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GOVERNMENT POLICY AND INTERNATIONAL TRADE IN COTTON

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I. Introduction

Empirical analysis of the international market for cotton has proven a formidable exercise. The development of noncellulosic fibers in the 1950's and 1960's, cotton's role as an intermediate input rather than an item of final demand, government interference in the international trade of cotton and cotton textiles, and variations in cotton quality have complicated econometric analyses of post-war cotton demand. Existing analytical approaches range from models which regard the world cotton market as a single entity to models which view the international market as a composite of unique relationships between each exporter and importer of cotton. Data limitations and difficulties in model verification have frequently forced a reliance on ad hoc estimation procedures, and reliable estimates of income, own-price and cross-price elasticities of demand remain elusive. Competition among different qualities and the degree of integration of the world cotton market, the role of storage in the price adjustment process, and justification of appropriate lags and leads in price response represent additional unresolved issues.

This paper approaches the analysis of international cotton trade in an institutional framework. Price and trade control policies in many countries effectively isolate domestic producers or consumers from their counterparts in the international market. This has been particularly prevalent among potential cotton exporters, where cotton policy has been used to generate tax revenues or provide constant and subsidized prices to domestic textile producers. The international market thus becomes one in which international prices are influenced by exogenously determined export availabilities. This

provides the basis for an institutional model of international trade. The model is specified and estimated in Section IV.

II. Trade Patterns and Institutions in Cotton Trade, 1960-80 1/

The most dramatic changes in the world cotton economy involve the growth of the man-made fiber industry. Man-made fiber consumption increased by about 20 percent per year during the 1960's, from three to eight million metric tons (mt). Cotton consumption increased roughly at the rate of population growth (about two percent per year), from 10 to 12 million mt, with the consequence that cotton's share in total fiber consumption declined from 70 to 55 percent. Since 1970, however, market shares have stabilized. This stability was due to the decline in growth rates of both man-made fiber and total fiber demand rather than to an acceleration in cotton demand, as cotton consumption maintained its earlier rate of growth of about two percent per year. Cotton consumption was 10, 12, and 14.5 million mt in 1960, 1970, and 1980, respectively.

Summary data on exports and imports are provided in Table 1, and demonstrate the major changes in the patterns of trade. The total volume of cotton trade increased by 17 percent during the 1960-80 period, from 3.7 to 4.3 million mt, and its importance relative to total production decreased slightly. Most of the increase in trade volume occurred during the 1970's, as synthetic fibers reached stable market shares with cotton and other natural fibers.

1/ This summary is drawn primarily from Coevit (1978), Thigpen (1978), and the United Nations (1978).

Table 1. Cotton Trade Statistics, 1960-80.

	QUANTITIES, '000 mt					MARKET SHARES (%)				
	1960	1965	1970	1975	1980	1960	1965	1970	1975	1980
IMPORTING COUNTRIES										
Japan	769.7	670.2	798.8	701.2	* 698.2	21	18	21	17	* 16
Peoples Republic of China	43.3	130.1	97.6	130.1	* 737.2	1	4	3	3	* 17
India	148.3	68.3	132.3	(29.5)	*(112.7)	4	2	3	(1)	*(3)
Other Asia	299.2	405.6	659.8	1089.4	*1127.1	8	11	17	27	* 26
Western Europe	1592.8	1480.7	1285.7	1288.5	*1046.7	43	40	34	32	* 24
Eastern Europe	512.1	565.8	586.9	570.2	* 594.1	14	15	15	14	14
EXPORTING COUNTRIES										
U.S.A.	1465.6	639.5	849.9	701.0	*1284.1	40	17	22	17	* 30
U.S.S.R.	238.5	336.0	314.4	758.8	* 949.7	6	9	8	19	* 22
Pakistan	52.0	106.0	101.0	90.2	* 326.7	1	3	3	2	* 8
Turkey	58.8	199.5	244.6	470.9	* 227.7	2	5	6	12	* 5
Mexico	347.3	459.2	163.9	106.7	* 177.8	9	12	4	3	* 4
Egypt	-	343.0	304.2	65.0	* 23.9	-	9	8	2	* 1
Guatemala	16.3	76.8	53.8	97.4	* 108.4	4	2	1	2	* 2
Sudan	95.2	124.0	228.3	214.9	* 86.7	3	3	6	5	* 2
TOTAL WORLD EXPORTS	3703.4	3680.5	3832.0	4062.8	*4340.9					
WORLD PRODUCTION	10113	11577	11370	11774	*13878					
TRADE AS % OF WORLD PRODUCTION	37	32	34	35	31					

* indicates preliminary figure

( ) indicates net export if for importing country, net import if for exporting country

Source: International Cotton Advisory Committee, Cotton-World Statistics, various years.
Data represent marketing year quantities, beginning in August of the year cited.

Among importers, the most significant increases in trade volume occurred in Asia, primarily as a consequence of textile expansion in the People's Republic of China, Hong Kong, Taiwan, and Korea. By 1980, this region accounted for over 60 percent of world imports, nearly double their share in 1960. The most significant area of decline in imports occurred in Western Europe, where trade shares declined from 45 to 25 percent over the last two decades. These changes reflect primarily the shift in the competitive position of the textile industries of the two regions, and would probably have been more extreme were it not for the protection afforded the developed countries via the voluntary quota agreements of the 1960's and 1970's. These agreements (Long Term Arrangement on Cotton Textiles, 1963-73; Multifiber Textile Agreement, 1973-80) attempted to restrict the rate of growth of imports to 6 percent per year, by allowing importers of textiles to initiate quota restrictions or to negotiate voluntary export quotas when growth rates were excessive.

Exports are more concentrated than imports, as four countries, the U.S., the U.S.S.R., Pakistan, and Turkey account for about 65 percent of the total. The USSR has increased its market share the most, while Sudan, Egypt, and East African exporters have shown the most significant declines. Egyptian declines reflect growth in domestic textile production, while the declines in the other areas appear to be due to decreased domestic production. U.S. exports declined during the 1960's and early 1970's as a consequence of high support prices relative to world prices, and annual exports were largely determined by Commodity Credit Corporation policies. However, the decline in market share was reversed in the 1970's as U.S. support prices fell below world prices.

