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The Egyptian economy depends heavily on cotton as the major export commodity among agricultural commodities. Egypt is the largest exporter of extra long staple cotton in the world followed by Sudan and Peru. It provides about 45 percent of the world exports of extra long staple cotton. Instability in the demand and prices received for cotton result in instability in foreign exchange earnings upon which it depends for imports of other commodities. Therefore, Egyptian policy makers need to have a better understanding of the cotton market, of how the market functions, and of the factors which affect Egyptian exports.

Egyptian cotton faces competition from other long staple exporting countries, mainly Sudan. The U.S. is the major producing and exporting country of short and

medium staple cotton. The introduction of man-made fibers is believed to have affected the market for Egyptian cotton. The effect of variations in the income of the importing countries must be considered.

In this study, a simultaneous equation model was developed in order to investigate these effects. The model consists of eight structural equations, representing the demand for and supply of export cotton for Egypt, Sudan, Peru and the U.S. The analysis is based on time series data for the period 1950-80.

The results show that the export price of each country is the major factor in determining the export sales of its cotton. Demand elasticities ranged from -0.95 to -1.21. Egypt's export price affects the demand for Sudan's cotton, and Sudan's price affects the demand for Egypt's cotton. Peru's export quantities are affected by Egypt and Sudan prices more than they affect them. U.S. prices, and man-made fiber prices didn't significantly affect the demand for long staple cotton. The export supply for Egypt, Sudan and Peru is insensitive to changes in own export price.

AN ECONOMIC ANALYSIS OF THE WORLD MARKET FOR EGYPTIAN COTTON

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AN ECONOMIC ANALYSIS OF THE WORLD MARKET FOR EGYPTIAN COTTON

CHAPTER I

Introduction

Whenever Egypt is mentioned, cotton is mentioned. Egyptian people call it "the white gold" and they celebrate the days of its harvest with big festivals every year. Egyptian cotton is known all over the world as the best quality cotton.

Cotton has been grown in Egypt for hundreds of years. England turned to Egypt in the mid-1800s as its primary source of cotton, since cotton exports from the U.S. had suffered because of the American Civil War. Cotton still plays an important role in Egyptian agriculture. It is the country's main cash crop and represents about 25 percent of the value of all field crops. Egypt consumes 100 thousand tons of cottonseed oil, representing about 90 percent of all the vegetable oil production in Egypt. Cotton is the leading export crop in the Egyptian economy. In 1981, Egyptian cotton and cotton product exports were valued at $600 million. Relative importance of cotton exports in total export value has been decreasing consistently. Ninety-nine percent of Egyptian production was exported during the period 1900-19, 96 percent during 1920-39, 81 percent

during 1940-59, 63 percent during 1960-69, and 44 percent during 1970-79. Raw cotton exports provided about 84 percent of the value of all raw agricultural exports, while cotton yarn and textile represented about 60 percent of the value of all manufactured exports.

World Trade of Cotton

World production of cotton has doubled in the last thirty years. It was estimated at about 14 million metric tons in 1980. This increase is due mainly to increases in yields from 237 kilograms per hectare in 1950 to 438 kilograms in 1980. The area planted to cotton has increased from 28 million hectares to 32 million hectares during the same period. World trade in cotton has increased from 2.6 million metric tons in 1950 to about 4.6 million metric tons in 1980 (Table 1).

World patterns of cotton trade change continuously. The most dramatic change is the growth of the man-made fiber industry. While the consumption of man-made fiber increased from three to eight million metric tons during the 1960s, cotton consumption increased from ten to twelve million metric tons. That means that cotton's share of the world total fiber consumption has declined from 70 to 55 percent. The market

Table 1. World Cotton Area, Yield, Supply, and Utilization, 1950-1980
(Thousand 480 lb. Bales)

Year	1,000 Hectare	Yield KG Per HA	Beginning Stocks	Production	Total Supply & Distribution	Trade Imports	Trade Exports	Consumption	Destroyed	Ending Stocks
1950	28,093	237	15,651	30,530	46,181	12,561	11,956	35,560	-80	11,306
1951	35,487	239	11,306	38,899	50,205	12,266	12,369	35,678	-269	14,671
1952	34,951	253	14,671	40,608	55,279	11,801	11,916	37,641	-96	17,619
1953	32,946	276	17,619	41,831	59,450	13,018	13,246	38,932	-100	20,390
1954[1]	32,902	272	20,392	41,030	61,422	12,672	12,240	39,638	-176	22,392
1955	33,823	284	22,392	44,167	66,559	13,103	13,080	41,642	-137	25,077
1956	33,062	281	25,077	42,562	67,639	15,581	16,050	43,479	-64	23,755
1957	31,707	287	23,735	41,843	65,598	14,096	14,269	43,582	-280	22,141
1958	31,179	300	22,161	42,969	65,110	13,937	13,460	44,896	-187	20,878
1959	31,827	305	20,878	44,546	65,426	17,368	17,413	46,089	-357	19,647
1960[1]	32,269	299	19,692	44,312	64,004	17,313	17,123	45,359	-287	19,122
1961	31,976	305	19,122	44,827	63,949	15,922	15,637	45,571	-187	18,850
1962	31,936	328	18,850	48,054	66,909	16,530	15,933	45,064	-305	22,747
1963	32,485	338	22,747	50,477	73,226	17,808	17,932	47,926	-188	25,360
1964	33,024	351	25,350	53,240	78,600	17,355	16,862	50,617	-5	28,481
1965	33,067	362	28,481	55,051	83,532	17,132	16,930	52,121	-273	31,886
1966	30,891	351	31,886	50,032	81,918	17,985	18,232	53,742	13	27,916
1967	30,755	352	27,916	49,753	77,669	17,373	17,509	53,932	17	23,584
1968	31,853	373	23,589	54,510	78,096	16,934	16,972	54,352	63	23,641
1969	32,320	359	23,641	53,390	77,031	17,706	17,708	54,838	-67	22,257
1970	31,709	368	22,257	53,656	75,923	18,865	17,730	56,123	42	20,887
1971	33,153	392	20,887	59,732	80,619	18,453	18,671	58,605	6	21,790
1972	33,529	408	21,790	63,005	84,795	20,918	21,193	60,366	-94	24,248
1973	32,726	420	24,248	63,239	87,537	20,136	19,580	62,428	16	25,649
1974	33,429	419	25,649	64,473	90,122	17,048	17,498	58,708	107	30,857
1975	29,731	396	30,857	54,016	84,871	19,536	19,132	61,147	146	23,980
1976	30,624	410	23,980	56,767	80,747	17,990	17,615	60,606	130	20,386
1977	32,768	425	20,386	64,142	84,528	19,963	19,174	60,243	272	24,802
1978	32,396	406	24,802	60,173	84,975	19,780	19,817	62,900	-34	22,072
1979	32,104	445	22,072	65,664	87,741	22,843	22,973	65,602	97	21,912
1980	32,546	438	21,912	65,465	87,377	20,185	20,139	66,161	-16	21,278

[1]Beginning stocks do not equal ending stocks of previous year because of new countries added to data base in this year

Source: Foreign Agricultural Service, Foreign Agricultural Circular, USDA Washington, D.C., May 1981.

shares have stabilized since the 1970s. This stabilization was not due to an increase of cotton demand, but was due to a decline in the demand for man-made fiber and total fiber demand. Cotton consumption continues to grow by only 2 percent yearly.

Sixty percent of world imports of cotton in 1980 was in Asia. This was double its share of 1960. Western Europe's share declined from 45 to 25 percent of total world imports. These changes reflect the expansion of textile production in Asia, mainly in China, Hong Kong, Taiwan and Korea. Western Europe had voluntary quota arrangements in these two decades, when they tried to restrict the growth rate of imports of cotton to 6 percent a year by allowing importers of textiles to set quota restrictions or to negotiate voluntary export quotas when growth rates were excessive.

The U.S., the U.S.S.R., Pakistan, and Turkey account for about 65 percent of total world exports in the last two decades. Egypt and Sudan exports showed the most significant declines. The decline in Egypt's exports of raw cotton was primarily the result of the expansion of its textile production for domestic use and for exports. The decline in Sudan was mainly due to a decrease in production.

In the 1960s, the general world prices of cotton were stable. Monke and Taylor (1982) gave two reasons

for this stabilization: first, the growth in income which led to an increase in textile fiber demand, was offset by a rapid increase of the supply of man-made fiber. Secondly, the U.S., which has a domestic price support program, maintained a substantial amount of stocks and controlled the market by releasing this stock whenever it was needed.

In the 1970s, price instability increased. Monk and Taylor (1982) reported that the coefficient of variation in prices increased from 0.05 in the 1960-70 period to 0.33 in 1970-80. Two factors were behind this: first, the U.S. support programs became insignificant after world market prices rose above the U.S. support prices in 1973. The resulting reduction in buffer stocks led to increased variation in world supply, and hence, price. The second factor was the end of the rapid growth in man-made fiber production in the early 1970s. The increase in petroleum prices in 1973 led to sharp increases in man-made fiber prices.

The main exporters of extra long staple (ELS) of the world are Egypt, Sudan, Peru and the U.S. Table 2 shows that Egypt was the largest exporter in the period of 1950-80 and Sudan was the second. Egypt showed a decline in absolute and percentage values of the four main ELS exporters. This is consistent with the fact that Egypt was originally more dependent on trade with

Table 2. Total Exports of Extra Long Staple Cotton of Egypt, Sudan, Peru and the U.S. 1950/51 - 1979/80.

(Thousand 480 lb. Bales)

Year	Egypt	%	Sudan	%	Peru	%	U.S.	%	Total	%
1950/51	584.8	59.31	339.6	34.44	61.6	6.25	0	0	986.00	100.00
1951/52	499.6	57.77	338.8	39.18	26.4	3.05	*	0	864.80	100.00
1952/53	702.5	72.27	219.8	22.61	49.8	5.12	*	0	972.10	100.00
1953/54	757.3	66.18	341.8	29.87	45.2	3.95	0	0	1,144.30	100.00
1954/55	553.9	62.12	261.8	29.36	75.4	8.46	0.5	.06	891.60	100.00
1955/56	613.1	51.78	475.8	40.18	74.9	6.33	20.3	1.71	1,184.10	100.00
1956/57	513.4	52.24	303.9	30.92	107.6	10.95	57.9	5.89	982.80	100.00
1957/58	639.5	58.27	355.7	32.41	92.5	8.43	9.8	.89	1,097.50	100.00
1958/59	890.4	61.88	387.6	26.94	138.2	9.60	22.8	1.58	1,439.00	100.00
1959/60	1,235.7	65.03	546.3	28.75	113.9	5.99	4.2	.22	1,900.10	100.00
1960/61	917.8	62.81	398.7	27.29	137.3	9.39	7.4	.51	1,461.20	100.00
1961/62	782.7	51.91	590.1	39.14	128.2	6.50	6.8	.45	1,507.80	100.00
1962/63	941.5	50.46	732.5	39.26	188.9	10.12	2.8	.15	1,865.70	100.00
1963/64	898.0	51.08	672.8	38.27	185.7	10.56	1.6	.09	1,758.10	100.00
1964/65	922.9	58.93	429.0	27.39	193.1	12.33	21.2	1.35	1,566.20	100.00
1965/66	933.2	56.20	529.8	31.91	191.7	11.55	5.7	.36	1,666.40	100.00
1966/67	790.6	48.24	636.4	38.83	198.9	12.16	12.9	.79	1,638.80	100.00
1967/68	655.0	39.56	816.1	49.28	140.5	8.48	44.3	2.68	1,655.90	100.00
1968/69	607.6	39.36	793.7	51.42	133.8	8.67	8.5	.55	1,543.60	100.00
1969/70	748.8	41.39	918.1	50.75	126.8	7.01	15.2	.84	1,808.90	100.00
1970/71	857.0	45.24	897.1	47.36	130.2	6.87	9.9	.52	1,896.20	100.00
1971/72	811.7	45.43	830.9	46.50	138.5	7.75	5.6	.31	1,786.70	100.00
1972/73	680.9	40.91	897.9	53.95	84.3	5.06	1.3	.08	1,664.40	100.00
1973/74	645.2	46.06	603.8	43.09	147.3	10.51	5.0	.36	1,401.30	100.00
1974/75	512.7	49.29	400.0	38.46	115.1	11.07	7.2	.69	1,040.00	100.00
1975/76	513.5	36.32	303.1	57.16	85.2	6.08	7.0	.69	1,413.80	100.00
1976/77	425.0	42.07	451.2	41.10	131.6	13.01	2.6	.26	1,010.20	100.00
1977/78	469.2	44.33	465.6	43.99	103.6	9.77	20.2	1.91	1,058.40	100.00
1978/79	470.8	42.20	480.7	43.01	160.4	14.34	5.03	.45	1,118.53	100.00
1979/80	495.0	46.60	477.3	43.00	130.8	11.79	6.77	.61	1,109.90	100.00

*Less than 50 bales.

Source: International Cotton Advisory Committee, Cotton-World Statistics, Various Issues.

India and the USSR than its competitors. The sharp decline in international trade in ELS fiber is due to increased production in both India and the Soviet Union and, consequently, a reduction in their demand for imported cotton. Their share accounted for one-third of world imports in the early seventies. Now they are self-sufficient. Eastern and Western Europe imports have increased slightly during the last decade. Far Eastern countries imports are unchanged. Chinese imports and the rest of the world imports are down slightly.

While Egypt accounts for a small portion of total world cotton exports, it is the world's largest exporter of extra-long and long staple cotton. Its export was about 45 percent of world exports of extra-long staple cotton in 1980. Sudan ranks second with about 43 percent, and Peru is third with 12 percent of world exports. The production of these three countries represents over 90 percent of the world extra-long staple production, excluding the USSR. In 1950, Egypt was exporting about 60 percent of total world exports of extra-long staple cotton, followed by Sudan with 34 percent and Peru with 6 percent.

Export markets for the Egyptian cotton have changed over time (Table 3). The United Kingdom, the

Table 3. Exports of Egyptian Cotton by Country of Destination, 1970/71 = 1980/81 [1]

Country of Destination	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81
	(1.000 Bales, 480 Pounds Net)										
Australia	9	18	16	20	0[2]	2	4	2	5	5	2
Bangladesh	0	0	7	5	[2]	4	5	0	4	0	0
Belgium	8	7	13	18	3	5	6	5	4	4	0
Bulgaria	14	17	16	15	26	14	6	18	12	22	13
China, Mainland	71	78	64	34	40	115	47	83	69	131	#157
China, Taiwan	0	0	..[2]	0	15	0	..[2]	..[2]	0	1	2
Czechoslovakia	96	85	90	89	113	76	60	54	42	32	6
Finland	1	2	2	3	0	1	..[2]	2	1	1	1
France	40	45	48	52	25	28	30	34	15	38	41
Germany, Dem. Rep.	17	15	10	14	31	17	17	12	34	0	10
Germany, Fed. Rep.	51	73	61	55	4	22	33	44	77	70	54
Greece	34	30	26	18	5	25	18	12	11	10	12
Hungary	13	26	22	18	15	7	11	22	23	6	18
India	154	111	95	55	8	9	12	17	0	0	0
Italy	63	57	76	62	20	29	31	33	38	71	63
Spain	129	124	190	260	38	95	102	87	108	155	121
Korea, South	7	4	7	0	9	7	0	9	0	23	31
Korea, Rep of	4	2	7	7	2	3	2	7	7	11	13
Netherlands	1	2	1	8	0	0	1	..[2]	1	0	0
Poland	51	38	38	12	58	24	33	25	38	52	32
Portugal	0	0	0	0	0	2	2	4	5	5	6
Romania	56	77	56	57	97	55	21	33	88	100	46
Spain	23	36	53	27	9	27	14	14	19	29	18
Sri Lanka	3	32	29	3	8	0	0	0	0	0	0[2]
Sweden	2	1	1	1	1	1	1	1	1	0	
Switzerland	17	23	34	23	4	14	13	31	34	42	44
United Kingdom	22	20	29	25	4	7	6	6	18	11	5
United States	7	9	5	5	..[2]	4	3	2	1	1	1
USSR	462	400	375	281	321	162	101	68	0	0	0
Venezuela	7	8	4	5	0	0	0	0	0	0	0
Yugoslavia	22	22	5	22	22	16	8	53	33	52	50
Other Countries	13	4	7	5	0	4	19	8	2	4	3
TOTAL	1.397	1.366	1.387	1.199	878	775	606	686	690	876	749

[1] August-July Crop Year [2] Less Than 500 Bales

Source: Monthly Summary of Foreign Trade, Egypt Statistical Department

United States, Europe, Japan, and India were major markets before World War II. The USSR became a major market during the 1950s, but has declined and disappeared as a market in recent years. Leading markets today are Europe, Japan, and China. Egypt's relative importance in world trade has been declining in the last ten years. Its share of world export was about 40 percent in the seventies compared with 75 percent in the thirties for long staple varieties.

