction". Sustainable Development Unit and South Asia Region. World Bank, Washington, DC, USA.

APPENDICES

Appendix 1: Model Equations

(Note: some of the indices which denote sectors and institutions are omitted for simplicity)

Production

(1) $$X_j = \min\left[\frac{CI_j}{io_j}, \frac{VA_j}{v_j}\right]$$

(2) $$VA_{ag} = \kappa \cdot \left(\omega_{usk} \cdot USL^{-\rho_{va}} + \omega_k \cdot K^{-\rho_{va}} + \omega_{lw} \cdot LW^{-\rho_{va}}\right)^{-1/\rho_{va}}$$

(3) $$VA_{nag} = \kappa \cdot \left(\omega_{sk} \cdot SL^{-\rho_{va}} + \omega_{usk} \cdot USL^{-\rho_{va}} + \omega_k \cdot K^{-\rho_{va}}\right)^{-1/\rho_{va}}$$

(4) $$SL = VA_{nag} \cdot \left(\frac{Pva \cdot \omega_{sk}}{w_{sk} \cdot \kappa^{\rho_{va}}}\right)^{1/1+\rho_{va}}$$

(5) $$USL = VA_{ag} \cdot \left(\frac{Pva \cdot \omega_{usk}}{w_{usk} \cdot \kappa^{\rho_{va}}}\right)^{1/1+\rho_{va}}$$

(6) $$USL = \kappa_{usl} \cdot \left(\omega_{wk} \cdot WK^{-\rho_{usl}} + \omega_{fr} \cdot FR^{-\rho_{usl}}\right)^{-1/\rho_{usl}}$$

(7) $$FR = USL \cdot \left(\frac{w_{usk} \cdot \omega_{fr}}{w_{fr} \cdot \kappa_{usl}^{\rho_{usl}}}\right)^{1/1+\rho_{usl}}$$

(8) $$LW = VA_{ag} \cdot \left(\frac{Pva \cdot \omega_{lw}}{rlw_{ag} \cdot \kappa^{\rho_{va}}}\right)^{1/1+\rho_{va}}$$

(9) $$CI_j = io_{ij} \cdot X_j$$

(10) $$mat_{ij} = aij_{ij} \cdot CI_j$$

Demand

(11) $$Ct_h = Dyh_h - Savh_h$$

(12) $$C_h = C_{min,h} + \frac{\alpha}{Pq}\left(Ct_h - \sum Pq \cdot C_{min,h}\right)$$

(13) $$INTD = \sum mat_{ij}$$

(14) $$INV = \tau \cdot TINV / Pq$$

(15) $TINV = TINVR \cdot Pinv$

(16) $TINVR = \sum IND$

(17) $IND/K = \lambda\left(r/u\right)^2$

(18) $GC = ϑ \cdot (GT \cdot Pindex)/Pq$

Income/Revenue and Savings

(19) $YSL = \sum w_{sk} \cdot SL$

(20) $YLFR = \sum w_{fr} \cdot FR$

(21) $YLWK = \sum w_{wk} \cdot WK$

(22) $YK = \sum r \cdot K$

(23) $YLW = \sum rlw \cdot LW$

(24) $$YH = YSL \cdot Sh\_SL + YLFR \cdot Sh\_FR + YLWK \cdot Sh\_WK + YK \cdot Sh\_K + YLW \cdot Sh\_LW + DIV\_H \cdot Sh\_DIV \cdot Pindex + TRGOVH \cdot Pindex + YFOR \cdot Sh\_YFOR \cdot er$$

(25) $DYH = YH \cdot (1\text{-}dtxrh)$

(26) $YF = YK \cdot (Shf\_K) \cdot (1\text{-}dtxrf)$

(27) $TMREV = \sum tm \cdot M \cdot er \cdot Pwm$

(28) $DTXREV = \sum dtxrh \cdot YH + \sum YK \cdot (Shf\_K) \cdot (dtxrf)$

(29) $ITXREV = \sum itxr \cdot D \cdot Pl + \sum itxr \cdot M \cdot er \cdot Pwm \cdot (1+tm)$