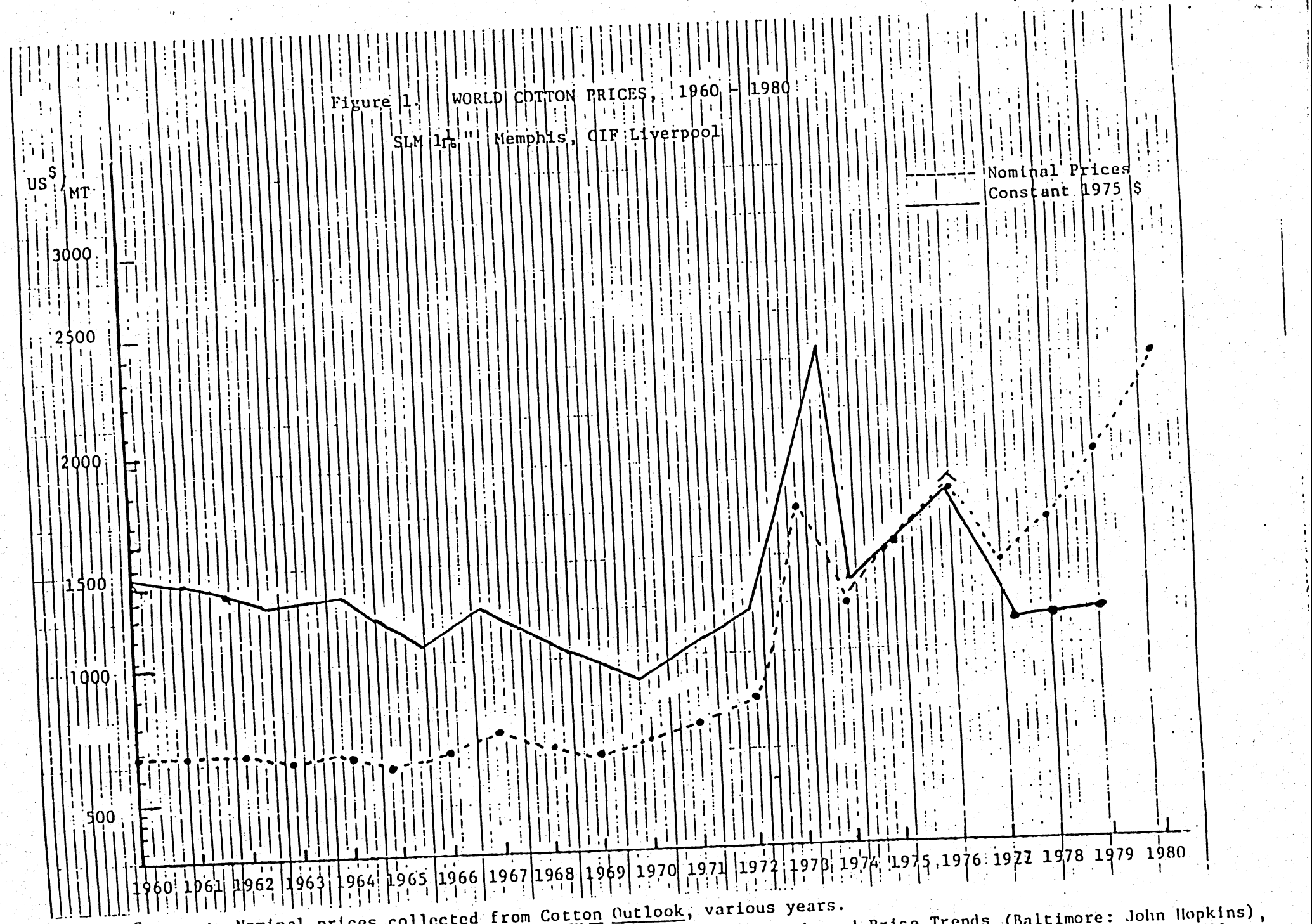
In contrast to the stability in cotton trade and growth of consumption, cotton prices exhibited markedly different behavior during the two decades. As indicated by the pattern of cif Liverpool prices shown in Figure 1, the 1960's demonstrate little price fluctuation. Two factors may be especially important in the explaining this stability. First, net increases in textile fiber demand as a result of income growth were offset by the rapid increases in the supplies of man-made fibers. Second, the U.S. maintained substantial stocks as a consequence of domestic price support programs. Release of these stocks could prevent any substantial upturn in prices.

The 1970's brought marked increased in price instability. The coefficient of variation of prices, for example, increased from 0.05 in the 1960-70 period to 0.33 in the 1970-80 period. Two factors may be particularly relevant in explaining the changes in price behavior. In the first place, U.S. support programs became insignificant after world market prices rose above U.S. support prices in 1973. This reduction in buffer stocks gave annual variations in demand and supply to have a much larger impact on market prices. The second factor was the end of the rapid growth in man-made fiber production in the early 1970's. Increases in petroleum prices after 1973 led to sharp increases in man-made fiber prices, and cotton and man-mades assumed a competitive market relationship in which volatine relative prices became important determinants of fiber usage.

Government policies have influenced the supply of exports and, to a lesser extent, the demand for imports in the international market. Table 2 classifies producer price policies for countries which produced more than 200,000 bales (43,500 mt) in 1980. This group of countries accounts for 97 percent of world production. Perhaps the most striking feature of the table is the small share of world production which is exclusively affected by world

Figure 1. WORLD COTTON PRICES, 1960 - 1980

SLM 1 1/16" Memphis, CIF Liverpool



Sources: Nominal prices collected from Cotton Outlook, various years.
cif Price deflator taken from World Bank, Commodity Trade and Price Trends (Baltimore: John Hopkins), 1980.

Table 2. Producer Price Policies, 1960-80.

Country	Production, 1981/82 (1000 bales)	No minimum or fixed price policy	Minimum prices	Fixed prices for producers	Other Restrictions
Argentina	735	X			X[a]
Australia	550	X			
Brazil	2,635		X		X[b]
China	13,800			X(?)	
Columbia	320	X			
Egypt	2,400			X	
Greece	550		X		
Guatemala	400	X			
India	6,000			X	
Iran	230	X			
Israel	420	X			
Ivory Coast	260			X	
Mexico	1,440	X			
Nicaragua	285	X			
Pakistan	3,360			X	
Paraguay	390	X			
Peru	430	X			X[c]
South Africa	215	X			
Spain	320		X		
Sudan	710			X	
Syria	600			X	
Tanzania	240			X	
Thailand	325			X	
Turkey	2,200		X[d]		
USA	15,625		X[e]		
USSR	13,400			X	
Zimbabwe	210				
Total	68,050	5,415	21,330	41,095	
World Total	70,395	(7.6%)	(30.3%)	(58.4%)	

Sources:

Production data are provided by International Cotton Advisory Committee, reported in Pyramid Surveys, No. 4, 1982.

Policy information is taken from the following sources: International Cotton Advisory Committee, 1980, Government Regulations on Cotton, 1980, Report by the Secretariat to the 39th Plenary Meeting of the ICAC, Manila, Philippines.

United Nations, Conference on Trade and Development, 1978, Extent, nature, causes and consequences of fluctuations in prices in world markets for cotton, Trade and Development Board, Integrated Programme for Commodities, Third Preparatory Meeting on Cotton TD/B/IPC/COTTON/11. Geneva, Switzerland.

Stevenson, J.H. and C.E. Goldthwait, 1977, South America's 'Big Four' Expand Cotton Output, Foreign Agriculture, No. 26, June 27, 1977.