Study Objectives

As we have seen, the world trade of cotton, in general, and for the long staple varieties, in particular, shows instability in prices and in the quantities supplied and demanded. Egypt as one of the main producers, and the largest exporter of long staple varieties, is also facing instability in demand and prices, and consequently instability in foreign exchange earnings upon which Egypt depends to meet its needs to import other commodities. Therefore, Egyptian policy makers need to have a better understanding of the market conditions of cotton, how the market is functioning, and what factors affect the Egyptian export market.

Egyptian cotton is superior to that from the rest

of the world, but it faces competition from other long-staple producing countries, mainly Sudan. Since the U.S. is the major producer and exporter of short and medium staple cotton, its influence on the international trade of cotton cannot be ignored.

The objective of this study is to analyze the effects of selected factors on the Egyptian export market. Specifically, the study aims at analyzing the effect of variations in export quantities (or prices) of Egyptian cotton and the effect of its main competitors on the export prices (or quantities) of Egyptian cotton. A secondary objective is to measure the effect of real income of the importing countries on the quantities of cotton imported from Egypt. The effect of man-made fibers on the demand for Egyptian cotton also will be examined. The study will look at the effect of variation in domestic production and consumption on the Egyptian export of cotton. Income and price elasticities of foreign demand and price elasticity of export supply will be estimated for Egypt and the other exporting countries. So, in fact, the study will estimate the demand for and the supply of export for these four countries.

Organization of the Study

The study includes five chapters. The first con-

tains the Introduction, description of the Egyptian agricultural policy in general, and in more detail, the cotton policy. Chapter Two will review the literature. Chapter Three will be devoted to the theoretical and empirical model. The results will be reported in Chapter Four. Finally, Chapter Five will present the summary and the conclusions.

Egyptian Economy

In order to understand the Egyptian cotton policy, we should understand the agricultural policy and the Egyptian economy as a whole, which is the source from which that policy is operating.

In the last forty years, the Egyptian economy has been swinging between domination by the private sector on the one hand and government control on the other. The private sector dominated before the Egyptian revolution in 1952. This domination continued until 1956. Government intervention started to grow in 1957. In 1960, the first five-year plan began. Its objective was to double per-capita income in ten years, and to increase agricultural production by 30 percent in order to achieve self-sufficiency in food. Nationalization was declared in 1961. It covered most of the aspects of the Egyptian economy, including banks, insurance

companies, basic industries, companies such as textiles, sugar, cement, electrical, copper, and many others.

Massive government control continued until 1973 when Egypt shifted to an open door policy. This policy was intended to encourage the Egyptian private sector and foreign investors to invest in projects within Egypt. The government gave them all the facilities and the guarantees they wanted, even free taxes on their profits. More than 30 new banks were opened. Bureaucracy, weakness of the utility services, the fear of new and different policies, all discouraged many of these investors. The rest invested in fast-circulating capital projects which are consumption projects. Long term investment projects like agriculture had little success.

Egyptian Agriculture

Agriculture is still the backbone of the Egyptian economy. More than 35 percent of the labor force (11.3 million) are working in agriculture. Its share in the gross domestic product was about 23 percent in 1981. This share dropped 3 percent per year in the 1970's because of the high growth of the non-agricultural sectors. The annual growth rate of agriculture was only about 2 percent per year during the 1960's and 1970's.

During the period 1970-80, agriculture's share of all the exported goods declined from 80 percent to 16 percent, while the share of food imports of all the imported goods increased from 21 percent to 34 percent.

The total area of Egypt is 238 million feddans.* The cultivated land is about 6.5 million feddans. The cropping area is about 12 million feddans, which means that about 2 crops are cultivated in the same area of land during the year. There are about one million feddans of newly reclaimed land. This land, economically, is still under marginal profit.

Egypt grows many crops. The main crops are clover, (26% of total cropping area), maize (17%), wheat (13%), cotton (11%), and rice (10%). These crops accounted for 77 percent of the total cropping area in 1981. Cotton makes a heavy demand on the nitrates in the soil, so it is grown after clover, which builds up the nitrate content of the soil. Also, for this reason, cotton is grown in rotation with other crops in two or three-year cycles. As a result of this, cotton is grown only once each two or three years on the same piece of land. Any adjustment in the area cultivated of one or more of these crops would require changes in the area planted of the other crops.

* A feddan is equal to 1.038 acres or 0.42 hectares.

Government Agricultural Policy

Since the 1952 Egyptian revolution, the government has been interfering in the agricultural sector, starting with land reform. Government control now includes area allocation, delivery quotas, and fixed prices for requisitioned crops. The government is the only exporter and importer of the main crops. One of the objectives of government policy is to provide farmers with low cost inputs and to make food cheap and available for the increasing demands of the population, which has increased by 2.7 percent or 1.2 million people per year in the last two decades. Further objectives are to avoid the price fluctuations in the world markets, to supply the domestic industries with low cost inputs and to export the surplus of the agricultural and industrial products in order to get foreign exchange, which is necessary for imports.

In more detail, the government sells the inputs to the farmers at low, subsidized prices. These inputs include fertilizer, fuel, seeds, pesticides, and others. It provides them with cash loans before planting. Specific land areas are allocated for production of different crops in each district within each governate. The government determines these quotas by projecting the annual needs for the domestic and export

market. It also takes into account the productivity of the land in the previous year.

Production quota for several crops is required by law to be delivered to the government collecting centers. For example, in 1980, all of the cotton, 11 percent of the wheat, 52 percent of the rice, 52 percent of the onions, and 34 percent of the beans produced, were compulsory delivered. No delivery quotas are required for vegetables and fruits. Fines for violations of area and production quotas are imposed. The benefits from breaking these rules far exceeded the fines. Government requisition prices for the quota crops ranged from 20 to 50 percent below the free market prices. For example, Table 4 shows the Egyptian and international prices for wheat. The quantity that farmers produce above the quota is sold in the free market, or kept for household use. The government sells these food crops as well as the imported food crops to the consumers at low, subsidized prices. For instance, in the 1983 fiscal year, the government spent $1.7 billion on direct food subsidies, nearly 15 percent of the country's budget.

Cotton Policy

Egypt's cotton can be classified into three categories according to its length: extra-long (longer

Table 4. Egyptian Domestic and International Prices for Wheat, 1970-80.

Year	Egyptian Domestic Price		International Price for U.S.[3]
	Fixed[1]	Farm Gate[2]	
	U.S. dollars/metric ton		
1970	47.76	55.34	59.52
1971	47.76	50.62	63.19
1972	47.76	50.14	74.22
1973	47.76	54.53	139.24
1974	59.57	67.11	178.55
1975	66.72	73.40	149.16
1976	66.72	67.40	134.10
1977	66.72	77.41	105.08
1978	66.72	88.00	130.79
1979	94.88	92.00	175.10
1980	109.68	108.56	203.00

[1]Fixed prices are paid by the government for the Feddan quantity required under the marketing quota.

[2]Prices paid by the government for wheat delivered over the quota.

[3]Prices for U.S. No. 2 hard winter wheat for gulf ports (calendar year average).

Source: Egyptian Ministry of Agriculture, Cairo, Egypt.

than 1.29 inch), long (1.15 - 1.29 inch), and medium staple cotton (1 to 1.14 inch). It is worthwhile to mention that each one of these lengths has several varieties. The long staple varieties are produced in northern Egypt, with the extra-long staple being grown on the best soils. Medium staple varieties are produced in central Egypt.

Staple length is the most important indication of cotton quality. The longer the staple, the finer and the stronger is the yarn. Grade is the second most important characteristic. Different grades are determined by color, waste content of ginned cotton (e.g. leaf piece), and whether or not the fiber has knots. The lower grades of cotton have higher processing costs and more defects in the yarns and in the fabric. The third characteristic is the uniformity of the fiber length. The more variation there is, the more difficult the processing, and more waste and much less output quality.

The long staple varieties are grown for export. On the average 90 percent of extra-long staple and 80 percent of long staple have been exported in the last two decades. Most of the medium staple varieties are used for the domestic textile industry, where only 17 percent have been exported during the same period.

The composition of Egyptian cotton production has been changing. In 1971, the production of extra-long staple cotton represented 39 percent of all cotton produced. Thirty percent was long staple, and 28 percent was medium. In 1981, the production of medium staple was insignificant, extra-long accounted for 25 percent and long staple had increased to 64 percent of total production. Experimental plantings of upland cotton in the reclaimed desert area of Egypt have been undertaken. If these are successful, upland cotton may replace the long staple varieties in the domestic textile industry.

Areas planted in cotton have continued to decline from the World War II peak. Of the 1,986 thousand feddans in 1961, there are now about 1,210 thousand feddans, as an average, in the period 1978-81.

Production of cotton averaged 2 million bales* during 1960-64, increased to 2.3 million bales in 1970-74, but has declined to 1.9 million bales in 1975-79. This reduction is due to the decrease in the area planted, although the yield has been increased. The production totaled 2.4 million bales for the year 1981-82 (Table 5).

Egypt currently ranks fourth in cotton yield in the world. The reduction in the cotton area is due to

* One bale weighs 480 pounds.

Table 5. Egyptian Cotton Area and Production by Type, 1971/72 - 1981/82

CROP YEAR	EXTRA LONG		LONG		LONG MEDIUM		SCARIO[1]	TOTAL	
	AREA	PRODUCTION	AREA	PRODUCTION	AREA	PRODUCTION	PRODUCTION	AREA[2]	PRODUCTION
	1,000 Hectares	1,000 Bales[3]	1,000 Hectares	1,000 Bales[3]	1,000 Hectares	1,000 Bales[3]	1,000 Bales[3]	1,000 Hectares	1,000 Bales[1]
1971/72...	290	924	175	713	175	655	49	641	2,341
1972/73...	273	869	213	835	166	602	52	652	2,359
1973/74...	288	812	207	838	177	54	58	672	2,249
1974/75...	245	735	199	733	166	500	44	610	2,010
1975/76...	237	653	177	602	152	451	49	565	1,755
1976/77...	217	702	173	662	135	408	48	524	1,820
1977/78...	218	659	247	883	133	241	48	598	1,832
1978/79...	178	662	264	1,134	58	177	41	499	2,013
1979/80...	183	775	296	1,322	23	79	46	502	2,220
1980/81...	159	712	333	1,565	31[4]	105[4]	47	523	2,428
1981/82...	122	584	373	1,747			44	495	2,375

[1]Waste Cotton Use for Stuffing [2]Totals May Not Add Due to Rounding [3]Bales of 480 Pounds Net
[4]Less Than 500 units.

Source: The Egyptian Cotton Gazette

the increasing demand for food crops, and with the limited land available, the reduction of the cotton area is inevitable. Contributing to the reduction of cotton growth, it may be worthwhile to mention that the cotton leaf worm and the ballworm are the most harmful insects for cotton in Egypt. In 1978, the total cost of cotton pesticides was 47 million L.E. (about $120 at 2.56 U.S. $/L.E.*). The government's share of the cost was 68 percent and the farmer paid 32 percent of the total cost.

The domestic consumption of cotton is increasing. It represented 23 percent of the crop in the 1950's, 35 percent in the 1960's, 53 percent in the 1970's. In 1981, domestic consumption was 1.4 million bales (about 305 thousand metric tons) or 61 percent of the total Egyptian cotton production.

Cotton foreign trade was nationalized in 1962. Today, exportation is handled by six government agencies. Each one is alloted one-sixth of the total production which is purchased from producers. Each firm has developed its own facilities. Cotton for export is moved from all over Egypt to the Port of Alexandria where it is weighed and stored. When an order is placed, cotton is moved to the blending area where the bales are opened and the cotton blended to

*U.S. dollars per Egyptian pound

order, moistened, and allowed to stand for one day to adjust moisture. It is then pressed into bales, weighed, marked to indicate type, buyer and export company and stored until requested for shipping.

Since 1966, the entire cotton crop is compulsory delivered. There are 2000 collecting centers which receive cotton from the farmers. The centers weigh the cotton, determine the staple length and the grade. Then it is registered to each farmer's account. The cotton is taken to the ginning mills where it is processed and pressed into bales and stored or it may be sent to local spinners (or exported). The farmers are paid part of the value of their crops upon delivery; the remainder is received after ginning. A deduction is made for all of the farmer's debts, which include the cash loans and the cost of the inputs that the farmers used during the production period.

Government Intervention in the Cotton Market

Cotton is the crop most strictly controlled by the Government. Until the return of the Sinai oil fields from Israel in 1978, cotton was the major source of revenue for the Egyptian government. Its production is overseen by the General Egyptian Cotton Organization. This group controls the acreage planted and provides seed, fertilizer, and pesticides for production through

a system of farmer cooperatives. Farmers must buy these inputs at rates which are generally quite high relative to the cooperative purchase price. After the cotton is harvested, the cotton organization purchases the entire crop. The General Egyptian Cotton Organization distributes some of the cotton to produce domestic textile mills and exports the rest. The largest quantity was formerly exported, but now most goes to produce domestic textiles.

Four methods of government intervention in cotton pricing have been initiated during the last four decades. Prior to 1952, cotton prices were determined in the free market. Acreage control on cotton was initiated during the last 30 years. The policy of holding buffer stocks was employed during the period 1953-61. In this period, the Egyptian Cotton Commission (ECC) bought large quantities at fixed prices, by buying future contracts, and stored them in anticipation of increases in export prices. In this way, it could exercise control over the market by increasing its stock in years of low demand and decreasing it when the demand was high. Nationalization of the cotton trade was declared in 1961. Since then, all sales for exports and local consumption have been determined by the ECC.

Export taxes on cotton were introduced in 1948. The objective was to protect the infant domestic textile industry and the Egyptian consumers. It functioned by depressing the domestic raw cotton price. This policy was used as a means to increase government revenue. It also worked as a supplement to the acreage restriction policy. Subsidies were given to those exporters who were selling their cotton to hard currency and convertible currency countries. These subsidies led exporters to lower their export price and increase the volume and values of exports. Prior to 1956, it took the form of a preferential exchange rate: that is a relatively high number of Egyptian pounds per each unit of hard currency. During the period of 1956-60, it took the form of reduction in the export tax rate. The subsidy policy was also used as a tool to offset any adverse effects caused by the export taxes.

Producer prices increased during the period 1962-67, but were still less than the cost of production. As farmers shifted to the production of other crops, the government increased producer prices of cotton by 10-22 percent between 1967-70. In 1979, the farmers received a substantial increase in the price paid by the government.

Cotton prices paid to the farmers are determined annually by the Ministry of Agriculture. These prices

differ according to the length, the variety, and the grade of the cotton. Prices are set at levels that they believe give the farmers a fair profit margin based on the estimated cost of production and the export prices.

Domestic consumption and needs of the mills are established before the quantity available to export is determined. The government resale of cotton to mills is at a higher price than it pays to the producer, but lower than the export price. The mills sell the processed cotton to the textile manufacturers. Table 6 shows the differences between farm gate prices, mill prices and export prices.

The Egyptian textile industry is dominated by 30 government nationalized companies which produce primarily for the domestic market. Thirty-five percent of the production of these companies is sold at consumer subsidized prices which sometimes are below the manufacturing cost. The rest is sold domestically at higher prices or exported. Textile production has been steadily increasing. In 1981, cotton yarn production reached 231 thousand tons -- about one and a half times the average production of the period 1965-69. Production of cotton fabrics has doubled during the period 1960-79, reaching 117 thousand tons on average during the period 1975-79. Man-made fiber production

Table 6. Domestic, Export and Mill Prices of Egyptian Cotton, 1970-1980.
(Dollars per metric ton)

Year	Domestic[1] Price	Average Export Price	Mill[2] Prices
1970	496	1,176	676
1971	642	1,207	803
1972	635	1,263	803
1973	845	1,641	803
1974	925	2,908	803
1975	834	2,768	803
1976	981	2,389	803
1977	984	2,238	--
1978	997	2,527	--
1979	1,287	2,603	--
1980	1,312	2,987	--

[1]Prices paid to farmers
[2]Prices paid by mills to the government

Source: Central Agency for Public Mobilization, Cairo, Egypt. Mill price from Cuddihy (1980).

accounted for 4 thousand tons of rayon and acetate fibers, 6 thousand tons of yarn, and 6.8 thousand tons of other fabrics in 1980. Table 7 shows the change in Egypt's exports of textile products.