(30) $YG = TMREV + DTXREV + ITXREV + YLW \cdot Shg\_LW$

(31) $SAVH = aps \cdot DYH$

(32) $SAVF = YF - DIV\_H \cdot Pindex - er \cdot DIV\_FOR$

(33) $SAVG = YG - GT \cdot Pindex - \sum TRGOVH \cdot Pindex - er \cdot PAYGV\_FOR$

International Trade

(34) $X = \mu \cdot (\theta \cdot E^{\rho_e} + (1-\theta) \cdot D^{\rho_e})^{(1/\rho_e)}$

(35) $E = D \cdot \left[\frac{Pe}{Pl} \cdot \frac{1-\theta}{\theta} \right]^{\sigma_e}$

(36) $Q = \xi \cdot (\delta \cdot M^{-\rho_m} + (1-\delta) \cdot D^{-\rho_m})^{(-1/\rho_m)}$

(37) $M = D \cdot \left[\frac{Pd}{Pm} \cdot \frac{1-\delta}{\delta} \right]^{\sigma_m}$

(38) $CAB = \sum Pwm \cdot M + DIV\_FOR + PAYGV\_FOR - \sum Pwe \cdot E - \sum YFOR - GRANT\_FOR$

Prices

(39) $Pm = Pwm \cdot er \cdot (1 + tm) \cdot (1 + itxr)$

(40) $Pe = Pwe \cdot er$

(41) $Pq \cdot Q = Pd \cdot D + Pm \cdot M$

(42) $Px \cdot X = Pl \cdot D + Pe \cdot E$

(43) $Pd = Pl \cdot (1 + itxr)$

(44) $Pva = (Px \cdot X - \sum mat_{ij} \cdot pq) \Big/ VA$

(45) $Pinv = \prod \left(Pq \Big/ \tau \right)^{\tau}$

(46) $Pindex = \sum w\_va \cdot Pva$

(47) $r_{ag} \cdot K = Pva \cdot VA_{ag} - w_{uskl} \cdot USL - rlw_{ag} \cdot LN$

(48) $r_{nag} \cdot K = Pva \cdot VA_{nag} - w_{sk} \cdot SL - w_{uskl} \cdot USL$

(49) $w_{usk} \cdot USL = w_{fr} \cdot FR + w_{wk} \cdot WK$

(50) $u = Pinv \cdot (ir + dep)$

Equilibrium

(51) $Q = INTD + \sum C_h + GC$

(52) $TINV = \sum SAVH + SAVF + SAVG + CAB \cdot er$

(53) $SLS = \sum SL$

(54) $FRS = \sum FR$

(55) $WKS = \sum WK$

Endogenous variables

X	output
VA	value added
USL	unskilled labor
WK	unskilled workers
FR	unskilled farmers
SL	skilled labor
K	capital
LW	land
CI	intermediate input
mat	inter-industry matrix
D	domestic demand
E	exports
Q	composite demand, domestic and imports
M	imports
CT	total consumption of households
CH	commodity consumption of households
INV	investment demand, by origin
IND	demand for capital, by destination
INTD	intermediate demand
GC	sectoral real government consumption
GT	nominal total government consumption
TINV	nominal total investment
TINV_R	real total investment

YSL	income from skilled labor
YLWK	income from unskilled workers
YLFR	income from farmers
YLW	land income
YK	capital income
YH	household income
DYH	disposable income
YF	firm income
YG	government income
TMREV	tariff revenue
DTXREV	direct tax revenue
ITXREV	indirect tax revenue
SAVH	household savings
SAVF	firm savings
SAVG	government savings
er	nominal exchange rate
Pl	local prices
w_{sk}	wage for skilled labor
w_{usk}	average wage for unskilled labor
w_{fr}	wage for farm labor
w_{wk}	wage for workers
rlw_{ag}	return to land
er	exchange rate
Pm	import price
Pe	export price
Pq	composite price of commodity
Px	output price
Pd	domestic price
Pva	value added price
r	return to capital
Pinv	price of investment
u	user cost of capital