Petges, Richard, 1980, Pakistan's Cotton Industry, Foreign Agricultural Service, USDA, FAS-M-296.

United States Department of Agriculture, 1977, Soviet Cotton Production and Trade, FAS-M-277.

Evans, R.B., 1976, Cotton in the USSR, Foreign Agriculture 23A:2-5. June 14, 1976.

Evans, R.B., 1976, Brazil's Cotton Industry, Foreign Agricultural Service, USDA, FAS-M-272.

Notes:

a The Domestic textile industry was given priority purchase rights at preset prices until 1977/78.

b Cotton and polyester imports are prohibited. Cotton exports are occassionally restricted, and domestic prices are often above cif prices.

c System similar to Argentina.

d Minimum prices were greater than world prices in 1975/76.

e Minimum prices were greater than world prices for most of the 1960/73 period.

market prices. Less than eight percent of world production falls in this category. A more substantial share (30 percent of cotton production) is grown in countries with minimum price support, although except for Brazil floor prices are currently low enough that production is influenced by world prices. For the 1960-73 period, however, the U.S. minimum prices were above world prices, and thus world prices did not determine U.S. production levels. Fixed producer prices represent by far the largest category of producer price policies, accounting for 60 percent of world production. Government marketing boards usually implement these policies in the countries involved by maintaining a monopoly on the procurement of cotton.

For the vast majority of cotton production, world prices are not a directly relevant decision parameter. As a consequence, exports of many countries are determined by government policy rather than world markets. Two factors may be relevant to the decisions to use fixed price policies. Most of the countries with fixed producer prices are LDC's or CPE's, in which the textile industry is regarded as a principal component of the industrialization process. Since raw material costs comprise 50 percent or more of textile production costs, low prices for seed cotton would appear to allow both low domestic consumer prices for textiles and a competitive advantage for textile exports. As a result of these policies, textiles have become a dominant source of manufacturing employment. Textiles and clothing industries were responsible for 29-36 percent of valued-added in manufacturing among the fixed-price countries of Table 2, with the exception of Thailand (17 percent) and the USSR (six percent).[2/] A second factor which influences the use of

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2/ Data are taken from the World Bank (1980). Data for China, Ivory Coast and Tanzania are not available.

fixed price policies is the ability of the government to impose commodity taxes. Cotton is exclusively a cash crop, and processing facilities are easily monitored by the government, which allows problems of tax evasion via parallel private markets or home consumption of the commodity to be minimized.

Net importers of cotton do not interfere with the international market to the same degree as exporters. Strong competition and quantitative restrictions on international textile trade, as well as budget constraints, make direct government subsidization of cotton use implausible in most importing countries. The centrally-planned economies of China and Eastern Europe purchase cotton through government-controlled trading agencies and may determine cotton imports independently of cif prices. India also buys imports through a centralized purchasing agency (Cotton Corporation of India, Ltd.), with imports determined as the difference between the planned quantity of yarn production (determined by the government) and domestic availabilities of cotton. Since India is largely self-sufficient in cotton production, these amounts are minor.

III. Models of the Demand for Cotton

Previous studies of cotton demand have focused on two types of models, separable demand functions and lagged-adjustment models. The first approach has viewed cotton demand in two stages. Initially, the consumer is assumed to allocate his budget among broad categories of goods such as apparel and other textile products. In the second stage, relative prices of cotton and alternative fibers are assumed to influence the specific composition of the bundle of textile goods. Lagged adjustment models generally are not specified as such, but arise from the inability to find significant relationships between current prices and current demand from the analysis of time series data.

Recent developments on the separability of consumer preferences provide a theoretical justification for the two-stage approach to cotton demand. Estimates of studies of the elasticity of demand for all fibers are summarized in Table 3. The earliest study in this group is that of Donald et al. (1963). In this model, the fiber market consists of four levels of demand: consumer, retailer, fabricator, and mill. It is assumed that demand is unspecified by fiber type until the mill level is reached, where fabricator demands are distributed among alternative fibers on the basis of relative prices and "special conditions" of demand. The results from the Donald study for the U.S. are presented in equation (1) of Table 3. The income elasticity of fiber demand is somewhat greater than 0.8 and is strongly significant. Dudley (1974) estimated a similar function with more recent data utilizing polyester rather than nylon prices as representative of noncellulosic prices for 1958-70. He arrived at similar estimates, although the Durbin-Watson statistic suggests serial correlation and the price coefficient has the wrong sign. Collins et al. (1979) attempted a time series analysis of FAO consumption data for the 1960-74 period, in which the world was divided into twenty regions. In general, income elasticities appear higher in developed than in developing regions, although results were statistically insignificant for eight of the 20 regions. The omission of a price variable may create some uncertainty about the validity of the results. French (1980) undertook a time-series estimation over a longer time period (usually 25 years) and fewer regions (eleven), and found significant relationships between income and demand. His income elasticities ranged between 0.3 and 0.9. As in the Collins study, however, the relative price variable was usually omitted.

Table 3. Estimates of Total Fiber Demand and Separable Demand Functions.

1. Donald et al., 1927-32, 1935-40, 1948-60, U.S.

$$\ln Q = -0.38 + \underset{(8.89)}{0.8}\ \ln Y + \underset{(4.73)}{1.23}\ \ln \alpha - \underset{(1.93)}{0.27}\ \ln P \qquad R^2 = 0.90$$

where Q = U.S. per capita fiber consumption in pounds of cotton equivalents, Y = real per capita income, and P = deflated fiber price index, where individual fibers are weighted by total use shares.

2. Dudley, 1953-70, U.S.

$$\ln Q = 0.88 + \underset{(10.38)}{0.86}\ \ln Y + 0.51 \ln P_{t-1}, \qquad R^2 = 0.91 \quad DW = 1.29$$

3. French, 1951/52-1975/76, 11 regions

a. Brazil

$$\ln FD = -5.0 + \underset{(-5.1)}{.92}\ \ln Y - \underset{(-5.1)}{.028}T$$

b. China

$$\ln CD = .218 + \underset{(4.6)}{.76}\ \ln PROD - \underset{(-2.0)}{.12}\ \ln \left(\frac{P^c}{P^s}\right)_{t-1} + \underset{(3.9)}{.149}\ \text{Dummy (1 from 1971 onward)}$$

c. Egypt

$$\ln FD = .234 + \underset{(.21)\ (1.4)}{.327}\ \ln Y$$

d. India

$$\ln FD = .65 + \underset{(4.4)}{.94}\ \ln Y - \underset{(-2.3)}{.01}T + \underset{(2.6)}{.39}\ \ln FD_{t-1} - \underset{(-2.4)}{.11}\ \text{Dummy (1 in 1969/70)}$$

e. Japan

$$\ln FD = .28 + \underset{(1.4)}{.44}\ \ln FD_{t-1} + \underset{(2.6)}{.17}\ \ln Y - \underset{(-3.3)}{.23}\ \text{Dummy (1 from 1974-76)}$$