Some Economic Studies of Egyptian Cotton

Many studies have examined the economics of Egyptian cotton. Their concerns covered every aspect of the cotton industry. We will review these studies briefly, referring to the most important results. Special consideration will be given to studies related to the farmer's response to the price changes.

A number of economic studies are concerned with the optimal allocation of cotton and grains. Hansen (1964), on the basis of a value-added criterion (profit per acre without deducting rent),recommended a reduction in cotton area and the expansion of the grain area.

A study by Rizk and Afr (1973) was concerned with regional specialization and investigated the productivity of land, labor and capital in six of Egypt's 17 provinces for cotton and other crops. They used a sample of farms and, using regression analysis, they found significant variations among the provinces in the productivity of the above inputs. Their results

Table 7. Egyptian Exports of Textile Products, 1966 - 1980.

YEAR	COTTON YARN	COTTON FABRICS	KNITTING	TERRY FABRICS	READY MADE GARMENTS	MADE-UP FABRICS	COTTON/ WOOL
			(METRIC TONS)				
1966.....	40,510	15,242	850	--	--	--	--
1967.....	41,627	20,302	557	--	--	--	--
1968.....	42,581	22,554	755	683	481	914	--
1969.....	46,374	21,120	924	781	827	1,079	--
1970.....	41,370	21,349	896	811	930	003	--
1971.....	41,182	22,402	1,134	986	699	1,291	205
1972.....	44,683	19,003	1,405	1,011	1,007	1,234	187
1973.....	44,619	18,994	1,705	932	1,000	1,258	221
1974.....	35,508	13,288	1,728	1,172	1,210	1,244	291
1975.....	32,457	11,016	2,138	1,020	1,551	1,058	837
1976.....	40,884	13,311	1,931	1,081	1,488	1,182	640
1977.....	29,998	14,850	1,204	908	957	999	829
1978.....	34,387	15,514	887	304	804	1,114	434
1979.....	44,875	16,456	997	801	855	711	410
1980.....	47,100	18,400	NA	NA	NA	NA	NA

Source: Country Statements, Fortieth Plenary Meeting ICAC.

favored more regional specialization in cotton production.

In 1974, Sherbiny and Zaki introduced a linear programming model to estimate the possible gains resulting from increased specialization. The study analyzed interregional comparative advantages, including the agronomic and institutional constraints that dominate Egyptian agriculture. According to this study, substantial gains could be achieved without additional inputs or improved means of production.

Some studies gave a general description of cotton cultivation, processing, marketing and distribution, consumption and government intervention. [See, for example, by Ross (1968), the National Book of Egypt (1973), Central Bank of Egypt (1973).] Hansen (1960) presented a model to forecast the raw cotton export and the local consumption of yarn, fiber, and textiles. He assumed that the Egyptian economy has a competitive nature. A multisectoral dynamic model by Kheir El-Din (1969) called for maximization of foreign exchange earnings from each cotton variety and the distribution of cotton between export and domestic needs.

In the area of price policies, Abdel-Rassoul (1971), and Allam (1972) gave a description of the agricultural price policies. They explained the conflicts between the government policies. Ibrahim (1974)

studied the role of price incentives in inducing technological transformation. His results showed that the return of cotton, which is sold at fixed prices , is less than its production cost, and this leads to a weakness in the process of technological transformation.

Bashir (1964) discussed and analyzed the production and cost of cotton and the reasons for the high cost of production. He suggested that the world prices should be considered in setting farm prices. Khedr and Kheir El-Din (1982) addressed some policy questions related to the economic efficiency of cotton production and ginning in Egypt. A comparative analysis was conducted using a set of social profitability measures. The criteria used for comparing the social profitability were cotton staple length, the economics of different irrigation techniques, land preparation techniques and location.

Glassburner (1983) examined the exchange rate policy in Egypt since 1973 and its significance for cotton.

Fahmy's study (1969) favored the expansion of domestic cotton textile industries of high quality. He suggested that these industries should be specialized in the export market because the income elasticity of

high quality cotton consumption increases over time in the high income countries. Other studies in this area include those of El-Hariry (1964), and Attar and Rizk (1974).

Jamie (1970) presented a historical study on the cooperative marketing of raw cotton in the period 1953-68. The effects of cooperative marketing on cotton production was examined by El-Shat and Yassin (1971).

A-Shami (1979) examined the issue of the share of cotton in the Egyptian government revenue, and in the rest of the economy, its contribution to foreign exchange earnings and the effect of cotton and the cotton textile industry on employment and income distribution.

There are major arguments about whether or not the Egyptian farmer is responding to the price changes considering all of the restrictions imposed upon him by the government.

Table 8 gives the estimated price elasticities of supply as reported in different studies. The price elasticities of supply -- in general -- range from zero to 0.90 depending on the formula used in calculation and the length of data series. The estimations show that the Egyptian farmer responds to the changes in cotton prices even with all the restrictions that are put upon him.

Table 8. Summary of the Estimated Price Elasticities of Farm Supply of Egyptian Cotton.

Year	Investigator	Price elasticity
1959	Stern	less than 0.9
1965	Hansen and Marzouk	0.1 to 0.4
1973	Khedr	0.5
1976	Zaki	0.73 in static model, 0.28 in short runs, and 0.51 in long run
1978	Mustafa	0.30
1978	USDA	0.10
1980	Taha	0.04 to -0.37
1980	Lutz and Scandizzo	less than 0.33
1980	Cuddihy	-0.09 for short run, and -0.12 for long run
1981	Sarris	0.31 in short run, and 0.98 in long run
1981	Bale and Lutz	0.05 to 0.15
1983	Levy	For extra long staple: 0.58 in short run, and 0.94 in long run. For long staple: 1.66 in short run, and 2.65 in long run.

Source: See Bibliography.

CHAPTER II

Review of Literature

Introduction

Econometric studies of the cotton trade can be classified into domestic and international. The number of studies published does not reflect the importance of cotton in both the domestic and international economies. Cotton is still the most important textile fiber used in the world.* Despite the increasing importance of synthetic fibers, cotton accounts for more than one half of the world fiber consumption.

The approaches used in the analysis of cotton in international trade have varied widely, ranging from models which look at the world as one entity to models which divide it into several economic regions. Still others deal with separate exporting and/or importing countries. Some studies follow the market share approach in their analysis of foreign demand. While some studies estimate total fiber demand, others concentrate on single fibers. Absolute and relative variables, lagged independent variables as well as current variables are used. Both time series and cross-section

* Textile fibers include: cotton, wool, silk, flax; cellulosic (rayon and acetate), and noncellulosic (nylon, polyester, acrylic) man-made fibers.

analysis have been used. Differences in methods, variables, time period, and equation forms can be noticed.

The review will begin with a brief description of several studies at the domestic level, followed by studies of the supply and demand for cotton and other fibers by world economic regions. The chapter ends with a detailed description of studies relating to the trade of the countries of concern in the present analysis.

The reason for presenting the domestic studies for the countries under study (Egypt, Sudan, Peru and the U.S.) is that these countries are exporting countries and any changes in their domestic market certainly will affect their exports. So, it is important to have a clear idea about these domestic markets in order to have a better understanding of the export supply side. In order to analyze the world demand for cotton from these countries, it is important to know the world supply and demand elasticities. The cotton market cannot be studied separately from other fibers such as wool, silk, polyester, rayon and others. Therefore the total fiber market is also included in this literature.

For studies of domestic demand, most price elasticity estimates were found for cotton, while income elasticities estimates were found for the total fiber use. These estimates are reported in Tables 9 and 10.

Table 9. Estimated Income Elasticities of Total Fiber Use*

Investigator	U.S.	Egypt	Sudan	Peru
FAO (1954)	0.78			
FAO (1958)	0.00	1.10		1.05
FAO (1960)	-0.63	1.99		1.67
ICAC (1962)		1.20		
Donald, Lowenstein and Simon (1963)	0.80, 0.37 (for wool)			
FAO (1967)	0.00 to 1.50	0.90	1.60	1.00
NACFF (1967)	0.47			
PIPD (1969)				1.07
FAO (1971) household use = 2.23 industrial use = 0.96 clothing = 0.43		0.62		0.59
Magleby and Missian (1971)	1.12 to 1.15	0.24 (but not significant)	1.7 to 1.8	0.73 to 0.79
Dudly (1974)	0.86			
Collins (1979)	1.24	0.20	0.20	
French (1980)	1.67	0.33		

Source: See Bibliography

* Estimates of income elasticities of cotton for U.S. include Lowenstein and Simon (1954) as 0.89 to 1.05; FAO (1954) as 0.78, Blakely (1962) as 1.57, and Fowler (1963) as 0.32 to 0.70.

Table 10. Price Elasticities Estimates of Demand for Cotton*

U.S.		Egypt	
Investigator	Estimate	Investigator	Estimate
Lowenstein (1952)	-0.29	USDA (1978)	0.20
Lowenstein and Simon (1954)	-0.24 to -0.27	Lutz and Scandizzo (1980)	-0.33 to -0.66
Blakley (1962)	-0.86	Bale and Lutz (1981)	-0.10 to -0.30
Donald, Lowenstein and Simon (1963)	-0.14	Levy (1983)	extra long: -1.03 long: -0.24
Martin and Havlicek (1977)	-0.89		

Source: See Bibliography.

* Collins (1979) estimated the price elasticities of total fibers as -0.17 for the U.S., -0.40 for each of Egypt and Sudan.

Price elasticities of demand for cotton in the U.S. ranged from -0.14 to -0.89. It ranged between -0.66 and zero for Egypt. There is one estimate that found it positive (0.20). The income elasticities for total fibers differ significantly from one estimate to another.

Tables 11 and 12 represent the estimated elasticities of regional demand and supply of cotton and other fibers. They show that the world demand for cotton is inelastic and the demand curve is almost vertical. The demand and supply of the developed countries are more elastic than the demand and supply of the developing countries. The demand elasticity of the developed countries is about -0.20. It ranges between -0.09 and 0.06 for the developing countries. The income elasticities estimates differ significantly.

Studies of the U.S. Cotton Exports

In 1966, Harvey measured the effect of the U.S. export policies on the prices and quantities of raw cotton exported by five major competitors (Egypt, Sudan, Brazil, Mexico and Pakistan) in the period 1950-62. These policies are: the export allocation quotas, P.L. 480 and the cotton export subsidies. The model used was not an export demand or export supply

Table 11. Estimated Elasticities of Regional Demand for Cotton and Other Fibers.

Investigator	Estimates			
Blakley (1962)	Price elasticity for world demand for cotton (excluding U.S.): -0.07			
Magleby and Missian (1971)	Income elasticity of total fibers for 33 world regions : 0.62 to 0.66 income elasticity for 10 most developed countries : 0.42 to 0.44			
Martin and Havlicek (1977)	Price elasticity for world demand for cotton (excluding U.S.): -0.03			
Thigpen (1978)		Developed	Developing	Centrally Planned
	Income elasticity of :			
	Total fibers	0.30	1.40	0.60
	Cotton	0.07	0.50	0.20
	Demand elasticity with respect to:			
	Price	-0.20	-0.09	--
	Industrial Production	0.24	0.58	--
Hwa (1979)	Price elasticity for world demand for cotton : 2.0			
Collins (1979)	Income elasticity for total fiber worldwide : 1.08 to 1.21 Price elasticity for total fiber worldwide : -0.20			
French (1980)	Income elasticity for total fiber worldwide: 0.30 to 0.90			

Source: See Bibliography.

Table 12. Estimated Elasticities of Cotton Supply and Demand for World Regions

The Estimated Elasticity	Developed		Developing		Centrally Planned	
	Supply	Demand	Supply	Demand	Supply	Demand
Short run price elasticity	1.35	-0.23	0.07	(-0.02 to -0.06)	0.44	0.11
Long run price elasticity	1.34	-0.44	0.07	-0.18	1.02	-0.14
Mean lag in Price response (years)	1.0	1.9	1.0	2.8	4.3	0.3
Secular Trend (Percent per year	6.3	-5.1	3.7	--	7.7	0.3
Short run income or gross domestic product elasticity	--	0.60	--	0.47	--	0.20
Long run income or gross domestic product elasticity	--	1.15	--	0.47	--	0.00
Mean lag in income of GDP response (years)	--	0.09	--	0.00	--	--

Source: Adams, F.G. and J.R. Behrman (1976).

equation, but rather a combination of them in one multiple regression equation. The model consisted of five equations. The first two looked at the major determinants of the U.S. export price and quantities. The third and fourth examined the effect of U.S. export policy on the prices and quantitites of the above five competing exporters. The last equation considered the effect of the U.S. policy on the terms of trade of four of the five competing countries. A summary of his results is shown in Table 13.

In 1971, Sirhan and Johnson introduced a study about the foreign demand for U.S. cotton. They assumed that cotton is a nonhomogeneous commodity. Cotton from different countries is a close but not a perfect substitute. It differs in quality, location in process facilities, contractual obligations and custom duties. Also, they assumed that the consumers at the importing countries will change their purchases gradually rather than immediately since they are not sure whether or not the price changes are temporary. Using a market share approach, they introduced the following model:

Table 13. Summary of Harvey's Analysis of U.S. Cotton Export Policy.

Country	Dependent Variable	The Expected Signs	Significance Tests	R^2
U.S.	Price	U.S. production minus consumption, U.S. price support level did not have the expected signs.	All of them were insignificant except: world production, rate of U.S. export subsidy	0.93
	Quantity	Stocks in major consumer countries, estimated U.S. export price didn't have the expected signs.	All of them were significant, except U.S. cotton stock.	0.84
Egypt	Price	World production, stocks in major consumer countries and value of U.S. P.L. 480 barter exports didn't have the expected sign.	All of them were insignificant, except Egypt's export tax rate.	0.60
	Quantity	World production and U.S. estimated cotton exports did not have the expected signs.	All of them were significant, except the stocks of major consuming countries and estimated Egypt's export price.	0.91
Sudan	Price	Sudan's production minus consumption, world production and the value of U.S. P.L. 480 barter exports did not have the expected sign.	All of them were insignificant, except Sudan's export tax rate.	0.65
	Quantity	The variables that had expected signs were Sudan's cotton stocks, Sudan's production minus consumption, estimated U.S. cotton exports.	All the variables were insignificant.	0.67

Source: Harvey, Jack L. , 1960.

The import market of cotton from an exporting country can be written as:

$$Ma = f\ (Pa, Po)$$

Where:

$Ma = \frac{qa}{Q}$ = the exporting country's share in an import market.

qa = the quantity of cotton imported by a given country.

Q = total cotton imports from all sources by that country.

Pa = price of the exporting country's cotton.

Po = weighted average price of cotton from other sources in the given country's import market.

The price elasticity of foreign demand for cotton from the exporting country can be calculated by knowing the elasticity of market share. This relationship can be written as:

$$\frac{\delta qa}{\delta Pa} \cdot \frac{Pa}{qa} = \frac{\delta Ma}{\delta Pa} \cdot \frac{Pa}{Ma} + \frac{\delta Q}{\delta Pa} \cdot \frac{Pa}{Q}$$

The above equation shows that the price elasticity of demand for an exporting country in the given country's import market is equal to the share elasticity of the importing country plus the elasticity of total import demand by this country with respect to the price of the exporting country's cotton.

The assumption of the gradual adjustment in the quantity imported by a country suggests the following equations:

$$M_{at} = \gamma a + \gamma B\ P_t + (1 - \gamma)\ M_{a(t-1)}$$

where: Pt = ratio of the exporting country's price to the average of other prices.

The authors applied this model to U.S. cotton exports to West Germany and to England. They used time series data for the period 1953/54 - 1966/67. Their results showed that the market share short run elasticity in West German market was -8.0, long run elasticity was -11.0. These elasticities were statistically insignificant. The short run elasticity in the British market ranged from -2.70 to -8.67, and -9.67 to -20.16 in the long run. These ranges were due to the form of the equation that was used.

They concluded that their high elasticities estimation suggests that there is a high degree of competition between the U.S. and other countries which export cotton. If any exporting country lowers its price the other exporting countries will lower their prices, too. However, Johnson, Grennes and Thursby (1979) argued that the Sirhan and Johnson results had not found that the market differentiates cotton by its place of origin.