Exogenous variables

Pindex	weighted value added price
Pwm	world prices of imports
Pwe	world prices of exports
ir	real interest rate
dep	depreciation rate
DIV_H	total dividend income of households
TRGOVH	government transfers to household
YFOR	foreign income of households
GRANT_FOR	foreign grant to government

PAYGV_FOR	debt service payment of government
DIV_FOR	dividends paid to foreigners
CAB	current account balance or foreign savings
dtxrh	direct income tax rate of households
dtxrf	income tax rate of firms
itxr	indirect tax rates
tm	tariff rate
SLS	supply of skilled labor
WKS	supply of workers
FRS	supply of farm labor

All other notations represent elasticities and calibrated share and scale parameters, which are fixed. The following sets are used: (i, j) = production sectors; ag = agricultural sectors; nag = non-agricultural sectors; h = households;

Appendix 2: Substitution Parameters in Cotton-Related Sectors

We introduce a 20 percent increase in world prices of cotton lint under various combinations of factor substitution and export and import parameters in raw cotton, cotton lint and yarn, and textile sectors and examine and compare the quantity and price responses with the actual price movements. We assume that an increase in world prices of cotton lint will affect both world export and import prices of this commodity. For the factor substitution elasticity we alter $\sigma_{va} = 1+1/\rho_{va}$ in the CES production function in Equations 2 and 3 in Appendix 1. For the import function we alter $\sigma_m = 1+1/\rho_m$ in Equation 36, while for the export function we change $\sigma_e = 1+1/\rho_e$ in Equation 34. Below we examine the results of two cases:

Case 1

(1a) σ_{va} =0.75 for raw cotton; = 1.5 for cotton lint and yarn; = 1.5 for textile

(1b) σ_e = 2 for cotton lint and yarn; = 2 for textile

(1c) σ_m= 1.5 for cotton lint and yarn; = 1.5 for textile

Case 2

(2a) σ_{va} =2.25 for raw cotton; = 1.25 for cotton lint and yarn; = 1.25 for textile

(2b) σ_{e} = 25 for cotton lint and yarn; = 25 for textile

(2c) σ_{m}= 25 for cotton lint and yarn; = 25 for textile

(2d) for the rest of the sectors, retain all elasticity parameters in Table 5.1

The results are in Table A2.1**.** In Case 1 the export price of cotton lint and yarn increases by 17.3 percent, while its output price improves by 8.8 percent. The price ratio is 0.5. This is very far from the ratios we find in Table 3.5 where the market price does not deviate much from the export parity price. Furthermore, the output price of raw cotton improves by 15.3 percent, significantly higher than the increase in the output price of cotton lint and yarn of 8.8 percent. The ratio is 1.74. This ratio is high compared to the historical ratio presented in Figure A2.1. In the past 5 years, the percent change in seed prices relative to the percent change in cotton yarn prices is 0.66.

In Case 2, export price of cotton lint and yarn improves by 17.75 percent. Its output price increases by 16.43 percent. The ratio is 0.926, which is higher than Case 1 and nearer to 1. Furthermore, the output price of raw cotton improves by 13.02 percent. Thus the output price ratio of raw cotton over cotton lint and yarn is 0.79, which relatively nearer to the historical ratio. Thus we consider the elasticities in Case 2.

Table A2.1—Sectoral effects under various elasticity parameters

% change from the base		Case 1	Case 2
Real exchange rate		-2.2	-1.88
Domestic Price		0.1	0.42
Raw cotton	Output	6.3	11.75
	Output price	15.3	13.02
Cotton yarn	Output	7.1	13.27
and lint	Domestic demand	0.3	-0.55
	Export	24.5	50.15
	Output price	8.8	16.43
	Export price	17.3	17.75
Textile	Output	-3.6	-8.61
	Output price	-0.6	-1.54

Figure A2.1—Price movements of seed cotton and yarn, %