f. Mexico

$$\ln FD = .12 + .48 \ln FD_{t-1} + .207 \ln Y$$
$$(.92) \quad (2.0) \qquad\quad (2.5)$$

g. Pakistan

$$\ln FD = .62 + .62 \ln FD_{t-1} + .40 \ln Y$$
$$(3.8) \quad (11.6) \qquad\quad (1.6)$$

h. Turkey

$$\ln FD = -.76 + .86 \ln Y + .29 \ln FD_{t-1}$$
$$(-3.9) \quad (6.8) \quad\; (4.0)$$

i. USA

$$\ln FD = .22 + 1.67 \ln Y - .03T$$
$$(.63) \quad (6.5) \quad\; (-5.6)$$

j. USSR

$$\ln CD = .14 + .23 \ln PROD - .047 \ln \left(\frac{P^c}{P^s}\right)_{t-1} + .68 CD_{t-1}$$
$$(3.7) \quad (4.6) \qquad\quad (-2.8) \qquad\qquad\qquad (13.1)$$

k. Rest of World

$$\ln FD = -2.69 + .55 \ln Y$$
$$(-15.5) \quad (22.6)$$

where FD = per capita fiber demand, CD = per capita cotton demand, Y = per capita real income, T = Time, PROD = cotton production, pc = cotton price, ps = synthetic price.

4. Magleby and Missaien, 1964, Global model with 33 regions

$$\ln Q = a + 0.62 \ln Y, \qquad R^2 = 0.82$$
$$(11.7)$$

$$Q = a + \underset{(12.9)}{8.92}\ln Y, \qquad R^2 = 0.84$$

Income Level	Elasticity
100	2.45
200	.91
500	.50
1,000	.37
2,000	.29
3,000	.26
Sample Average	.65

where Q = per capita raw fiber consumption, unadjusted

5. Thigpen, 1970-72, averages, Global model with 19 regions

$$Q = \underset{(11.0)}{-23.07 + 4.78}\ln Y \qquad R^2 = .88$$

$$\ln Q^c = \underset{(-6.25)}{1.66 - 194.99}\frac{1}{Y}, \qquad R^2 = 0.70$$

where Q = per capita raw fiber consumption; Q^c = per capita cotton consumption

	Income Level	Income Elasticities: Fiber Demand	Income Elasticities: Cotton Demand
Developing economies	$235	1.4	0.5
Centrally planned	$450	0.6	0.2
Developed	$4,000	0.3	0.07

6. Dudley, 1953-70, U.S.

$$Q^{MA} = a_1 \underset{(1.28)}{- 3.93}\left(\frac{p^c}{p^p}\right) \underset{(7.74)}{+ 0.64}\, D^{MA} \underset{(7.19)}{- 0.74T} \qquad R^2 = 0.89, \quad DW = 1.68$$

$$Q^{WA} = a_2 \underset{(1.54)}{- 5.11}\left(\frac{p^c}{p^p}\right) \underset{(2.05)}{+ 0.64}\, D^{WA} \underset{(3.31)}{- 0.74\,T} \qquad R^2 = 0.94 \quad DW = 2.30$$

$$Q^{IIII} = a_3 \underset{(3.65)}{- 6.13}\left(\frac{p^c}{p^p}\right) \underset{(4.09)}{+ 0.12}\, D^{IIII} \underset{(2.07)}{- 0.10\,T} \qquad R^2 = 0.71 \quad DW = 1.78$$

$$Q^{OP} = a_4 - \underset{(5.01)}{3.27}\left(\frac{p^c}{p^p}\right) - \underset{(0.54)}{0.03}\, D^{OP} + \underset{(2.19)}{0.06}T \qquad R^2 = 0.71 \qquad DW = 2.14$$

$$Q^{IU} = a_5 - \underset{(13.01)}{6.80}\left(\frac{p^c}{p^p}\right) + \underset{(8.25)}{0.35}\, D^{IU} - \underset{(10.86)}{0.18}T \qquad R^2 = 0.98 \qquad DW = 2.23$$

where Q = cotton consumption per capita' p^c = price of SLM $1\frac{1}{16}$" cotton at group B mill points, U.S. cents/lb.; p^p = average of wool, cellulosic and noncellulosic prices, U.S. cents/lb; D = total fiber demand, in lbs. per capita, T = time trend from 1964 through 1970. The superscripts MA, WA, HH, OP and IU represent men's apparel, women's apparel, household furnishings, other consumer products, and industrial uses, respectively.

7. French, 1950-76, 9 regions

a. Brazil

$$MS = \underset{(103.3)}{1.1} - \underset{(-7.3)}{.061}\, P_{t-1} - \underset{(-26.3)}{.006}T$$

b. Egypt

$$MS = \underset{(100.2)}{.98} - \underset{(-3.2)}{.017}\, P_t + \underset{(5.8)}{.001}T - \underset{(-5.1)}{.04}\, DUMMY \quad (1 \text{ in } 1950/51)$$

c. India

$$MS = \underset{(175.6)}{1.02} - \underset{(-1.6)}{.007}\, P_{t-1} - \underset{(-16.1)}{.0025}T$$

d. Japan

$$MS = \underset{(2.0)}{.07} - \underset{(-1.3)}{.02}\, P_{t-1} + \underset{(20.8)}{.92}MS_{t-1}$$

e. Mexico

$$MS = \underset{(59.4)}{1.10} - \underset{(-6.7)}{.098}\, P_{t-1} - \underset{(-11.9)}{.006}T$$

f. Pakistan

$$MS = \underset{(2.3)}{.308} - \underset{(-2.0)}{.008}\, P_t + \underset{(5.2)}{.698}MS_{t-1}$$

g. Turkey

$$MS = \underset{(96.9)}{1.14} - \underset{(-7.2)}{.067}\, P_{t-1} - \underset{(-22.5)}{.0071}T$$

h. US

$$MS = \underset{(42.9)}{1.21} - \underset{(-5.8)}{.13}\, P_{t-1} - \underset{(-23.8)}{.018}T$$

i. Rest of World $MS = .982 - .067\ P_t - .01T$
(87.3) (-7.2) (-34.3)

where MS = cotton consumption/total fiber demand, P = price of cotton/price of synthetics, and T = time.

Difficulties with defining appropriate price indices for fibers have led other authors to rely on cross-sectional data in order to estimate the income elasticity of total fiber demand. Magleby and Missaien (1964) used 1964 FAO data for domestic availability of total fibers to estimate income elasticities. Double logarithmic and semi-logarithmic forms were tested, with little difference in terms of closeness of fit. Both forms suggested a global income elasticity of 0.6. The implications for demand projection, however, differ substantially. The semi-log form suggests elasticities for high income countries of 0.3, only one-third as large as the time series estimates of Donald and Dudley, and one-half as large as those suggested by the constant elasticity form. Thigpen (1978) applied a semi-log form to 1970-72 FAO data, and obtained results similar to those of Magleby and Missaien (equation (4)). Both the t-statistic and R^2 were higher than the results of attempts to estimate elasticities of cotton demand from the same data. A semi log-inverse form provided the best fit in the latter case, suggesting income elasticities of demand for cotton of 0.2, well below the estimated elasticities for total fiber demand.