Another criticism of their study was introduced by Firch (1972). He mentioned that while they reported that "each exporting country to some degree is a "price maker" in an import market but differs from the "pure monopolist" in the sense that its cotton exports have close, but not perfect, substitutes", Firch argued that these conditions were not satisfied during the period covered by their analysis. He criticized their results in the sense that their market share elasticity -10.00 or -20.00 would not differ significantly from α. Practically -10.00 elasticity means that the market share would drop from 100 percent to zero with 10 percent increase in the price ratio. With -20.00, only 5 percent increase in the price ratio is needed to reach the same conclusion.

Hakim (1972) examined the effect of U.S. cotton policy on the world market for ELS cotton. In his analysis, he divided the world into three markets: the U.S. market for short staple cotton and the rest of the world market for short staple and for extra-long staple cotton. The study introduced two econometric models. In the first model, the economic forces in the rest of the world that may affect the rest of the world were ignored. The price in the rest of the world was assumed to be affected only by the U.S. economic forces

and policies. The variables of the rest of the world were introduced in the second model.

The first model included four equations and one identity. These equations are the U.S. mill consumption demand for upland cotton, the U.S. inventory demand for upland cotton, the rest of the world price for upland cotton, and the world price for extra-long staple cotton. The equilibrium condition in the U.S. market for upland cotton was set as the U.S. supply of upland cotton equal to the U.S. mill consumption plus the U.S. inventory demand.

The second model included five equations and two identities. These equations were: the U.S. mill consumption demand for upland cotton, the U.S. inventory demand for upland cotton, the foreign mill consumption demand for upland cotton, the export demand for U.S. cotton, and the equilibrium condition between the U.S. and the rest-of-the-world market. The study used OLS and 2SLS methods in estimating the parameters. The period included in the analysis was 1947-70.

The research examined the effect of the U.S. main policies on the world price of extra-long staple cotton. He concluded that the loan rate was the most effective tool. The second was the export subsidy followed by the government financial exports. The U.S. policy of reducing the supply of upland cotton had no

direct effect on the world price of extra-long staple cotton.

Bredahl (1979) estimated the U.S. export demand elasticities for cotton and other commodities under different assumptions of price transmission elasticity (response of the i^{th} country's price to change in the U.S. price). These assumptions were: the price transmission elasticity of the rest of the world is zero; it was assumed to be one, in the second assumption; and the free trade assumption, which assumes all the price transmission elasticities are equal to one. The estimated U.S. export demand elasticities for cotton were -0.39, -0.65, and -1.92 respectively for the above assumptions.

Studies of Egypt's Cotton Exports

A-Shami (1979) examined the impact of cotton on the economic development of Egypt, 1952-76. In his study, he estimated the Egyptian export price equation of cotton by the generalized least squares method using the double-log form. The independent variables were quantity of cotton exported from Egypt, exports of Sudan and Peru together, world stock, sales of man-made fiber in the non-communist world, and Egypt cotton yarn exports. The world stock variable was insignificant, so it was dropped in the second equation. In it, he

divided Egypt's exports of cotton into two variables: exports to USSR and exports to the rest of the world. Results of the two equations were very similar. The signs were as expected except the sales of the man-made fibers which had a positive sign in the two trials. All of the other variables were statistically significant, R^2 was equal to 0.91 in each of them.

The own elasticity of the demand for Egypt's cotton was -0.55. The cross-elasticity, with respect to Sudan and Peru's production, was -0.11.

A-Shami also estimated the foreign demand for Egyptian cotton yarn. The quantity exported was a function of the export price of the Egyptian cotton yarn, quantity of cotton exported from Egypt, rest of the world exports of cotton yarn, and the average price of polyester and yarn. All signs were as expected except for the price of polyester and yarn. The only significant variable was the exports of cotton yarn from the other parts of the world. R^2 estimated as 0.98.

USDA (1978) estimated the domestic demand elasticity for Egyptian cotton at 0.20. Lutz and Scandizzo (1980) reported a range of domestic demand elasticities for Egyptian cotton from -0.33 to -0.66. They used these estimates to measure the price distortion that resulted from the government's interference in Egypt

and in other countries in the agricultural section. For the same reason, Bale and Lutz (1981) used a range of -0.10 to -0.30 as domestic demand elasticities for the cotton in Egypt.

Heckerman, Khedr, and Kheir, El-Din (1982) estimated the demand function for ELS Egypt's cotton in three different equations. These equations differ in the variables included. All three were in double-log form; the analysis used a time series data for the period 1966/67 crop year to 1980/81. The estimated foreign demand elasticity was -1.24, and the income elasticity was 1.58.

Page (1982) also estimated the demand elasticity for Egyptian cotton exports at different levels of long run elasticities of supply from competitors, and at the same time, different levels of Egypt's share in total world output. His results are shown in Table 14.

Levy (1983) introduced a model explaining the cotton price policy in Egypt, 1965-78. The model consisted of three equations and three identities. The equations were: the domestic supply, the domestic consumption, and the export demand. The identities were: the market clearing identity, the prices received by farmers which is equal to the difference between the export price and the export tax, and the prices paid by consumers which is equal to the

Table 14: Estimated Elasticities of Demand for Egyptian Cotton Exports

Egypt's share in total output	Elasticity of supply from the rest of the world		
	0	0.5	1.0
0.50	-1.30	-1.80	-2.30
0.45	-1.44	-2.06	-2.67
0.40	-1.63	-2.38	-3.13

Source: Page, John M. (1982).

difference between the export price and the consumer subsidy. The study measured the welfare and the transfer effects of the export taxes and consumption subsidies. All of the equations were estimated by two-stage least squares method, except the equation of the domestic consumption, which was estimated by ordinary least squares. The estimated foreign elasticities of demand for Egyptian cotton were -1.42 for extra-long staple cotton and -1.66 for long staple cotton. The study also estimated the price elasticities of domestic demand at -1.03 for extra-long staple cotton and -0.24 for the long staple cotton.

Studies of Sudan's Cotton Exports

Abbadi (1981) analyzed the world market demand, supply, and the price of Sudan's ELS cotton (1956-1977). He estimated the import demand function for Sudanese cotton by the six most important countries in Sudan's export cotton market. These countries are: France, West Germany, Italy, U.K., Japan and India. The foreign mill consumption function and the world demand function for Sudan's ELS cotton were estimated. The only difference between the two was that the world imports of Sudan's cotton in year t were defined to be equal to mill consumption during period t + 1 plus the change in stocks from year t to year t + 1. The study

applied HWA's model of stock flow adjustment on the demands of Sudan cotton.

Lagged variables were used to measure past changes in the independent variables on the current imports. This is because of the lag between orders and shipment. The model was estimated by the OLS method.

The study results showed that the price elasticities of these six countries are generally between 1.00 and 2.10.

The own price elasticity of Sudanese cotton ranged from -0.28 to -0.35 in the mill consumption model* and -0.03 to 0.83 in the import demand model. The cross elasticities ranged from 0.09 to 0.74 for Egypt's price and 0.29 to 0.37 for the U.S. price in the first model. In the second model, it ranged from 0.48 to 0.53 for Egypt's price and from 0.80 to 0.84 for the U.S. price. R^2 ranged from 0.84 to 0.86 in the first model and about 0.60 in the second model, depending on the variables being used. All equations were in the double-log form.

* All the prices are lagged by six months in the mill consumption model and three months in the world import demand function.

CHAPTER III

The Econometric Model

Introduction

In the last few years, a number of studies have been carried out on international trade. Most of these studies have been demand-side oriented. Supply studies, both on the import and export side, have been neglected.* The majority of these studies analyzed the total demand and total supply of all commodities of a country. The single equation method was widely used in them.

World demand for the developing countries' exports, as well as their import demand, have generally been assumed in the literature to be determined by non-market forces. Therefore, products imported and exported by these countries were considered relatively insensitive to changes in price (Chenery and Strout

* For example, Stern, Francis and Schumacher's (1976) bibliographical survey of price elasticities lists 350 pages of demand estimates, and only 10 pages for supply. For more detail, see the following studies on the demand side: Warner and Kreinin (1983); Goldstein, Khan, and Officer (1980); Goldstein and Khan (1978); Khan and Ross (1975); Khan (1974); Taplin (1973); Adler (1970); Houthakker and Magee (1969); Kreinin (1967); and Horner (1952). For the supply side, see studies by: Haynes and Stone (1983); Dunlevy (1980); Goldstein and Khan (1978); Basevi (1973); Rhomberg (1973); Leamer and Stern (1970); and Morgan and Corlett (1951).

1966; Maizels 1968; Khan 1974). The individual country's studies have in certain cases included price variables as a determinant of imports and exports, but this cannot be generalized among the developing countries.

Most studies have assumed that the export or import supply curve facing any country is perfectly elastic. This assumption might be reasonable in the world supply of imports to a single country, but it has less validity when we deal with the supply of exports of an individual country. According to economic theory an increase in world demand for a country's export is usually accompanied by an increase in the price of its export. A country which has a world monopoly for a commodity faces a demand curve of the world market. On the other hand, a country with a small proportion of a free export market faces a perfectly elastic demand curve. Horner argues that when the exporting country supplies a reasonable amount of its export market, the price elasticity of export demand for its own product will be greater than the price elasticity of demand on the export market for the commodity in general. This will depend also on the response of other supplying countries to a change in the export market price, i.e., the elasticity of supply in other countries.

Klein (1960) has argued that the ordinary least squares method is a valid procedure for estimating international trading relationships for a small country. The objection to the use of the ordinary least squares method to estimate the demand for export, for example, is that one must assume that there is no possibility of supply relationship between the export price and the quantity exported. If the supply relationship is less than infinitely price elastic, the estimated price elasticity in the demand equation will be a weighted average of a positive supply elasticity and a negative demand elasticity, and the estimate will then be biased and inconsistent. Most studies in the international trade area have applied a single equation model. Only a few studies have employed a simultaneous equation system in their studies of international trade.*

Most of the previous studies have not estimated the supply response in international trade, and hence they ignore the possibility of a simultaneous relationship between demand and supply of exports. This connection needs to be built into the specification of the export equations. The equations must also reflect the essentials of competition between countries for export

* For example, see: Dunlevy (1980); Goldstein and Khan (1978); Turnovsky (1968); and Morgan and Corlett (1951).

markets, and between the substituted commodities for the commodity under study.

The Theoretical Model

In this section, it is assumed that the market is competitive. In addition, we will assume that the response of the quantity exported to the exported price is instantaneous, i.e., there are no lags in the system. So, the model is an equilibrium model.

The world demand for country "B"'s export of commodity "A" is specified as:

$$X_i^d = a_{00} + a_{01} P_i + a_{02} P_m + a_{03} P_n + a_{04} I + U_{00}$$

where:

X_i^d = Quantity of exports of the commodity "A" demanded from the country "B".

P_i = Real export price of commodity "A" for country "B".

P_m = Real export prices of commodity "A" of countries "M", where m = number of countries which export commodity "A".

P_n = Real export price of the substituted commodities.

I = Real income in the importing countries who import commodity "A" from country "B".

U_{oo} = Random error term that is independent, and normally distributed, $U_{oo} \sim N(0, \sigma^2)$.

In this demand equation, it is expected that a_{o1} will be negative, a_{o2}, a_{o3} will be positive; a_{o4} will be

assumed to be positive unless the commodity is an inferior good.

The commodity's own price elasticity, the income elasticity, and the cross elasticities with respect to both the other countries export prices, and the prices of the substituted commodities can be estimated directly or indirectly, depending on the form of the equation.

The export supply equation is specified as follows:

$$X_i^s = b_{00} + b_{01} P_i + b_{02} Q + b_{03} C + U_{10}$$

where:

X_i^s = Quantity of exports of commodity "A" supplied by country "B".

P_i = Real export price of commodity "A" for country "B".

Q = Quantity produced and stocked of commodity "A" in country "B"

C = Quantity consumed locally of commodity "A" by country "B".

U_{10} = Random error term that is independent and normally distributed, $U_{10} \sim N(0,\sigma^2)$.

The equation embodies the hypothesis that as the price of export of a commodity rises, the quantity of exports supplied would increase. In addition, exports rise, ceteris paribus, when there is an increase in the country's production or decrease in the domestic consumption of the commodity. Therefore, it is expected

that b_{01}, b_{02} will be positive, and b_{03} will be negative. The equilibrium condition of the market (or clearance equation) requires that:

$$X_i^d = X_i^s.$$

The supply and demand equations must satisfy the rules of identifiability.

The necessary condition for an equation to be identified is that the total number of variables excluded from it but included in other equations must be at least as great as the number of equations of the system, less one (Koutsoyiannis 1977).

Let G = total number of endogenous variables (equations)

K = number of total variables in the model (endogenous and predetermined)

M = number of variables, endogenous and exogenous, included in a particular equation.

Then the order condition for identification is:

$$K - M \geq G - 1.$$

Each equation must be exactly or over-identified in order that its coefficient can be statistically estimated. Indirect least squares can be used if the equation is exactly identified. This method cannot be applied in case of an overidentified equation because it will not yield unique estimators of the structural parameters. Other methods can be used such as two-stage least squares (2SLS), or maximum likelihood methods.

Goldstein and Khan (1978) note that the meaning of the coefficient of determination in simultaneous equation models is ambiguous. This is because it is not bounded between (0,1) but $(-\infty,1)$, but it is still a fairly good indication of the goodnesss of fit of the individual equations. Also the meaning of Durbin-Watson test of autocorrelation is not clear in simultaneous models.

The Empirical Model

To achieve the objectives of the study, the export supply and export demand functions will be specified and empirically estimated through a simultaneous equation model of cotton exports from Egypt, Sudan, Peru and the U.S. for the period 1950-80, assuming a competitive world market.

In estimating the demand or the supply, an important question is raised: Does the price(s) affect the quantity(s) demanded (or supplied) or is the price a function of quantity? Different studies have different answers for this question. It is an empirical question. In the case of Egyptian cotton, there are two conflicting opinions:

A report by USDA (1982) about Egyptian cotton stated that:

> Export sales terms and selling conditions are announced annually by the Ministry of Economy. This policy is determined at a meeting of the Cotton Exporters Association. The meeting is held after representatives of the six export companies return from their August and September travel to major sales markets and assessment of export prospects. Initial selling prices are valid for one week. The association's intent is to sell the major part of the crop during the initial week. Weekly meetings of the association are held to review prices as the season progresses.

A working paper by Heckerman and others (1982) noted that:

> The Egyptian authorities are following the practice of setting a dollar export price at the beginning of the crop year which was maintained with little variation throughout the year. (Official Egyptian policy is to raise prices if market conditions permit, but to never lower prices). Because of this policy, it is appropriate to assume that prices are exogenous and quantities exported are endogenous.

In contrast, A-Shami (1979) and Levy (1983) presented results consistent with the opposite view. A-Shami presented an equation for foreign demand for Egyptian cotton in the international market. The equation has the export price as function of the exported quantity.

Levy introduced a model explaining the cotton price policy in Egypt, 1965-78. The model consists of six equations: a domestic supply equation, a domestic consumption equation, an export demand equation, a market clearing identity, and two identities defining the

price received by farmers and paid by consumers. He noted that:

> An increase in world cotton stocks normally would affect prices in the following year. But if the stocks build-up stems from speculation by producing countries, it may raise world cotton prices in that same year. Thus the export demand equation specifies that Egypt's price is a function of its cotton export, the export of its main competitors, world cotton stocks and total world exports of man-made fibers.

With these two opposite views, a simultaneous equation model is a suitable model to deal with this problem. The hypothesis here is that the quantity exported of Egyptian cotton is affected by and has an effect upon the export price. The exported quantity does not only depend on the Egyptian export price, but also on the other competitive countries' prices, as well as the prices of the commodities substituted for cotton and the income of the importing countries.

Other studies -- Osman on U.S. cotton; Abbadi on Sudan's cotton -- suggest that quantity of cotton supplied for export from these countries is a function of their own export prices. This assumption is adopted here. There are no available studies for Peru; it will be assumed that the same logic is true here as well.

The model consists of eight equations and eight identities. Each country (Egypt, Sudan, Peru and U.S.) is represented by two behavioral equations: one is the

foreign demand equation, the other is the export supply equation. Equations defining the quantity of cotton available for export in each country and the four market clearing equations are the eight identities.

Since these four countries are competitive in their exports of cotton, the model assumes that the quantity demanded from each of them depends on its own export price and the other three countries' export prices. Also, it will depend on the prices of rayon and polyester -- goods which are closely related to cotton in consumption. The level of income in the importing countries is assumed to be another shifter for the demand curve.