The studies of French and Dudley explore the second stage of the allocation process. Dudley's study estimates U.S. per capita cotton demand in five end-use categories as a function of relative prices, total fiber demand as a proxy for fiber expenditures, and a time trend for 1964-70 to represent noncompetitive substitution of synthetics for cotton. Unlike in most studies, current rather than lagged prices were utilized, which may account for the two cases of insignificant t-statistics. Relative price elasticities (calculated at mean values) ranged from -0.09 to -0.61, with a weighted average elasticity of -0.25. Expenditure elasticities ranged from 0.9 for men's apparel to -0.4 for women's apparel, with a weighted average elasticity of -0.31. The total

income elasticity of U.S. demand for cotton implied by these results is 0.27. French's results use the market share for cotton as the dependent variable. French finds statistically significant relationships between relative prices and cotton's market share in almost all cases, although regions apparently vary in the time lag of response. In all cases, however, the impact of relative price changes appears limited. Assuming a market share of 0.55, an initial price ratio of 1 and an average coefficient of -.07, a doubling in the price of cotton reduces the market share by .14, suggesting an own-price elasticity of -0.25. The cross-price elasticities are equal in absolute value to the own-price elasticity in this formulation.

A second group of studies has estimated the demand for cotton directly as a function of own price, the price of substitutes and income. These studies have generally found current demand to be related to lagged prices. The empirical analyses of the studies are presented in Table 4. Ecevit's quantity data are in aggregate rather than per capita terms, and thus suggest larger own- and cross-price elasticities relative to those obtained by Adams and Behrman. The treatment of the quantity variable may also explain the differences in the sign of the trend coefficient. The important similarities among the two studies are the presence of lagged values of consumption, cotton prices, and polyester prices.[3/]

The estimation of own- and cross-price elasticities represents one of the most difficult problems in the study of cotton demand. The own-price elasticities found by Adams and Behrman ranged from -0.1 to -0.4, and generally agree with the results of other studies. Thigpen (1978) estimates a

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3/ The Adams-Behrman study uses an index of synthetic end-product prices rather than raw material prices.

Table 4. Regression Estimates of Cotton Consumption from Time-Series Data

1. Ecevit, 1958-75, World

$$Q = \underset{(1.3)}{5747} - \underset{(3.7)}{7633.2}\ P^{c}_{t-1} + \underset{(3.0)}{3888.4}\ P^{p}_{t-1} + \underset{(2.8)}{0.481}Q_{t-1} + \underset{(4.6)}{377.2}T$$

$$R^2 = .95 \qquad DW = 1.7$$

where Q = world consumption, '000 bales; p^c = Liverpool cotton price index, p^p = price of 1.5 denier polyester staple (both prices deflated by the CPI for ten industrial countries); T = time.

2. Adams and Behrman, 1955-73, World

a. Developed Economies

$$\ln\left(\frac{Q}{POP}\right) = \underset{(1.0)}{-1.365} + \underset{(2.7)}{0.475}\ \ln\left(\frac{Q}{POP}\right)_{t-1} - \underset{(2.9)}{0.230}\ \ln\left(\frac{p^c}{p^p}\right)_{t-1} + \underset{(1.8)}{0.603}\ \ln\left(\frac{GDP}{POP}\right) - \underset{(2.2)}{0.027}T$$

$$R^2 = .92 \qquad DW = 1.6$$

b. Developing Economies

$$\ln\left(\frac{Q}{POP}\right) = \underset{(10.7)}{-1.564} - \underset{(0.9)}{0.021}\ \ln\left(\frac{p^c}{p^p}\right)_{t-1} - \underset{(2.9)}{0.046}\ \ln\left(\frac{p^c}{p^p}\right)_{t-2} - \underset{(4.2)}{0.060}\ \ln\left(\frac{p^c}{p^p}\right)_{t-3} - \underset{(2.2)}{0.050}\ \ln\left(\frac{p^c}{p^p}\right)_{t-4}$$

$$+ \underset{(15.0)}{0.471}\ \ln\left(\frac{GDP}{POP}\right)$$

$$R^2 = .98 \qquad DW = 2.7$$

c. Centrally Planned Economies

$$\ln\left(\frac{Q}{POP}\right) = \underset{(4.0)}{0.237} + \underset{(2.9)}{0.197}\ \ln\left(\frac{Q}{POP}\right)_{t-1} \underset{(2.6)}{-0.108}\ \ln\left(\frac{p^c}{p^p}\right)_{t-1} + \underset{(12.4)}{0.604}\ \ln\left(\frac{Q^s}{POP}\right) + \underset{(3.2)}{0.003}T$$

$$R^2 = .97 \qquad DW = 1.9$$

where Q = consumption, '000mt; POP = population, in millions; p^c = UN export price index, p^p = index of manmade fiber textile products; GDP = gross domestic product index; Q^s = production, '000 mt; T = time.

3. Thigpen, 1955-75, World

a. Developed Economies, 1956-75

$$\ln Q = 7.09 - \underset{(-10.15)}{0.20}\ \ln\left(\frac{p^c}{p^p}\right)_{t-1} + \underset{(6.44)}{0.24}\ \ln IPI,$$

$R^2 = .88$ DW = 1.43

b. Developing Economies, 1955-75

$$\ln Q = 1562.64 - \underset{(-3.49)}{4.90}\ p^{cl}_{t-1} + \underset{(53.85)}{22.56}\ IPI$$

$R^2 = .99$ DW = 2.56

c. Centrally Planned Economies

No significant relationships were found.

where Q = mill consumption of cotton in '000 mt; p^c = cif Liverpool price of Mexican SM1$\frac{1}{16}$" cotton, in U.S. cents/lb; p^p = fob plant, U.S. price of 1.5 denier polyester staple in U.S. cents/lb; IPI = UN index of industrial production (an income proxy) p^{cl} = cif Liverpool price for Pakistan 289F S.G. cotton, in U.S. cents/lb, deflated by U.S. wholesale price index.

4. Donald et al., 1927-32, 1935-40, 1948,60, U.S.

$$\ln Q = 0.39 + \underset{(5.0)}{0.40}\ \ln Y + \underset{(4.6)}{0.92}\ \ln \Delta Y - \underset{(2.3)}{0.14}\ \ln P_{t-1} - \underset{(4.3)}{0.13}\ \ln NC - \underset{(4.5)}{0.09}\Delta S$$

$R^2 = .87$

where Q = per capita cotton consumption, in lbs.; Y = real per capita income, P_{t-1} = real producer price for cotton, lagged 15 months; NC = per capita consumption of noncellulosic fibers, S = ratio of stocks of cotton broadwoven goods to unfilled orders, measured at textile mills.

lagged relative price elasticity of -0.20 for the developed countries, and a lagged own-price elasticity of -0.09 in the developing economies. The results of Donald et al. for U.S. demand for the period 1927-60 yield a lagged own-price elasticity of -.14. Noncellulosics were the dominant synthetic fibers during that period, but unavailability of reliable price series forced the use of quantity data. The availability of synthetics appears to have had an influence duruing the period studied, although the cross-price effects cannot be estimated from the Donald results.

The magnitude of cross-price elasticities that have been obtained seems unusually small given the technical feasibility of adjusting the polyester/cotton mix in yarn. Noncellulosic fibers can be produced to any desired degree of fineness ranging from shirt material (1.5 denier) to carpet yarn (15.0 denier). Mill adjustments to changes in fiber mix involve cleaning equipment and altering equipment settings and operating speeds, and should not be particularly difficult in plants with post-1960 drafting technologies. The inability of cotton to mimic the permanent press properties of polyester and the comfort advantages of cotton due to its superior moisture absorption may limit the magnitude of substitution, but variations of at least 20 percentage points in the share of an individual fiber appear plausible.[4/] One possible

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4/ Much of the competition between cotton and polyester fibers during the past two decades was not price-competitive. Polyester materials are far superior to cotton in a number of end-uses due to fiber uniformity and control over fineness, length and strength of fibers. Much of the substitution for cotton in the 1950's and early 1960's depended on synthetic fiber availability rather than price, and cotton's share in total fiber use declined substantially. Industrial and miscellaneous use markets, such as tires, rope and carpeting, were almost entirely captured by synthetic fibers. The shares for apparel and household furnishings also declined substantially, primarily becuase of the easy-care properties of synthetics. But this factor cannot be responsible for low cross-price elasticities, for (if anything) such intrusions into market share should have impinged upon the quantity demanded and price of cotton, resulting in overestimates of cross-price elasticities.

explanation for low cross-price elasticities is the use of data for cotton quantity and synthetic prices to derive estimates. Published synthetic price data are list prices, and the frequent of discounts offered by manufacturers and the substantial differences in prices across countries complicates the use of a single series of list prices. Such prices will show less variation than their true values, and thus cross-price elasticities will be underestimated.

An important implication of lagged price response in consumption is that current prices become entirely dependent on the behavior of stockholders. The analysis of stock data (for 1953-72) by Adams and Behrman suggests that current stocks (measured relative to total demand) were not responsive to current prices, and significant relationships between stock levels and prices occurred with a three-year distributed lag. The authors caution, however, that this "may not be a realistic result and may reflect the systematic downward trend of the (deflated price) variable over the sample period" (Adams and Behrman, p. 38). French (1980) found significant relationships between stocks and current prices with an elasticity of -1.7. Lagged stocks also showed a relationship to current prices, but with a positive relationship to prices (an elasticity of 2.5).

IV. An Institutional Model of International Trade

An alternative approach to the analysis of international market demand emerges from the fact that international trade and world prices for cotton are largely independent of price responses of domestic consumers and producers. This reflects the pervasive role of government. For exports, Table 2 shows that most cotton production is government controlled. Preferences for domestic textiles combined with reliance on trade taxes for much of government revenues mean that world prices have little relevance to many producing

areas. Cotton imports are usually not taxed, but controls over domestic textile production significantly influences the demand for cotton fibers, particularly among the centrally-planned economies. All of this suggests that the cotton imports and exports for countries with government controls on consumption and production should be treated separately. In particular, market segregation in terms of price responsive and non-price responsive exports and imports implies that the global trade identity can be rearranged as

$$X^E - M^E \equiv M^R - X^R, \tag{1}$$

where X = exports, M = imports, the superscripts E and R represent countries for whom world prices are irrelevant and relevant, respectively.

Demand and supply in the price-responsive countries can be modelled in a standard manner. For the price-responsive portion of the world market, we will have (be definition),

$$M_t^R - X_t^R \equiv D_{Q_t}^R - S_{Q_t}^R + (CS - OS)_t^R, \tag{2}$$

where: D_Q = consumption,

S_Q = production,

CS = closing stocks,

OS = opening stocks,

t = time.

The task, now, is to specify an equation for each of the components, D_Q^R, S_Q^R, and $(S-OS)^R$. Production S_Q^R, is assumed to follow a standard adaptive expectation process, in which current production depends on expected price. This leads to a Nerlovian form in which production is determined as follows:

$$S_{Q_t}^R = \alpha_1 + \alpha_2 P_{t-1}^C + \alpha_3 S_{Q_{t-1}}^R + \sum_{i=4}^{n} \alpha_i P_{t-1}^{Xi} \tag{3}$$

where p^C denotes the price of cotton and

and p^{Xi} denotes the price of substitute i.

The analysis of cotton consumption must reflect cotton's role as an intermediate input. Spinning mills are the principal consumers of cotton, although small amounts are utilized by other industries such as pharmaceuticals. The production of yarns involves a number of prior decisions, such as the determination of fabric colors and patterns, yarn counts, and fiber blends. These decisions are usually made in consultation with apparel and household furnishing wholesalers and manufacturers, and orders are usually taken for the delivery of fabricated goods in a future period. Cotton consumption decisions by spinning mills are thus made in advance of actual purchases, so that (as with production) expected prices again dictate economic behavior. Accordingly, our model of cotton consumption assumes that the demand for cotton is a function of the expected own price, the expected price of substitutes, income, and trends in tastes and technology.

$$D_{0}{}^{R}_{t} = f\ (P_t^{c*},\ P_t^{SYN*},\ Y_t,\ T_1,\ T_2, \ldots), \tag{4}$$

where:

p^{c*} = price of cotton,

p^{SYN*} = price of synthetic fibers,

Y = income,

T_1, T_2 = taste and technological trend variables.

Assuming linearity for equation (4) and Nerlovian adaptive expectations for p^{c*} and p^{SYN*}, we obtain

$$D_{Q_t}^R = \alpha + a\beta_1 P_{t-1}^C + b\beta_2 P_{t-1}^{SYN} + (a-b)\beta_2 P_{t-1}^{SYN*} + (1-a) D_{Q_{t-1}}^R$$

$$- (1-a)\beta_4 Y_{t-1} + \beta_4 Y_t ,$$

where a and b are the coefficients for the expectations of cotton and polyester prices, respectively. If each individual adjusts his expectational errors consistently, a will equal b and P_{t-1}^{SYN*} disappears from the equation. All remaining independent variables are observable.