The factors assumed to be affecting the supply of export of cotton for each country are its own export price of cotton, the quantity of cotton produced, the difference between the stock of the cotton in the end and the beginning of the year, and the quantity of cotton consumed locally in each country.

The Model

$$XE^d = a_{01} + a_{02}\,PE + a_{03}\,PS + a_{04}\,PP + a_{05}\,PU + a_{06}\,I + a_{07}\,PR + a_{08}\,PY + V_1.$$

$$XE^s = a_{11} + a_{12}\,PE + a_{13}\,TE + a_{14}\,CE + V_2.$$

$$TE = QE + KE_{t-1} - KE_t.$$

$$XE^d = XE^s.$$

$$XS^d = b_{01} + b_{02}\,PE + b_{03}\,PS + b_{04}\,PP + b_{05}\,PU + b_{06}\,I + b_{07}\,PR + b_{08}\,PY + V_3.$$

$$XS^s = b_{11} + b_{12}\,PS + b_{13}\,TS + b_{14}\,CS + V_4.$$

$$TS = QS + KS_{t-1} - KS_t.$$

$$XS^d = XS^s.$$

$$XP^d = C_{01} + C_{02}\,PE + C_{03}\,PS + C_{04}\,PP + C_{05}\,PU + C_{06}\,I + C_{07}\,PR + C_{08}\,PY + V_5.$$

$$XP^s = C_{11} + C_{12}\,PP + c_{13}\,TP + C_{14}\,CP + V_6$$

$$TP = QP + KP_{t-1} - KP_t.$$

$$XP^d = XP^s.$$

$$XU^d = d_{01} + d_{02}\,PE + D_{03}\,PS + d_{04}\,PP + d_{05}\,PU + d_{06}\,I + d_{07}\,PR + d_{08}\,PY + V_7.$$

$$XU^s = d_{11} + d_{12}\,PU + d_{13}\,TU + C_{14}\,CU + V_8.$$

$$TU = QU + KU_{t-1} - KU_t.$$

$$XU^d = XU^s.$$

Variable Definitions

XE^d = Total quantity of cotton demanded by the importing countries from Egypt.

XS^d = Total quantity of cotton demanded by the importing countries from Sudan.

XP^d = Total quantity of cotton demanded by the importing countries from Peru.

XU^d = Total quantity of cotton demanded by the importing countries from the U.S.

XE^s = Total quantity of cotton supplied for export by Egypt.

XS^s = Total quantity of cotton supplied for export by Sudan.

XP^S = Total quantity of cotton supplied for export by Peru.

XU^S = Total quantity of cotton supplied for export by the U.S.

PE = Real export price of Egyptian cotton.

PS = Real export price of Sudanese cotton.

PP = Real export price of Peruvian cotton.

PU = Real export price of American cotton.

PR = Real export price of rayon of the U.S.

PY = Real export price of polyester of the U.S.

I = Real GNP in the importing countries.

QE = Quantity of cotton produced in Egypt.

QS = Quantity of cotton produced in Sudan.

QP = Quantity of cotton produced in Peru.

QU = Quantity of cotton produced in the U.S.

CE = Quantity of cotton consumed in Egypt.

CS = Quantity of cotton consumed in Sudan.

CP = Quantity of cotton consumed in Peru.

CU = Quantity of cotton consumed in the U.S.

KE = Quantity of cotton stocked in Egypt.

KS = Quantity of cotton stocked in Sudan.

KP = Quantity of cotton stocked in Peru.

KU = Quantity of cotton stocked in the U.S.

TE = Quantity of cotton available for exports from Egypt.

TS = Quantity of cotton available for exports from Sudan.

TP = Quantity of cotton available for exports from Peru.

TU = Quantity of cotton available for exports from the U.S.

t = end of the year.

t-1 = beginning of the year.

V = Error term

The demand equations demonstrate a relationship in which the quantity of cotton demanded from each country is assumed to be inversely related to the country's own price, while the prices of competitive countries, and prices of man-made fibers would have a positive relationship. Income of the importing countries is expected to be positively related to the quantity demanded.

The supply relationships consider the export price of each country to be positively related to the quantity exported. It is assumed that the quantity exported increases when the production increases or the domestic consumption decreases.

Each pair of equations (demand and supply for exports) constitutes an equilibrium model, and estimates of the structural parameters can be obtained by estimating these two equations. Simultaneously, the order and rank conditions of identifiability are both satisfied. Each equation is overidentified and the two stage least squares (2SLS) method will be used to

estimate the coefficients of the structural model. There will be four reduced form equations in the final model. Each one has the export price of each country as a function of the quantity produced and the quantity consumed in each country and in the other three countries, as well as the price of rayon, the price of polyester, and the income of the importing countries.

The assumptions of the 2SLS method as reported by Koutsoyiannis (1977) may be outlined as follows:

(1) The disturbance term V of the original structural equation must satisfy the usual stochastic assumption of zero mean, constant variance and zero covariance. Otherwise the reduced-form error terms will not possess these characteristics and hence the whole method breaks down;

(2) The error term of the reduced form equations must satisfy the usual stochastic assumptions, that is (a) the error term has zero mean, constant variance and zero covariance, (b) the error term must be independent of the exogenous variables of the whole structural model;

(3) The explanatory variables are not perfectly multicollinear;

(4) It is assumed that the specification of the model is correct so far as the exogenous variables are concerned;

(5) It is assumed that the sample is large enough, and in particular that the number of observations is greater than the number of predetermined variables in the structural system. If the sample size is small in relation to the total number of exogenous variables, it may not be possible to obtain significant estimates of the reduced-form coefficients when applying ordinary least squares at the first stage. If the sample size is small, one might try to reduce the number of exogenous variables by applying the method of principal components.

Data Discussion

Data on the quantities exported of raw cotton for each country production, consumption and stocks were obtained from USDA publications of Foreign Agriculture Circulars concerning cotton for the period 1950-80, which gave thirty-one observations for each regression equation.

There are many varieties of each staple length of cotton. They differ in quality and hence, also in locality. The variations in the Egyptian prices are illustrated in Table 15, where buying prices, export prices and selling prices to domestic mills are shown for different varieties of cotton for the years 1965 to 1976. The variation in export prices of Egyptian

Table 15. Egyptian Cotton Prices by Type, 1965-1976

(Egyptian Pounds per Ton)

Cotton Varieties	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
Buying Prices:												
Extra-long Staple												
Giza 45	360	360	360	372	412	440	542	542	566	566	596	696
Menoufi	308	308	318	342	374	398	456	456	480	480	510	565
Long Staple												
Dandara	290	290	290	302	302	302	342	342	352	352	392	392
Medium Staple												
Ashmouni	287	287	287	299	315	315	371	371	411	411	451	461
Export Prices:												
Extra-long Staple												
Giza 45	435	416	404	458	532	512	592-596	604-628	604-886	1276-1352	1144	905
Menoufi	392	371	416	416	460	460	520-524	528-548	528-808	1200-1276	1068	829
Long Staple												
Dandara	326	296	280	310	328	316	404-406	434-466	628-728	1068-1166	866	677
Medium Staple												
Ashmouni	306	404	376	384	-	-	-	-	-	-	-	-
Giza	na	na	na	na	na	na	360-366	392-420	384-686	1044-1120	820	-
Selling Prices to Domestic Mills												
Extra-long Staple												
Giza 45	420	420	420	420	420	420	472	472	472	472	472	472
Menoufi	376	375	375	375	375	375	392	392	392	392	392	392
Long Staple												
Dandara	290	302	302	294	294	294	314	314	314	314	314	314
Medium Staple												
Ashmouni	302	302	302	302	302	302	322	322	322	322	322	322

Source: Technical Secretariat for Cotton Sector, Cairo, Egypt.

cotton are explained by the differences between prices paid by bilateral trade agreement countries and those paid by convertible currency countries. Ninety-five percent of Egypt's cotton exports in 1970 went to hard currency countries. This share dropped to 40 percent in 1976 when these arrangements were being phased out. Since 1976, substantial subsidies were paid to the domestic mills for textile exports and for sales in the domestic market. These sales have increased by about twenty percent a year, which has forced Egypt to import shorter staples cotton from the U.S. and other countries. Another point should be noted: the table shows the stability in the local prices in Egypt compared with the extreme instability in foreign prices.

With this mixed system of cotton prices in Egypt, and probably in the other exporting countries under study, a calculation for each country's export price was needed. The following formula was used:

$$P_{ikt} = \frac{V_{ikt}}{X_{ikt}}$$

where:

P_{ikt} = average price of cotton exported from country "i" to country "k" in year "t".

V_{ikt} = The value of cotton exported from country "i" to country "k" in year "t".

X_{ikt} = quantity of cotton exported from country "i" to country "k" in year "t".

A problem often encountered is that the quantity exported as reported by the exporting country is not the same amount as reported by the importing country. There are reasons that might cause this problem. For example, a shipment from one country to another may be reported in two different years, i.e., a shipment from Alexandria in December 1983 may arrive in Marseilles in January 1984. Consequently, it will be reported in two different years in the two countries. Another reason is the existence of an economic organization of the importing countries. For example, most of the cotton is imported by Western Europe, for which they have an economic union called the European Common Market Countries (EEC). There are interior regulations which facilitate movement of goods among the member countries. An importing member can transfer the amount of its imports from an exporting country to another country in the union and each country will report it differently. The customs system in the importing country and how it reports imports could be another reason for for these differences. The reported value of exports might also differ, depending on whether or not it included the transportation and the handling cost, i.e., c.i.f. or f.o.b.

Even with these problems, the method of the average price is still a good representative method to

calculate the export price. It will be very hard, or almost impossible, to trace every variety of the exported cotton and try to equalize the amount reported by the exporting countries and the importing countries. In this research, the amount of raw cotton and the value reported by the exporting countries was used. The reason behind this is that our concern is with the exporting countries and not the importing countries.

The formula used to calculate the average export price for each country is as follows:

$$P'_{ikt} = \frac{P_{ikt}}{D_{kt}}$$

where:

P'_{ikt} = real export price of cotton exported from country i to country k in year t,

P_{ikt} = defined above

D_{kt} = consumer price index, country k, year t

and

$$P_{it} = \Sigma^{k} \gamma_{kt} P'_{ikt}$$

where

P_{it} = real price of cotton exported by country i in year "t", c.i.f.

γ_{kt} = the proportion of country i total cotton exports going to country k, year t.

P'_{ikt} = defined above

i = the four countries exporting raw cotton in the model (Egypt, Sudan, Peru, and the U.S.).

k = different numbers of importing countries differ to each exporting country for each year.

The base year of the price indexes is 1975, i.e. (1975=100). The export prices are in U.S. dollars per ton. A problem with a country like Egypt is that it has a system of multiple exchange rates for both imports and exports and which rate should be used is a problem which can be addressed by itself. The exchange rate used in estimating the value of the raw cotton exports is the official rate. However, there are other exchange rates which evaluate the Egyptian pound with higher value against the dollar. Using that rate leads to an undervaluation of the proceeds of the cotton by the amount of the overvaluation of the Egyptian Pound (L.E.) during the period. Ikram (1980) estimated that the rate of overvaluation of the black market compared to the official rate was 20 percent to 30 percent during the time period 1965-78.

The procedure used to calculate the price was also applied to the calculation of the income variable. Gross National Product, in billions of dollars, of the importing countries was used as representative of the income variable. The consumer price index for each importing country was used to deflate the corresponding

GNP variable. The formula used to calculate the income figure is as follows.

$$I_{it} = \Sigma \alpha_{nt} I_{nt} = \sum_{k} \gamma_{kt} \cdot I'_{kt}$$

where

I_{it} = real income of countries importing cotton from country "i" in year "t".

$_{kt}$ = defined above.

I'_{kt} = real gross national product of each of these importing countries in year "t",

i = the four countries exporting raw cotton in the model (Egypt, Sudan, Peru, and the U.S.),

The introduction of man-made fibers has, presumably, affected the demand for cotton. They are cheaper than cotton and yet have the same strength and fineness of cotton. They launder more easily, do not wrinkle or shrink, and wear well. The man-made fibers compete most directly with short and medium staple cotton and to a lesser degree with the long staple varieties. The prices used for the man-made fibers are those quoted by the U.S. Prices of 1.5 and 3.0 denier regular rayon staple were used to represent the cellulosic portion of the man-made fibers. To represent the non-cellulosic portion, prices of polyester, dacron type 54, 1.5 denier were chosen. The data series of these prices are in U.S. dollars per ton. The consumer price index of the OECD (Organization for Economic Cooperation and

Development) countries was used to obtain the real prices.

Prices and incomes are reported on a calendar year basis while the quantities of raw cotton were reported on a crop year basis (beginning of August to the end of July). Data were not available to the author for all variables on the same year basis. A simple method was used to overcome this problem. The crop year was assumed to be from August of year "t" to end of July of year "t+1". Also assumed that the two calendar years are "t" and "t+1". The method is applied by fixing the crop year quantities and changing the calendar year data. This is done by taking five twelfths of price, or income, of the calendar year "t" and seven twelfths of the price, or income, of year "t+1" and adding them. The resulting value is considered to be the price, or income, for crop year t.

CHAPTER IV

The Results

This chapter looks at the empirical results of estimating the proposed model of supply of, and demand for, exports of the major exporting countries of long staple lengths of cotton.

An ordinary least square (OLS) method is applied as well as the two stage least square (2SLS) method to show the differences in the value of the estimated parameters and their significance.

Four models were estimated. The first includes Egypt and Sudan only. All of the competitive factors are operable between these two countries. They export almost the same variety of cotton. They are located in the same area close to the major consuming countries, especially Europe. The second model added Peru as the third largest exporter of long staple cotton. The U.S. was added in the third model as the main exporter of upland cotton. Prices of rayon and polyester are added in the final model. Income is included in all of the models.* The results of the final model are presented in detail in this chapter, while the results of the first three models are reported in Appendix II.

* In reporting the effect of each independent variable on the dependent variable, it is always assumed that the rest of the independent variables are held constant.

The Final Model

In addition to the export prices and quantities of the exporting countries and the income of the importing countries, the final model includes the prices of man-made fibers -- rayon and polyester. In the OLS demand equation for Egyptian cotton, export price of Sudan and income of the importing countries show unexpected negative signs. Neither are statistically significant. R^2 is 0.69. The export price of Egyptian cotton is negatively related to the quantity supplied for exports, but it is insignificant. R^2 is 0.82 (Table 16).

The demand equation for Sudan's cotton exports shows negative signs with respect to the export prices of Peru and the U.S. The signs of the rest of the variables agree with a priori expectation. R^2 is 0.72. Parameters of the supply equation of Sudan's cotton export also have the expected signs at different levels of statistical significance. The value of R^2 is 0.80.