Since both consumption and production are recursive, the change in stocks can be written as an identity:

$$(CS - OS)_t^R \equiv (X^E - M^E)_t + (S_{Q_t}^R - D_{Q_t}^R) , \qquad (5)$$

where $X^E - M^E$ is substituted for $M^R - X^R$ by use of equation (1). Equation (5) states that stock changes in price-responsive countries must adjust to absorb the excess supplies (demands) of the price-exogenous countries as well as the differences between current consumption and production in the countries responsive to lagged world prices.

If both current consumption and production are dependent on past prices, has current price adjustment depends entirely on stocks and thus requires closer examination of the behavior of stockholders. The change in the supply of stocks, normally expressed as $\Delta^S S_t = f(\Delta P_t)$, becomes perfectly inelastic in the cotton market, and is defined by equation (5). However, the demand for stocks depends on expectations of future prices, since carrying costs must be covered by the expected price change during the period for which inventories are held. Similarly, inventories will not be released for current consumption until price changes are sufficiently large to compensate the stockholder for carrying costs. The demand relationship can be expressed as

$$\Delta^D S = g(P^* - P_t) \qquad (6)$$

Since the demand for stocks must equal the supply of stocks, equations (5) and (6) can be combined in a reduced form equation,

$$g(P^* - P_t) = \Delta^S S_t. \tag{7}$$

If g is a separable function in its arguments P* and P, equation (7) can be rewritten as a price determination equation

$$P_t = h(P^*, \Delta^S S_t). \tag{8}$$

Finally, if the expected price is a function of past prices, then the current price can be estimated as

$$P_t = \gamma_1 + \gamma_2 \Delta^S S + \gamma_3 P_{t-1} + \gamma_4 P_{t-2} + \ldots + \gamma_n P_{t-n} \tag{9}$$

The sign of γ_2 should be negative, while the signs of $\gamma_3, \gamma_4, \ldots \gamma_n$ should be positive.

Equations (3), (4) and (9) form our institutional model of international cotton trade. Segmenting the cotton market into price responsive and non-price responsive countries implies that the price-responsive countries will adjust in the short-run to the actions of price-exogenous countries through adjustments in inventories, and in the long-run via adjustments in levels of production and consumption.

The production and consumption equations have been estimated using a pooled time-series/cross-sectional data set. Annual observations for the 14 price-responsive countries listed in Table 5 for the years 1960-1980 comprise the data set for the production model.[6/] The results for the production model are presented in Table 5. As in previous investigations, our attempt to estimate cross-price elasticities did not yield significant estimates, and a second equation was estimated which replaced the prices of other crops with

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6/ The data are for 1973-80 for the U.S., and 1960-63 for Peru.

Table 5. Estimated Production Equations in Countries Responsive to World Prices, 1960-80 [a]

Dependent Variable = Production

Independent Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
Constant	-2.37	-2.58	-1.48	-1.55
P^C_{t-1}	0.39	3.09	0.37	2.96
$S_{O_{t-1}}$	0.92	51.84	0.84	29.09
PRICES OF SUBSTITUTES[b]				
Soybeans	0.02	1.25		
Sorghum	-0.03	-1.38		
Wheat	-0.01	-0.60		
Sugar	-0.01	-0.53		
Tobacco	-0.01	-1.08		
Maize	-0.03	-1.50		
COUNTRY DUMMIES				
Argentina			-0.43	-3.02
Australia			-0.60	-3.20
Columbia			-0.45	-3.06
Greece			-0.44	-3.00
Guatemala			-0.42	-2.74
Israel			-0.56	-3.23
Mexico			-0.27	-2.11
Nicaragua			-0.46	-3.07
Paraguay			-0.60	-3.28
Peru (1960-1968)			-0.47	-2.94
South Africa			-0.63	-3.42
Spain			-0.57	-3.61
Turkey			-0.22	-1.76
R^2	0.95		0.95	
F	(8,260) = 669.74		(15,253) = 366.17	

[a] All variables except country dummies are in logarithmic form. All prices are in 1975 US $/mt. Production data are taken from USDA, FAS, World Cotton Statistics, 1947-80, FC 12-81, 1981, while price data are taken from the World Bank, Commodity Trade and Price Trends, various years.

[b] Substitute crops were chosen on the basis of information presented in ERS, USDA, World Demand Prospects for Cotton in 1980, Foreign Agricultural Economic Report No. 000, 1971. Soybean prices are used for Argentina (as a proxy for sunflower prices), Mexico and the United States. Sorghum prices are used for Argentina. Wheat prices are used for Australia, Greece, Israel, Mexico, Paraguay and Turkey. Sugar prices are used for Columbia, Guatemala and Nicaragua. Tobacco prices are used for Columbia and South Africa. Maize prices are used for Spain.

country-specific dummy variables. The short- and long-run price elasticities do not differ substantially between the two equations. The short-run elasticity is 0.37, while the long-run elasticity is 2.30. Since the countries under consideration account for less than one-third of world production, total world supply will consequently appear inelastic with respect to world price changes even in the long run.

The consumption model was estimated using pooled time-series/cross-section data set consisting of annual observations for six regions for the period 1960-80. The six are Western Europe, Japan, Other Asian countries (except the PRC and India), Australia, the United States, and Other Americas (all Latin and North American countries except the U.S. and Brazil). Region-specific dummy variables were included to allow for separate intercepts. The choice of an appropriate income variable is particularly difficult, since many cotton consuming countries import cotton with the intention to export textiles, and thus domestic income is not the sole determinant of the income-demand relationship. In all cases, income is represented by an International Monetary Fund estimates of GDP in 1975 prices. Domestic income has been used for all regions except Other Asia, for which the Western Europe income is assumed to be most relevant.

The results are presented in Table 6. The adaptive expectations model is confirmed, as the coefficients for lagged cotton price and lagged consumption have the expected signs and highly significant t-statistics. The own-price elasticity is -0.37, a value similar to that found in other studies. In the long run, however, consumption appears price-elastic, with a point elasticity of -1.69. The coefficient on current cotton price is statistically significant, but of a positive sign. This result is also consistent with the adaptive expectations model. That this is so follows from the fact that if

Table 6. Estimates of the Cotton Consumption Model in World Price-Responsive Countries, 1960-80.[a]

Dependent Variable = Cotton Consumption, (Mean = 6.307) Independent Variable	Mean	Coefficient	t-Statistic
Constant	1.0	2.13	5.06
P^{C}_{t-1}	7.329	-0.27	-6.20
DQ^{R}_{t-1}	6.299	0.84	20.40
P^{C}_{t}	7.319	0.10	2.69
Y	695.246	0.115×10^{-3}	3.03
P^{SYN}_{t-1}	0.0278	0.026	2.23
Regional Dummy Variables			
Western Europe		0.036	1.36
Japan		0.030	1.42
Other Asia		0.16	3.90
Australia		-0.47	-3.89

$R^2 = 0.999$ $F_{(9,94)} = 8223.0$

[a] Prices and consumption variables are entered in logarithmic form. Income is entered in nominal form. Consumption is measured in '000 mt, and the data is taken from USDA, FAS, World Cotton Statistics, 1947-80, FC 12-81, 1981. Cotton prices are in 1975 US $/mt. Income is in millions of 1975 US$, taken from the International Monetary Fund, International Financial Statistics, various years. Synthetic price data are represented by US manufacturer list prices, published in United States Department of Agriculture, Cotton and Wool Situation, various years. Prices are entered in 1971 US $/lb.

prices are relatively high in year t, consumption in year t+1 will decline while production will increase. Thus $S_0^R - D_0^R$ will increase, and price in year t+1 must decline in order to induce stockholders to accumulate the additional inventories.

The estimates of cross-price and income effects are less satisfactory, however, and reflect difficulties in variable definitions and data availability. While the estimated income elasticities are signifiant, the t-statistic is well below the values for the lagged cotton price and lagged consumption. The income elasticity (at the point of mean income) is 0.08 in the short run, and 0.59 in the long run. The long-run value is consistent with Thigpen's cross-sectional estimates presented in Section III. The semi-logarithmic form also suggests substantial differences between low- income and high-income regions.

The cross-price elasticity is only 0.12 in the long run, which is substantially less than technical considerations would suggest. The principal difficulty appears to lie in the data. List prices for synthetic fibers are frequently discounted, and vary substantially across countries due to protection of domestic producers from international markets. Thus measured price variability will understate the true changes, and elasticities may be underestimated. Attempts to divide the observation period into subperiods of non-price competition with cotton (1960-72) and price competition (1973-80) failed to yield anyting useful. Alternatively, the cross-price elasticity can be estimated by applying the homogeneity condition, in which the sum of own- and cross-price elasticities must equal the negative of the income elasticity. A long-run income elasticity of 0.5 and a long run price elasticity of -1.7 implies that the sum of the cross-price elasticities is 1.2. Although synthetic fibers are probably not the only substitute for cotton, an elastic cross-price elasticity appears plausible.

Table 8. Estimation of the Demand for Stocks, 1960-80.

Dependent Variable: Cotton price

Independent Variable	Mean	Coefficient	t-Statistic
Constant	1.0	87.19	1.34
ΔS_t	-1450.51	-0.30	-6.20
P^C_{t-1}	966.94	0.49	5.33
DUMMY (1973 = 1)	856.26	7.10	

$R^2 = 0.94$ $F_{(3,16)} = 101.46$ DW = 1.83

The results of the price equation estimation are presented in Table 7. Nominal prices are used as the dependent variable. A dummy variable is included for the year 1973, as unprecedented competition from food crops due to declines in global food production and short-term scarcities of synthetic fibers due to the oil crisis encouraged speculation and record levels of stock accumulation among cotton importers. The results confirm the dependence of current prices on inventory adjustments in the price-responsive countries. The elasticity (calculated at the point of means) is -0.42, based on an average stock change of 1.45 million mt. This value is substantially less than average world trade for the period of 3.95 million mt. Total annual carryovers are about 50 percent greater than the volume of trade. If price-quantity changes are compared to trade volumes, rather than the exogenously-determined changes in the quantity of stocks, the price elasticity of international market demand declines to -0.15. Substantial price changes are necessary to induce stockholders to augment their annual carryover, and their price-responsiveness is relatively less elastic than that of final consumers. The coefficient for lagged prices also supports the view of a conservative process of inventory adjustment, as only about half of past price changes appear to be incorporated into the expected future price.

V. Summary and Conclusions

The analysis of the international market confirms the presence of adaptive expectations behavior among both consumers and producers in countries responsive to world prices. This information on current prices can allow prediction of consumption (elasticity = -0.3) and production (elasticity = 0.4) in succeeding years. The actual price in succeeding years depends, however, on the demand for inventories, which appears substantially less

price-elastic (-0.15) with respect to the volume of international trade. The problem for countries like Egypt, who take world prices as exogenous (with the possible exception of ELS prices), is that production and consumption response will only partly determine the world price. The second element involves the balance between exogenously-determined exports and imports. Thus, world price estimations are devoid of predictive power unless government policy is simultaneously projected.

Given the lack of consistency in the conduct of government behavior over time, such exercises may be of little more than academic interest. Indeed, it is the unpredictability of policy decisions which has been a prime determinant of cotton price movements over the last two decades. Nevertheless, lacking information on policies of minor exogenous participants, future price predictions may usefully focus on the behavior of the largest market participants. In the cotton market, the trade policies of the USSR (with regard to exports) and China (with respect to imports) are likely to be particularly important for future movements in world cotton prices. In addition, "synthetic fiber availabilities and real income growth represent key constraints on world prices. But in the absence of major shifts in policy direction or technological changes in substitute crops, there appears little reason to be pessimistic about the future course of world market prices for cotton exports.

References

Adams, F.G. and J.R. Behrman, 1976, Econometric Models of World Agricultural Commodity Markets (Cambridge, Mass.: Ballinger Publishing Co.)

Collins, Keith J., R.B. Evans and R.D. Barry, 1979, World Cotton Production and Use: Projections for 1985 and 1990, ESCS and FAS, USDA, Foreign Agricultural Economic Report No. 154.

Deaton, Angus and J. Muellbauer, 1980, Economics and Consumer Behavior (New York: Cambridge University Press).

Donald, J.R., F. Lowenstein and M.S. Simon, 1963, The Demand for Textile Fibers in the United States, Economic Research Service, U.S.D.A., Technical Bulletin No. 1301.

Dudley, George E., 1974, U.S. Textile Fiber Demand: Price Elasticities in Major End-Use Markets, Economic Research Service, U.S.D.A., Technical Bulletin No. 1500.

Ecevit, Leyla U., 1978, Recent Developments in the World Cotton Market and the Future Outlook, International Monetary Fund Staff Papers 380-405.

El-Kholei, O.A. and M. Abbas, 1980, Effect of Existing Egyptian Cotton Policy on Deterioriation of Cotton Quality, The Egyptian Statistical Journal 24(1): 41-73.

French, Mark W., 1980, Effects of Commodity Price Stabilization: An Econometric Model of the World Cotton Market, unpublished Ph.D. dissertation, University of Pennsylvania.

Hagleby, R.S. and E. Missaien, 1971, World Demand Prospects for Cotton in 1980, with Emphasis on Trade by Less Developed Countries, Economic Research Service, U.S.D.A., Foreign Agricultural Economic Report No. 000.

Thigpen, M. Elton, 1978, International Cotton Market Prospects, World Bank Staff Commodity Paper No. 2, June, 1978.

United Nations, Trade and Development Board, 1978, Extent, Nature, Causes and Consequences of Fluctuations in Prices in World Markets for Cotton, Integrated Programme for Commodities, Third Preparatory Meeting on Cotton, TD/B/IPC/COTTON/11. Geneva.