The importing countries' income is the only parameter that has an unexpected sign in the OLS estimation of the demand for Peruvian cotton. R^2 is at 0.65. As in the case of Egypt and Sudan, the prices of man-made fibers are positively related to the quantities exported of Peruvian cotton, but are not statistically

Table 16. Final Model Equations Estimates

Dependent Variable	Explanatory Variables	OLS Estimate	OLS Student t Statistics	2SLS Estimate	2SLS Student t Statistics
Demand for Egypt's Export (XE^d)	Constant	189.2340		177.1478	
	PE	-0.0832	-1.5841*	-0.1453	-2.3458**
	PS	-0.0025	-1.1214	0.0888	1.9673**
	PP	0.1267	1.7313**	0.0401	1.3294*
	PU	0.0421	1.5431*	0.0357	4.3925***
	PR	0.0543	0.5457	-0.0823	-1.2895
	PY	0.0829	0.7623	0.0351	0.9645
	I	-0.0168	-1.2914	0.0724	5.7639***
Supply of Egypt's Export (XE^S)	Constant	124.9814		168.8524	
	PE	-0.0167	-0.8543	0.0083	1.3521*
	TE	0.6854	6.2131***	0.4376	5.3921***
	CE	-0.7289	-7.3947***	-0.9053	-6.4320***
Demand for Sudan's Export (XS^d)	Constant	98.9841		27.9020	
	PE	0.0129	1.2389	0.0487	2.4864***
	PS	-0.0142	1.9567**	-0.0834	-2.5435***
	PP	-0.0497	-1.2958	0.0216	1.1421
	PU	-0.0513	-1.2573	0.0253	1.4546*
	PR	0.0612	0.8563	-0.0662	-0.9247
	PY	0.0913	0.9532	0.0185	1.1147
	I	0.0367	1.4370*	0.0363	2.6732***
Supply of Sudan's Export (XSP^S)	Constant	16.4313		-3.7221	
	PS	0.0201	1.1932	0.0107	1.4532*
	TS	0.3846	5.8430***	0.4832	5.2198***
	CS	-0.3985	-2.0017**	-0.3739	-1.7324**
Demand for Peru's Export (XPd)	Constant	6.6829		8.4143	
	PE	0.0094	1.3295*	0.0188	1.3156*
	PS	0.1157	0.5423	0.0150	1.4768*
	PP	-0.0184	-1.3587*	-0.0460	-1.7238**
	PU	0.0243	1.5827*	0.0194	1.5231*
	PR	0.2431	0.9132	-0.0255	-1.1563*
	PY	0.1641	0.8195	0.0050	1.2347
	I	-0.0109	-0.9643	0.0202	1.9242**
Supply of Peru's Export (XP^S)	Constant	33.4715		6.0242	
	PP	0.0012	0.7582	0.0066	1.3817*
	TP	0.4931	5.6142***	0.3749	10.6943***
	CP	-0.5641	-3.9913***	-0.3954	-5.3824***
Demand for U.S. Export (XU^d)	Constant	27.5691		34.8643	
	PE	0.3172	1.0964	0.0751	1.1419
	PS	0.4559	1.1412	0.0828	1.2622
	PP	0.4913	1.1657	0.0763	1.1531
	PU	-0.4970	-1.3782*	-0.8330	-2.5890***
	PR	0.7351	1.6789*	0.4907	3.7318***
	PY	0.8154	2.0950**	0.2048	3.5564***
	I	0.1234	1.4523*	0.2692	1.8672**
Supply of U.S. Export (XU^S)	Constant	19.2519		13.2315	
	PU	0.1343	1.5558*	0.9283	2.1189**
	TU	0.1619	1.7329**	0.0911	2.3145**
	CU	-0.7946	-2.41[illegible]**	-0.4006	-3.3456***

* significant at 10 percent level
** significant at 5 percent level
*** significant at 1 percent level

significant. The supply equation for Peruvian exports of cotton has all of the expected signs. R^2 is 0.79.

The OLS estimates of the demand and supply parameters for the U.S. agree in sign with expectations. However, the export prices of the long length variety countries are not significant. R^2 is estimated at 0.71 for the demand equation and 0.75 for the supply equation.

OLS is used to estimate the reduced form price equations of this model. Their results are as follows:

PE = 2413.1639 + 0.2925 TE - 6.4921 CE - 0.19325 TS + 49.1257 CS - 3.9471 TP + 3.8721 CP - 0.0245 TU + 0.5439 CU + 0.0324 PR + 0.0193 PY + 0.8129 I; R^2 = 0.82

PS = 3598.1429 - 1.9665 TE - 8.2549 CE + 1.2195 TS + 27.1254 CS - 4.0139 TP + 29.1273 CP - 0.1039 TU + 0.6195 CU + 0.0432 PR + 0.0249 PY + 0.3025 I; R^2 = 0.79

PP = 3394.5492 - 1.5829 TE - 1.8439 CE - 0.1927 TS + 4.3175 CS - 2.5449 TP + 11.0571 CP + 0.0932 TU - 0.4932 CU + 0.0328 PR + 0.0217 PY +

PU = 2996.7321 - 1.9645 TE - 4.3275 CE - 1.9243 TS + 3.2181 CS - 4.9273 TP + 28.1425 CP - 0.0431 TU + 0.4937 CU + 0.1523 PR + 0.1617 PY + 0.9425 I; R^2 = 0.85

The 2SLS estimates of the structural parameters agree in most cases with expectations. The estimated equation of the demand for Egypt's cotton shows the following results:

(1) A change of one U.S. dollar per metric ton in the export price of Egypt's cotton results in change in the quantity demand of its cotton in the opposite direction by about 145 tons;

(2) A change of one U.S. dollar per metric ton in the export price of Sudanese cotton results in a change in quantity demanded of Egyptian cotton by 88 tons in the same direction;

(3) A change of one U.S. dollar per metric ton in the export price of Peruvian cotton results in a change in the quantity demanded of Egyptian cotton in the same direction of about 40 tons;

(4) A change of one U.S. dollar per metric ton in the export price of U.S. cotton results in a change of about 36 tons in the same direction in the quantity demanded of Egyptian cotton;

(5) A change of one billion U.S. dollars in the real GNP of the cotton importing countries results in a change of 72 tons in the same direction in the quantity demanded of Egyptian cotton;

(6) The price of polyester seems to have a weak effect on the quantity demanded of Egyptian cotton. The

price of rayon has, contrary to expectations, a negative sign; however, it is insignificant.

The equation of Egypt's export supply of cotton indicates that:

(1) A change in the export price of Egyptian cotton by one U.S. dollar per metric ton results in a change of only about 8 tons in the same direction in the quantity supplied by Egypt for export;

(2) A change in the quantity produced plus cotton stocks in Egypt by one thousand metric tons results in a change in the quantity supplied for export by 438 tons in the same direction.

(3) A change in the quantity of cotton consumed domestically by one thousand metric ton results in a change of 905 tons in the opposite direction in the quantity supplied by Egypt for export.

The estimation of the model of the demand for Sudan's cotton shows that the expected signs were obtained for all of the variables except for the price of rayon which has a negative sign. However, the export price of Peru and the price of polyester seem to have little effect on the quantity demanded of Sudan's cotton. The supply equation agrees with economic logic in its signs and the parameters are statistically significant.

The results for the Peruvian supply and demand equations also agree in signs with prior expectations. The case is the same for the parameters estimated for the demand and supply equations for U.S. cotton exports.

Estimates of the Elasticities

Tables 17 and 18 show the estimates of price and income elasticities of the four countries estimated at the mean values. The reported elasticities are from the final model.

The most important factor affecting foreign demand for Egyptian cotton is own export price. The estimated demand elasticity is -1.21, i.e., if Egypt changes its price by one percent, the demand for its cotton will be changed by 1.21 percent in the opposite direction. A change in the Sudanese export price of cotton by one percent will lead to a change in the quantity of Egyptian cotton demanded by 0.54 percent. The export price of Peru affects the quantity demanded from Egypt with an estimated cross elasticity of 0.22. The U.S. price affects the demand for Egypt's cotton, with a cross price elasticity of 0.20.

The incomes of the importing countries are important factors in determining the foreign demand for

Table 17. Estimated Demand Elasticities

	Export price of Egyptian cotton	Export price of Sudanese cotton	Export price of Peruvian cotton	Export price of U.S. cotton	Export price of rayon	Export price of polyester	Income of the importing countries
Elasticity of demand for Egyptian cotton with respect to:	-1.210	0.5434	0.2257	0.1956	-0.3481	0.3422	0.7421
Elasticity of demand for Sudanese cotton with respect to:	0.7689	-0.9728	0.2309	0.2655	-0.5316	0.3420	0.7041
Elasticity of demand for Peruvian cotton with respect to:	0.5747	0.3369	-0.9507	0.3903	-0.3957	0.1809	0.7524
Elasticity of demand for U.S. cotton with respect to:	0.1598	0.1291	0.1102	-1.1662	0.5297	0.5089	0.7091

Table 18. Estimated Supply Elasticities

	Own export price	Quantity available for export	Quantity consumed domestically
Elasticity of supply of Egyptian cotton with respect to:	0.0691	0.8832	-0.5658
Elasticity of supply of Sudanese cotton with respect to:	0.1247	0.9264	-0.0258
Elasticity of supply of Peruvian cotton with respect to:	0.1368	0.9147	-0.1317
Elasticity of supply of U.S. cotton with respect to:	1.3042	0.3800	-0.6962

Egyptian cotton. A one percent increase in the incomes of the consuming countries results in an increase in the demand for Egypt's cotton by 0.74 percent.

Rayon, which is assumed to have a lower degree of importance in man-made fiber consumption, shows a complementary impact on the demand for Egypt's cotton. The price of polyester is positively related to the demand for Egyptian cotton, with a cross elasticity of 0.34.

Egypt's export price of cotton affects the quantity Egypt supplies for export with an export supply elasticity of 0.07. This suggests that, ceteris paribus, a one percent increase in Egypt's export price will cause only a 0.07 percent increase in the quantity supplied for exports.

The elasticity of the quantity supplied for export with respect to the quantity of cotton produced and stocked is 0.88. A one percent increase in the domestic consumption of cotton in Egypt will decrease the quantity supplied for exports by 0.57.

Levy (1983) estimated the elasticity of foreign demand for Egyptian cotton at -1.42 for the extra-long varieties, and -1.66 for the long varieties. A-Shami (1979) estimated the foreign demand elasticity for Egyptian cotton at -1.81. Heckerman and others (1982) estimated it at -1.24 and they estimated the income elasticity at 1.58.

The own price elasticity of demand for Sudan's cotton is estimated at -0.97. The demand elasticity of Sudan's cotton with respect to Egypt's price is 0.77, and with respect to Peru's price is 0.23. The estimated elasticity with respect to U.S. exports of cotton is 0.26. The income elasticity of demand for Sudan's cotton is estimated at 0.70. Elasticity of demand with respect to the price of polyester is 0.16.

The estimated elasticities of export supply are 0.13 with respect to the Sudanese export price, 0.93 with respect to the quantity produced, and -0.03 with respect to the quantity consumed domestically in Sudan.

Abbadi (1981) estimated the own price elasticity of demand for Sudan's cotton at -0.83 in the short run and -1.47 in the long run. His estimate of the cross elasticity of demand with respect to Egypt's cotton price was 0.48 in the short run and 0.84 in the long run. The cross demand elasticity with respect to the polyester price was .60 in the short run and 1.07 in the long run. The cross elasticity with respect to the rayon price was estimated at 0.65 in the short run and 1.16 in the long run.

Peru's price is the main factor in determining the demand for its exports of cotton. The estimated own demand elasticity is about -0.95. It is estimated at 0.57 with respect to Egypt's export price, 0.34 with

respect to Sudan's price, and 0.39 with respect to the U.S. price. The income elasticity of demand for Peru's cotton is 0.75. Polyester price has little effect on the foreign demand for Peru's cotton, while the price of rayon shows a negative relationship.

The estimated elasticities of export supply of Peruvian cotton have the expected signs. These estimates are 0.14 with respect to Peru's export price, 0.91 with respect to its production, and -0.13 with respect to its consumption. Since there are no earlier estimates relating to demand for and supply of Peru's cotton, no comparison can be made.

The demand elasticity for U.S. cotton with respect to Egypt's price is 0.16, 0.13 with respect to Sudan's cotton, and 0.11 with respect to Peru's price. The own price elasticity is -1.17 and the income elasticity is 0.71. Positive elasticity estimates are found with respect to the prices of rayon and polyester. They are estimated at 0.53 and 0.51, respectively. The estimated elasticities of the export supply equation are 1.30 with respect to U.S. export price, 0.38 with respect to production, and -0.70 with respect to mill consumption in the U.S.

As reported earlier, Sirhan and Johnson (1971) estimated the market share elasticities of U.S. cotton in West Germany and England. The elasticity in the

West German market was -8.0 in the short run and -11.0 in the long run. Their estimate for the British market ranged from -2.70 to -8.67 in the short run and from -9.67 to -20.16 in the long run. Bredahl (1979) estimated demand elasticities for U.S. export for cotton at -1.92.

CHAPTER V

Conclusions and Policy Implications

Cotton is the main element in the economies of both Egypt and Sudan. The qualities of cotton produced by Egypt, Sudan and Peru are the long staple length varieties. These types tend to satisfy certain quality textile requirements in the countries of consumption. These countries are mainly Western Europe and Japan.

The demand for Egyptian cotton is price elastic. The same can be said about the demand for cotton exported from the U. S. Their estimated own demand elasticities are -1.21 and -1.16 respectively. The price elasticity for Sudanese cotton is -0.97. It is estimated at -0.95 for Peruvian cotton.

The estimated elasticities of foreign demand for Egyptian cotton are lower than the estimates of those studies that have been reviewed. The reason behind this is that in this study the demand is estimated for all of the countries which import from Egypt, including the Eastern block countries. These countries have had a bilateral trade agreement with Egypt in the fifties and sixties. This period is included in this study. It is expected that the demands of these countries for cotton are less elastic than are those of the so-called Western countries.

Sudan's export price is an important influence on the world demand for Egyptian cotton. Egypt's price is also a major factor in determining the export demand for Sudanese cotton. This is due to the fact that Egyptian and Sudanese cottons are close substitutes for each other. It was expected that Peru's price would affect the demand for Egypt and Sudan's cotton, but this has not been found to be true. However, Egypt and Sudan prices seem to have a significant effect on the demand for Peru's cotton.

It was found that the demand for U.S. cotton is very sensitive to its export price. The price of U.S. cotton seems to have relatively little effect on the main countries that export long-staple length cotton varieties. This is because the U.S. produces and exports short and medium staple length varieties, which cannot be substituted in certain uses for the long varieties of cotton. Conversely, as one would expect Egyptian, Sudanese and Peruvian prices have only a weak effect on the world demand for American cotton.

The price of polyester showed a positive relation with the cotton export quantities of Egypt, Sudan and Peru while the price of rayon is negatively related to cotton exports. These relationships, one assumes, reflect the technical relationships between the several fibers: competitive in the case of cotton and

polyester; complementary in the case of cotton and rayon. The estimated demand elasticities with respect to the price of polyester ranged from 0.18 to 0.34 for these countries. The export demand equation for U.S. cotton showed a relatively strong positive relationship to the prices of both polyester and rayon. This suggests a high degree of substitutability and competition between the textiles made of short and medium staple cotton and man-made fabrics.

The results suggest that cotton is a normal good as an export commodity for each of the four countries under study. This was found by estimating the income elasticity which ranged from 0.70 to 0.74. The highest elasticity was found for Egyptian cotton.

Estimates of the export supply equations also yield useful results. However, these results cannot be compared since there are very few estimates for the cotton export supply equations in the literature. The export price of cotton of each country is positively related to the exported quantity of cotton from that country. This relationship, in terms of price elasticities of the export supply, is found to be very weak in the case of Egypt, Sudan and Peru, but it is found to be very strong in the case of the U.S.

The quantity produced is positively related, as expected, with the quantity supplied for export of

cotton in each country, while the quantity consumed domestically has a negative relationship with the quantity of cotton supplied for export, also as expected. Export supply elasticity with respect to Egypt's production is 0.88 and with respect to Egypt's consumption is 0.57. This last figure agrees with the fact that in recent years a big portion of the raw cotton production is allocated to domestic textile production for local consumption and export rather than exported as raw cotton. This conclusion supports the fact that Egypt has a relatively strong textile industry. This is not the case in Sudan where most of the raw cotton production is directed to the exports market. Apparently, this is also the case in Peru. The U.S. supply for export is sensitive to its export price. It is also responsive to changes in the amount of the cotton produced or consumed domestically in the U.S. This is expected for a country like the U.S. where there is a strong free competitive market even with government policies of acreage restrictions, price supports and export subsidies.*

The study shows that the demand for cotton exported from each country of Egypt, Sudan and Peru is much more sensitive to changes in own export price than

* These are the policies that were reported and analyzed by Harvey (1966) and Hakim (1972).

is the export supply response. In this model, the elasticity of export supply is almost zero for each of these three countries. For the United States, the elasticity of export supply is higher than the elasticity of foreign demand for its cotton. These estimates reflect the fact that in the developing countries, the governments exercise greater control over the production and disposition of cotton than in the U.S.

The results of this study have important implications for Egyptian agricultural policy. The equilibrium prices and quantities for each country are estimated by solving the model simultaneously. Using the average values of the exogeneous variables, the model ended with eight equations and eight unknowns. These unknowns are prices and quantities of the four countries. In order to use the model for policy analysis one example is introduced: the effect of an export premium on Egyptian cotton on the quantities and prices of the exporting countries.

In this analysis, it is assumed that the Egyptian government raises the export price by 10 percent. The results are presented in Table 19. The table shows that raising the Egyptian export price from 2290 dollars per metric ton, the equilibrium prices, to 2519 dollars per metric ton, results in decreasing the quantity of Egyptian cotton exported by six thousand

Table 19. Estimates of the Equilibrium Prices and Quantities

Country	Solving the Model		Introducing an Export Premium for Egypt's Cotton	
	Prices	Quantities	Prices	Quantities
Egypt	2290	275	2519	269 277
Sudan	1685	145	1839	147
Peru	1550	75	1682	76
U.S.	1509	1074	1534	1097

* Prices are in dollars per metric ton. Quantities are in thousand metric tons.

tons. The results also show that this increase in Egypt's price leads to an increase in the quantities exported from Sudan, Peru and the U.S. These are estimated as two, one, and twenty-three thousand tons respectively. The effects on the equilibrium prices are also shown in Table 19.

In the same way, the model can be used to analyze the effect of a change in other variables in the model on the prices and quantities exported of the four countries.

This model can be improved by introducing the domestic demand for stocks in Egypt -- and perhaps in the other countries -- as an endogenous variable. This is an important point, especially if we know that Egypt is facing a stock accumulation problem. The unsold quantity of Egyptian cotton averaged about 114 thousand tons during the period 1975-80. On the supply side, the quantity produced and the quantity consumed domestically could be introduced as an endogenous rather than exogenous variable.

It would be interesting to compare the results if the equations used were price equations rather than quantity-type equations. Other suggestions for further research include applying other equation forms, introducing lags in the variables used, and using data which would be reported on the same basis.

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APPENDICES

APPENDIX I

MODELS USED IN COTTON STUDIES

APPENDIX I

Models Used in Cotton Studies

Magleby (1971): F=f (I) [cross-section analysis]

where: F= fiber user per capita

I= income (GNP) per capita

Magleby (1971): Time series analysis using one or more of these independent variables.

F=f (I, Pc, Ps, T)

where: F= per capita fiber use, calendar year average

I= real per capita income, calendar year average

Pc= real price of cotton, August-July average

Ps= real price of synthetic fiber, August-July average

T= time trend index

Adams and Behrman (1976):

Supply equations:

Developed economies: $PR = f \left[\left(\frac{PUS}{DUS}\right)_{-1}, USG, T \right]$

Developing economies: $PR = f \left[\left(\frac{P}{DF}\right)_{-1}, D, T \right]$

Centrally planned: $PR = f \left[(PR)_{-1}, \left(\frac{P}{DF}\right)_{-3}, T \right]$

Demand equations:

Developed economies: $C = f\ (C_{-1},\ (\frac{PUN}{PMM})_{-1},\ PGDP,\ T)$

Developing economies: $C = f\ (PGDP,\ [(\frac{PUN}{PMM})_{-1\ to\ -4}]$

Centrally planned: $C = f\ (PPR,\ (\frac{PUN}{PMM})_{-1},\ C_{-1},\ T]$

Where: PR = Production, PUS = average spot price of U.S., DUS = U.S. GNP deflator, USG = U.S. government acreage allotments for cotton, P = export price index, DF = price index of GNP of OCED, D = dummy variable, T = time trend, C = per capita consumption, PUN = UN export price index, PMM = index of man-made textile products PGDP, per capita index GDP. PPR = per capita production.

Ecevit (1978): $WC = f\ [(COT)_{-2},\ (POL)_{-2},\ (WC)_{-2},\ T)$

$IWC = f\ [(COT)_{-1} / (POL)_{-1},\ BCC,\ T]$

Where: WC = semi-annual world consumption, COT = deflated cotton price, POL = deflated polyester price, T = time, BBC = weighted index of the business cycle in industrialized countries.

Thigpen (1978)

World : $\log y = f(\frac{1}{x})$

World : $F = f(\log x)$

Developing countries: $C = f(P_{-1},\ IP)$

Developed countries: $\log C = f[(\log \frac{PC}{PP_{-1}}),\ \log IPI]$

Where:

y = per capita consumption of cotton, F = per capita raw fiber consumption, x = income per capita (1972 U.S. $), C = mill consumption of cotton, P = annual average price (CIF North Europe) for Pakistan 289 S.G. cotton deflated by U.S. wholesale price index, IP = UN index of manufacturing in the developing countries,

PC = annual average price (CIF North Europe) of Mexican SM 1 1/16" cotton, PP = annual average price (FOB plant, USA) of 1.5 denier polyester staple, IPI = UN index of industrial production in developed countries.

Harvey (1966):

$$X_1 = f\ (X_2, X_3, X_4, X_5, X_6, X_7, X_8)$$

$$X_9 = f\ (X_2, X_4, X_5, X_7, X_{10}, X_{11}, X_{12})$$

$$X_{13} = f\ (X_2, X_3, X_4, X_5, X_{11}, X_{14}, X_{12})$$

$$X_{15} = f\ (X_2, X_3, X_4, X_{16}, X_5, X_{12}, X_{17})$$

$$X_{18} = f\ (X_2, X_3, X_4, X_5, X_6, X_7, X_{10}, X_{12})$$

$$X_{19} = f\ (X_{16}, X_5, X_{12}, X_{17},)$$

$$X_{20} = f\ (X_{16}, X_5, X_{12}, X_{17})$$

$$X_{19} = f\ (X_{21})$$

Where:

X_1 = U.S. export price of cotton, X_2 = domestic stock of raw cotton at the beginning of the year, X_3 = net available for exports (production - consumption), X_4 = world production, X_5 = cotton stock at the beginning of the year in six major consuming countries, X_6 = U.S. government price support level for upland cotton, X_7 = value of P.L. 480 exports, X_8 = average rate of U.S. export subsidy, X_9 = quantity of exported U.S. cotton, X_{10} = value of export differentials and payments to exporters. X_{11} = value of P.L. 480 Title III barter out of CCC stocks, X_{12} = estimated U.S. raw cotton price CIF liverpool, X_{13} = average export price of each of the five competitive countries, X_{14} = export tax rate in each of the five competitive countries, X_{15} = quantity of raw cotton exported by each of the five competitive countries, X_{16} = estimated U.S. raw cotton exports, X_{17} = estimated average raw cotton price in each of the five competitive countries, X_{18} = quantity of U.S. commercial channel raw cotton exports, X_{19} = total income

terms of trade index for country, X_{20} = value of cotton exports for country i, X_{21} = cotton income terms of trade index for country i.

Hakim (1972):

The first model:

$$X_1 = f(X_2, X_3, X_4)$$

$$X_5 = f(X_2, X_6, X_7, X_8)$$

$$X_9 = f(X_2, X_{10}, X_8)$$

$$X_{11} = f(X_9, X_{12})$$

$$X_7 = x_1 + x_5$$

The second model:

$$X_1 = f(X_2, X_{13}, X_4)$$

$$X_5 = f(X_2, X_6, X_7, X_8)$$

$$X_7 = X_1 + X_5$$

$$X_{14} = f(X_{11}, X_{15}, X_{16})$$

$$X_{17} = f(X_9, X_{15}, X_{18}, X_{11}, X_{12})$$

$$X_8 = f(X_2, X_{19}, X_8)$$

$$X_{18} = X_{14} + X_{20} - X_{17} - X_{21}$$

Where:

X_1 = U.S. mill consumption demand for upland cotton, X_2 = the average price of American middling 1 inch cotton in U.S., X_3 = the quantity of rayon and acetate and polyester produced in the U.S., X_4 = the ratio of mill stocks of broadwoven goods to unfilled orders. X_5 = U.S. inventory demand for the following year plus exports. X_6 = the loan rate for American middling 1 inch cotton in the U.S. X_7 = total U.S. supply of upland cotton (production plus carry over from last year). X_8 = a time trend factor. X_9 = the price of American middling 1 inch cotton in Liverpool. X_{10} = U.S. export subsidy for cotton. X_{11} = price of extra-long Egyptian cotton (the Liverpool quo-

tations price). X_{12} = dummy variable. X_{13} = quantity of polyester produced in the U.S. X_{14} = foreign mill consumption demand for cotton. X_{15} = the average price of rayon in the U.S. X_{16} = quantity of rayon and acetate produced in the rest of the world. X_{17} = commercial exports of cotton from the U.S. to the rest of the world. X_{18} = total foreign supply of cotton. X_{19} = U.S. subsidy for cotton. X_{20} = foreign inventory demand for cotton. X_{21} = U.S. government financed exports of cotton.

A-Shami (1979):

$$X_1 = f(X_2, X_3, X_4, X_5, X_6)$$

$$X_1 = f(X_2, X_3, X_6, X_7, X_8)$$

$$X_6 = f(X_9, X_4, X_{10}, X_{11})$$

Where:

X_1 = price of Egyptian cotton at C.I.F. Liverpool. X_2 = exported quantities of Sudanese and Peruvian cotton. X_3 = sales of man-made fiber in the non-communist world. X_4 = world stock of cotton fiber. X_5 = Egypt's cotton exports. X_6 = Egypt's cotton yarn exports. X_7 = export of Egyptian cotton to USSR. X_8 = Egypt's export of cotton to the rest of the world. X_9 = price (F.O.B.) of Egyptian cotton yarn. X_{10} = average price of polyester and rayon. X_{11} = exports of cotton yarn from other parts of the world.

Abbadi (1981):

$$Y = f[(X_1)_{t-1}, (X_2)_{t-1}, \ldots\ldots (X_{13})_{t-1}, X_{14}]$$

$$X_{15} = f\,[(X_1)_{t-1}, \ldots (X_6)_{t-1}, (X_{10})_{t-1}, \ldots (X_{14})_{t-1}, (X_{16})_{t-1}, (X_{17})_{t-1}]$$

$$X_{18} = f[\ldots\ldots\ldots\ldots\ [(X_1)_{t-1}, \ldots\ldots (X_6)_{t-1}, (X_{10})_{t-1}, \ldots (X_{14})_{t-1}, (X_{16})_{t-1}, (X_{17})_{t-1}, (X_{18})_{t-1}]$$

Where:

Y = amounts of Sudan's ELS cotton imported by each country. X_1 = price of Sudan's ELS cotton. X_2 = Egypt's ELS cotton price. X_3 = U.S. upland cotton price. X_4 = per capita beginning stocks of ELS cotton in each of the major importing countries. X_5 = price of polyester. X_6 = price of rayon staple. X = per capita imports of cloth, X_8 = per capita imports of yarn. X_9 = per capita real income. X_{10} = index of industrial manufacturing. X_{11} = index of textile production. X_{12} = lagged dependent variables. X_{13} = time. X_{14} = dummy variables. X_{15} = world mill consumption of Sudan's ELS cotton. X_{16} = world cloth imported. X_{17} = world amount of cotton yarn. X_{18} = world import of Sudan's ELS cotton.

Heckerman and others (1982):

$$X_1 = f[(X_2)_{t-1},\ X_3,\ X_4]$$

$$X_1 = f\left(\frac{X_2}{X_5},\ (X_1)_{t-1}\right)$$

$$X_1 = f\left(\frac{(X_5)_{t-1}}{X_2},\ (X_1)_{t-1}\right)$$

Where:

X_1 = Egypt's ELS exports to market economies.

X_2 = real F.O.B. price of Egyptian ELS exports.

X_3 = real income in importing countries.

X_4 = real price of polyester fibers.

X_5 = real farm price of 1 3/16" middling cotton.

Levy (1983):

$$X_1 = f(X_2, X_3, X_4)$$

$$X_5 = f[(X_6)_{t-1}, X_7 (X_8)_{t-1}, (X_9)_{t-1}]$$

$$X_{10} = f(X_{11}, X_{12}, X_{13}, X_{14}, X_{15})$$

$$X_{11} = (X_6)_{t-1} - X_1 - X_{16}$$

$$X_7 = X_{10} - X_{17}$$

$$X_2 = X_{10} - X_{18}$$

Where:

X_1 - Egypt's domestic consumption of cotton. X_2 = consumption price of cotton. X_3 = wages in the textile industry. X_4 = output of the textile industry. X_5 = Egypt's domestic supply of cotton. X_6 = domestic output of cotton. X_7 = farm price of cotton. X_8 = farm price of wheat. X_9 = farm price of rice. X_{10} = export price of cotton. X_{11} = quantity of cotton exported by Egypt. X_{12} = quantity of ELS exported by Sudan and Peru. X_{13} = world stock of cotton. X_{14} = sales of man-made fibers in the non-communist world. X_{15} = dummy variables. X_{16} = Egypt's cotton stock during the year. X_{17} = export tax. X_{18} = consumption subsidy.

APPENDIX II

RESULTS OF THE FIRST THREE MODELS

APPENDIX II

RESULTS OF THE FIRST THREE MODELS

Table II-1. MODEL I. Egypt and Sudan

Dependent Variable	Explanatory Variables	OLS		2SLS	
		Estimate	Student t Statistics	Estimate	Student t Statistics
XE^d	Constant	165.6051		151.5624	
	PE	-0.0473	-1.3560*	-0.2456	-2.1426**
	PS	-0.0432	-0.0432	0.1876	1.0317
	I	-0.0513	-1.0034	-0.0156	-0.9435
	R^2=0.43				
XE^s	Constant	113.6813		141.3659	
	PE	-0.0317	-0.9617	-0.0389	-0.8439
	TE	0.6775	6.1546***	0.3742	5.7729***
	CE	-0.8341	-8.9921***	-0.8967	-8.8349***
	R^2=0.75				
XS^d	Constant	242.1125		185.3291	
	PE	-0.0002	-0.0013	0.0067	1.2156*
	PS	-0.0613	-1.4395*	-0.0231	-1.3459
	I	-0.0347	-0.2421	-0.0134	-1.1785
	R^2=0.52				
XS^s	Constant	64.9345		48.2358	
	PS	0.0235	1.0739	0.0293	1.1239
	TS	0.3746	5.5161***	0.3925	4.3864***
	CS	-0.3974	-1.9825**	-0.4246	-1.6532***
	R^2=0.75				

* significant at 10 percent level
** significant at 5 percent level
*** significant at 1 percent level

Table II-2. MODEL II. Egypt, Sudan and Peru.

Dependent Variable	Explanatory Variables	OLS		2SLS	
		Estimate	Student t Statistics	Estimate	Student t Statistic
XE^d	Constant	179.5661		155.1257	
	PE	-0.0531	-1.3815*	-0.1921	-2.2479**
	PS	-0.0132	-0.6253	-0.1123	0.9585
	PP	0.1983	1.2311	-0.1247	-0.5432
	I	-0.0434	-1.6758*	0.0129	2.1645**
	R^2=0.54				
XE^s	Constant	120.7892		158.3347	
	PE	-0.0209	-0.7831	-0.0258	-0.9897
	TE	0.7359	5.3213***	0.3549	4.8913***
	CE	-0.7623	-6.5421***	-0.8873	-7.5329***
	R^2=0.74				
XS^d	Constant	254.6539		176.4785	
	PE	-0.0053	-0.1593*	0.0143	1.3425*
	PS	-0.0092	1.6735*	-0.0305	-1.5082*
	PP	-0.0473	-1.3760	-0.0023	-1.2178
	I	-0.0232	-0.5678	-0.0024	-1.1529
	R^2=0.59				
XS^s	Constant	67.3458		48.3452	
	PS	0.0198	1.1339	0.0167	1.1528
	TS	0.3958	4.6321***	0.3829	4.8735***
	CS	-0.4029	-1.8231**	-0.4021	-1.4453
	R^2=0.77				
XP^d	Constant	5.9642		5.1943	
	PE	-0.0189	-1.1439	0.0543	0.9564
	PS	0.1321	0.9845	0.0021	1.1230
	PP	-0.0413	-1.7213**	-0.0821	-1.8452**
	I	-0.0143	-1.2425	0.0169	1.9215**
	R^2=0.43				
XP^s	Constant	45.6329		17.4329	
	PP	0.0012	0.9645	0.0064	1.2143
	TP	0.4735	6.4395***	0.3958	9.4372***
	CP	-0.4564	-4.3219***	-0.8643	-5.3214***
	R^2=0.75				

* significant at 10 percent level
** significant at 5 percent level
*** significant at 1 percent level

Table II-3. MODEL III. Egypt, Sudan, Peru and the U.S.

Dependent Variable	Explanatory Variables	OLS Estimate	OLS Student t Statistics	2SLS Estimate	2SLS Student t Statistics
XE^d	Constant	183.4372		164.4328	
	PE	-0.0756	-1.5231*	-0.1664	-2.3345**
	PS	-0.0124	-0.9461	-0.0346	1.4793*
	PP	0.1832	1.6753*	0.0321	1.1456
	PU	0.0318	1.4327*	0.0251	2.4576**
	I	-0.0245	-1.2328	0.0345	4.3219***
	R^2=0.61				
XE^s	Constant	127.5943		145.1258	
	PE	-0.0203	-0.9673	0.0245	1.0291
	TE	0.7458	5.6981***	0.3498	7.3721***
	CE	-0.7895	-6.6782***	0.9358	-6.5532***
	R^2=0.75				
XS^d	Constant	269.439		174.9487	
	PE	0.0021	1.1153	0.0127	1.3780*
	PS	-0.0213	-1.9465**	-0.0653	-1.9527**
	PP	-0.0519	-1.1864	-0.0124	-1.1797
	PU	-0.0664	-1.1645	0.0193	1.3385*
	I	0.0178	1.1231	0.0196	1.9532**
	R^2=0.64				
XS^s	Constant	65.4377		45.4582	
	PS	0.01952	1.1673	0.0193	1.1235
	TS	0.3618	4.7392***	0.4127	5.4732***
	CS	-0.3796	-1.9213**	-0.4258	-1.6239*
	R^2=0.78				
XP^d	Constant	6.2149		5.4273	
	PE	-0.0124	-1.4213*	0.0321	1.7098**
	PS	0.1239	0.6532	0.0148	1.8840**
	PP	-0.0358	-1.6512*	-0.0623	-1.8141**
	PU	0.0329	1.6492*	0.0216	1.6453*
	I	-0.0112	-1.1594	0.0153	1.8943**
	R^2=0.58				
XP^s	Constant	47.2376		14.3294	
	PP	0.0018	0.6534	0.0046	1.2612
	TP	0.5639	5.7824***	0.3517	8.2183***
	CP	-0.5543	-3.8124***	-0.8439	-6.4317***
	R^2=0.76				

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Table II-3. MODEL III (concluded)

Dependent Variable	Explanatory Variables	OLS Estimate	OLS Student t Statistics	2SLS Estimate	2SLS Student t Statistics
XU^d	Constant	1527.6149		2764.0131	
	PE	0.2883	1.0978	0.1554	1.3432*
	PS	0.3514	1.2235	0.1743	1.4539*
	PP	0.4112	1.2657	0.1532	1.5431*
	PU	-0.3667	-1.0291	-0.7015	-2.0567**
	I	0.1232	1.4520*	0.2134	1.7438**
	R^2=0.68				
XU^s	Constant	1780.1251		1794.2514	
	PU	0.5432	1.3329*	0.8627	1.8239**
	TU	0.4345	1.7529**	0.1458	2.4643**
	CU	-0.8743	-2.0345***	-0.4512	-3.1564***
	R^2=0.73				

* significant at 10 percent level
** significant at 5 percent level
*** significant at 1 percent level

APPENDIX III

COTTON AREA, YIELD, SUPPLY AND UTILIZATION

APPENDIX III

COTTON AREA YIELD, SUPPLY, AND UTILIZATION

Table III-1. Egypt: Cotton Area, Yield, Supply, and Utilization, 1950-1980

(Thousand 480 lb. Bales)

YEAR	1,000 HECT	YIELD KG PER HA	BEGINNING STOCKS	PRODUCTION	IMPORTS	TOTAL SUPPLY & DISTRIBUTION	CONSUMPTION	DESTROYED	EXPORTS AND/OR REEXPORTS	ENDING STOCKS
1950	7.221	301	6.713	9.999	189	16.901	10.729	-201	4.290	2.093
1951	10.904	302	2.093	15.123	79	17.295	9.344	-487	5.711	2.467
1952	10.490	314	2.467	15.116	195	17.958	9.422	-214	3.181	5.369
1953	9.651	343	5.369	16.438	145	21.952	8.741	-297	3.914	9.504
1954	7.791	382	9.504	13.673	158	23.327	8.982	-284	3.585	11.344
1955	6.851	447	11.044	14.498	137	25.681	9.371	-234	2.320	14.426
1956	6.319	458	14.426	13.298	137	27.851	8.788	-177	7.918	11.322
1957	5.487	434	11.322	10.948	141	22.411	8.144	-354	5.959	8.662
1958	4.795	522	8.662	11.491	137	20.294	8.639	-308	2.495	8.868
1959	4.118	517	8.868	14.527	136	23.531	9.115	-443	7.394	7.521
1960	6.195	500	7.521	14.237	129	21.887	8.353	-399	4.857	7.056
1961	6.327	492	7.056	14.251	153	21.492	9.017	-260	5.054	7.499
1962	6.301	512	7.499	14.827	137	22.463	8.484	-384	3.629	11.134
1963	5.752	579	11.134	15.291	135	26.545	8.674	-257	5.775	12.351
1964	5.689	580	12.351	15.165	118	27.634	9.241	-91	4.195	14.249
1965	5.518	598	14.249	14.936	118	29.305	9.594	-554	3.035	17.028
1966	3.864	536	17.028	9.557	185	26.698	9.574	-40	4.632	12.344
1967	3.234	901	12.344	7.443	149	19.936	9.877	-86	4.361	4.586
1968	4.112	979	4.586	10.926	68	17.578	8.332	-121	2.829	4.544
1969	4.674	466	4.544	9.990	52	16.586	8.114	-249	2.878	5.443
1970	4.514	492	5.443	10.192	37	16.072	8.206	-232	3.497	4.203
1971	4.443	491	4.203	10.477	72	14.752	8.259	-150	3.365	3.258
1972	5.255	568	3.258	13.704	34	16.996	7.749	-305	5.311	4.221
1973	4.844	583	4.221	12.974	48F	17.243	7.672	-160	4.123F	5.808
1974	5.084	494	5.808	11.548	34	19.182	9.840	-112	3.926	5.706
1975	5.560	508	5.788	8.302	92F	14.182	7.250	-140	3.311F	3.681
1976	4.417	522	3.681	10.581	38F	14.308	4.474	-84	4.784	2.928
1977	5.372	583	2.928	14.389	5F	17.322	4.539	-18	5.484F	5.367
1978	5.018	471	5.367	10.856	4	16.207	6.352	-283	6.180F	3.958
1979	5.193	413	3.956	14.429	5	18.592	6.506	-163	9.229	3.000
1980	5.348	453	3.000	11.122	37	14.159	9.745	-132	4.032	2.494

SOURCE: United States Department of Agriculture, Foreign Agriculture Circular, Foreign Agricultural Services, Different Issues.

Table III-2. Sudan: Cotton Area, Yield, Supply, and Utilization, 1950-1980

(Thousand 480 lb. Bales)

YEAR	1,000 HECT	YIELD KG PER HA	BEGINNING STOCKS	PRODUCTION	IMPORTS	TOTAL SUPPLY & DISTRIBUTION	CONSUMPTION	DESTROYED	EXPORTS AND/OR RE-EXPORTS	ENDING STOCKS
.....	440	434	83	434	--	634	--	--	364	170
1951.....	231	278	176	295	--	471	--	--	388	83
1952.....	251	344	83	396	--	479	4	--	257	218
1953.....	264	338	218	410	--	628	5	7	403	213
1954.....	277	324	213	413	--	626	2	3	296	325
1955.....	242	459	325	510	--	835	2	4	559	270
1956.....	309	433	270	615	--	885	2	--	333	550
1957.....	295	359	550	215	--	765	2	2	391	370
1958.....	359	349	370	575	--	945	2	2	671	270
1959.....	361	334	270	565	--	835	3	4	568	260
1960.....	383	300	260	525	--	785	5	3	437	340
1961.....	476	446	340	975	--	1,315	15	3	637	660
1962.....	448	351	660	721	--	1,381	35	13	787	546
1963.....	441	223	546	452	--	998	35	3	720	240
1964.....	449	339	240	700	--	940	35	--	471	434
1965.....	441	370	434	750	--	1,184	35	4	570	575
1966.....	486	399	575	890	--	1,465	50	8	682	725
1967.....	486	403	725	900	--	1,625	60	--	794	771
1968.....	488	469	771	1,050	--	1,821	65	--	848	908
1969.....	529	466	908	1,130	--	2,038	70	--	1,081	887
1970.....	510	483	887	1,130	--	2,017	65	--	1,049	903
1971.....	506	484	903	1,125	--	2,028	60	--	990	978
1972.....	486	412	978	920	--	1,898	60	--	1,090	748
1973.....	496	477	748	1,085	--	1,833	70	--	729F	1,034
1974.....	496	446	1,034	1,015	--	2,049	75	25	568F	1,381
1975.....	410	266	1,381	900	--	1,881	80	25	1,097F	679
1976.....	435	350	679	700	--	1,379	85	20	607F	667
1977.....	485	409	667	910	--	1,577	90	20	689F	778
1978.....	365	358	778	600	--	1,378	100	10	814F	454
1979.....	400	327	454	600	--	1,054	100	--	675	279
1980.....	350	311	279	500	--	779	100	--	400	279

Source: United States Department of Agriculture, Foreign Agriculture Circular, Foreign Agricultural Services, Different Issues.

Table III-3. Peru: Cotton Area, Yield, Supply, and Utilization, 1950-1980

(Thousand 480 lb. Bales)

YEAR	1,000 HECT	YIELD KG PER HA	BEGINNING STOCKS	PRODUCTION	IMPORTS	TOTAL SUPPLY & DISTRIBUTION	CONSUMPTION	DESTROYED	EXPORTS AND/OR REEXPORTS	ENDING STOCKS
1950	165	531	148	403	--	551	67	--	341	143
1951	188	496	143	429	--	592	55	--	307	230
1952	195	502	230	450	--	680	61	1	398	220
1953	215	481	220	475	--	695	65	14	361	255
1954	225	475	255	491	--	746	80	1	330	335
1955	222	483	335	492	--	827	78	7	487	255
1956	230	444	255	485	--	740	75	5	390	270
1957	247	445	270	505	--	775	78	5	402	300
1958	231	510	300	541	--	841	70	9	512	250
1959	253	488	250	566	--	816	78	1	417	320
1960	250	483	320	555	--	875	88	2	478	315
1961	247	578	315	655	--	970	85	9	576	300
1962	275	534	300	675	--	975	90	--	590	295
1963	275	494	295	625	--	920	90	--	510	320
1964	263	538	320	650	--	970	90	12	468	400
1965	243	466	400	520	--	920	95	--	518	307
1966	223	465	307	475	--	782	85	1	381	315
1967	206	491	315	465	--	780	75	--	283	422
1968	178	520	422	425	--	847	80	--	376	391
1969	170	487	391	388	--	771	90	--	344	337
1970	134	636	337	390	--	727	100	--	260	367
1971	148	531	367	368	--	727	125	--	255	347
1972	132	553	347	336	--	683	142	--	156	385
1973	152	588	385	410	--	795	150	--	237F	408
1974	156	481	408	344	--	752	135	--	158	459
1975	113	532	459	277	--	736	140	--	154F	442
1976	143	498	442	327	--	769	157	--	150F	462
1977	108	704	462	349	--	811	178	--	87	546
1978	138	697	546	416	--	962	238	--	95	629
1979	137	699	629	440	--	1,069	265	--	132	672
1980	147	637	672	430	--	1,102	275	10	200	617

Source: United States Department of Agriculture, Foreign Agriculture Circular, Foreign Agricultural Services, Different Issues

Table III-4. U.S.: Cotton Area, Yield, Supply, and Utilization, 1950-1980

(Thousand 480 lb. Bales)

YEAR	1,000 HECT	YIELD KG PER HA	BEGINNING STOCKS	PRODUCTION	IMPORTS	TOTAL SUPPLY & DISTRIBUTION	CONSUMPTION	DESTROYED	EXPORTS AND/OR REEXPORTS	ENDING STOCKS
1950	830			1,755	--	2,240	280	--	1,532	426
1951	832	436	428	1,666	--	2,094	311	24	908	851
1952	826	540	851	2,048	--	2,899	313	37	1,727	822
1953	556	572	822	1,461	--	2,283	337	3	1,485	458
1954	663	525	458	1,598	--	2,056	359	4	1,081	612
1955	763	438	612	1,535	--	2,147	408	10	1,433	304
1956	694	468	304	1,492	--	1,796	413	21	924	438
1957	764	531	438	1,862	--	2,300	445	2	1,256	597
1958	800	557	597	2,048	--	2,645	514	34	1,380	717
1959	739	619	717	2,100	--	2,817	517	29	1,838	433
1960	787	608	433	2,196	--	2,629	558	16	1,582	473
1961	834	403	473	1,542	--	2,015	637	8	1,121	249
1962	696	657	249	2,100	--	2,349	637	2	1,361	349
1963	684	646	349	2,029	--	2,378	647	--	1,372	359
1964	677	745	359	2,315	--	2,674	717	--	1,558	399
1965	798	653	399	2,392	--	2,791	778	10	1,575	428
1966	796	571	428	2,089	--	2,517	835	--	1,428	254
1967	683	639	254	2,006	--	2,260	847	3	1,171	239
1968	615	710	239	2,005	--	2,244	847	1	1,087	309
1969	681	795	309	2,487	--	2,796	872	13	1,463	448
1970	684	744	448	2,336	--	2,784	931	38	1,397	418
1971	641	795	418	2,341	--	2,759	966	19	1,366	408
1972	652	788	408	2,359	--	2,767	996	1	1,387	383
1973	672	729	383	2,249	--	2,632	1,026	9	1,199F	398
1974	610	717	398	2,010	--	2,408	1,016	6	878	508
1975	565	676	508	1,755	18	2,281	1,066	24	775F	416
1976	524	756	416	1,820	110	2,346	1,145	25	606F	570
1977	598	667	570	1,832	72	2,474	1,295	10	686F	483
1978	499	878	483	2,013	134	2,630	1,310	40	690F	590
1979	502	963	590	2,220	--	2,810	1,330	50	876	554
1980	523	1,013	554	2,434	--	2,988	1,340	20	665	963

Source: United States Department of Agriculture, Foreign Agriculture Circular, Foreign Agricultural Services, Different Issues.

APPENDIX IV

PRICES AND INCOMES OF THE EXPORTING COUNTRIES

APPENDIX IV

Table IV-1. Prices and Incomes of the Exporting Countries

Year	Egypt's Price	Sudan's Price	Peru's Price	U.S. Price	Polyester Price	Rayon Price	Income of the Countries that Import From: Egypt	Sudan	Peru	U.S.
1950	1112	1090	589	980	3748	707	424	429	410	431
1951	1220	1430	710	951	3682	765	496	493	498	484
1952	1342	1130	680	846	3637	776	533	537	539	528
1953	964	880	618	805	3571	688	562	560	565	550
1954	1128	1028	784	826	3417	680	577	581	563	578
1955	1112	920	800	832	3527	674	631	628	637	626
1956	1209	1043	786	695	2976	653	682	687	685	670
1957	1349	1052	825	666	3109	630	721	725	718	722
1958	1120	815	678	628	3120	607	737	735	723	7314
1959	995	644	595	534	2998	578	783	779	789	785
1960	1033	902	725	574	1778	570	930	935	927	918
1961	1017	842	700	696	2601	565	883	879	885	890
1962	961	779	695	605	2513	560	954	951	940	949
1963	864	735	730	582	2565	608	1025	1023	1031	1027
1964	1642	821	791	574	2228	630	1118	1114	1123	1106
1965	1581	845	882	602	1913	630	1217	1222	1203	1224
1966	1350	713	759	529	1778	608	1331	1331	1337	1329
1967	1332	691	812	515	1395	540	1419	1417	1424	1426
1968	1499	759	821	523	1260	563	1533	1529	1535	1521
1969	1650	826	737	516	1013	585	1703	1708	1709	1705
1970	1591	808	761	550	923	563	1879	1876	1865	1884
1971	1563	828	861	623	833	608	2110	2111	2104	2117
1972	1603	860	923	718	788	698	2480	2477	2483	2468
1973	2077	1018	1296	745	835	743	3043	3048	3049	3045
1974	2454	1527	2028	1138	1035	1148	3394	3390	3380	3401
1975	2006	1350	1638	1348	1080	1148	3819	3817	3821	3824
1976	2170	1427	1924	1516	1193	1215	4160	4165	4166	4148
1977	2604	1645	2213	1306	1260	1305	4483	4480	4469	4490
1978	2410	2058	2095	1420	1215	1305	4692	4693	4698	4697
1979	2530	1882	2538	1458	1350	1463	4931	4936	4933	4932
1980	2594	1920	2055	1584	1665	1688	5234	5231	5238	5222

*Cotton prices data are nominal weighted average export prices in U.S. dollars per metric ton. Source of these data is: "United Nations: Supplement to the World Trade Annual", various issues. Polyester and Rayon prices are nominal prices of the U.S. They are in U.S. dollars per metric ton. The source of these data is: "Textile Organon" magazine, various issues. Income data are weighted average nominal gross national product data in U.S. billions of dollars. Sources of these data are: "Yearbook of National Accounts Statistics" and "Statistical Yearbook of the United Nations", different issues. Consumer Price Indexes were used in this research were obtained from "International Monetary Fund" data.