TEXTILE TRADE LIBERALIZATION AND THE U.S. COTTON INDUSTRY

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Abstract: This study investigates impacts on the U.S. cotton industry of textile trade liberalization using a multi-market equilibrium displacement model. Textile trade liberalization would induce small changes in the total demand for U.S. cotton but would affect considerably U.S. cotton demand structure, making U.S. cotton growers more dependent on world markets.

Keywords: Multi-Fiber Arrangement, U.S. cotton industry, equilibrium displacement model

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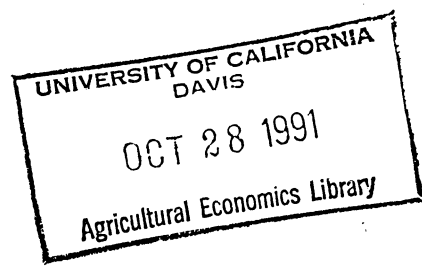
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The Uruguay Round is nearing the final stage. Textile trade liberalization is a central issue to this round. Trade of textiles and apparel has been regulated and managed under the Multi-Fiber Arrangement (MFA) since early of 1970s. The MFA is a legal agreement negotiated and signed by participating countries to manage textile trade flows from between exporting country to importing country. Currently, the United States has bilateral restraint agreements with 43 countries and regions, covering 80 percent of textiles and apparel imports from developing countries. In the EC, the MFA regulations cover about 77 percent of total EC textiles and apparel imports from 27 countries.

Hufbauer et al., Cline, Pelzman, Trela and Whalley and U.S. International Trade Commission (USITC) have shown that substantial welfare gains for both export and import countries would be obtained by phasing out the MFA. Most of these studies, however, center their analyses on textile and apparel and pay little attention to the impact on textile input industries.

The objective of this study is to investigate the effects on the U.S. cotton industry of phasing out the MFA. Cotton is one of the largest field and export crops in U.S. agriculture. Any impact on the cotton industry has important implications for the whole agricultural sector. On the other hand, U.S. cotton production has long been supported by farm programs so shifts in U.S. cotton demand curve must have important effects on government expenditures. These two reasons motivate this study.

The study relies on a multi-market equilibrium displacement model that captures the basic linkages of the U.S. cotton industry with textile and apparel markets in the United States and abroad and centers on the welfare effects on the U.S. cotton industry of phasing out the MFA.

DEMAND FOR U.S. COTTON AND THE MFA

The significant impacts on the demand for U.S. cotton of phasing out the MFA are mainly attributable to the demand structure for U.S. cotton and to world textile trade patterns. Demand for U.S. cotton is composed mainly of two components: domestic mill use and exports. Domestic mill demand accounts for about half of total demand in these years, which meets about 29 percent of U.S. total mill demand for fibers. Export demand accounts for another 50 percent of total demand, of which an important proportion, about 60 percent, is imported by the major textile exporters whose textile exports are restricted by the MFA. Other major U.S. cotton importers such as EC, Japan and Canada account for about 40 percent of the U.S. cotton export market (USDA).

The United States, the EC and Canada are the major importers of textiles in the world. Their imports account for more than half world textiles trade in recent years. In terms of quantity, annual average cotton textile imports during 1984-87 account for 45.75 percent of total U.S. textile imports. Of total cotton textile imports, cotton apparel accounted for 52.4 percent during the same period (USDA). Imports of cotton textiles and apparel in the EC accounted for 46.62 percent of total textile imports from non-OECD countries, of which about 50.6 percent was apparel during 1982-86 (TEB).

Textile and apparel export supply come mainly from non-OECD countries. Leading suppliers are Hong Kong, Korea, China, Taiwan and India, which account for about 50 percent of the U.S. cotton textile import markets, 66 percent of the EC textile import markets, and 67 percent of the Canadian textile import markets (Anson and Simpson). Some textile and apparel export suppliers such as Korea, Taiwan and Hong Kong import U.S. cotton, but others such as India and Pakistan use little U.S. cotton. Trade in textiles and apparel also occurs between the United States and other OECD countries and among other OECD countries. However, it is free of the MFA restrictions.

Under such a demand structure and textile trade patterns, it appears that removal of the MFA in all OECD countries will have significant effects on the demand for U.S. cotton. If textile trade is liberalized, the supply of textile export would increase to the amount it would have been without intervention; that, in turn, will bring down the import price. This lower import price induces consumers to substitute imports for competing domestic goods, which cause demand for domestically produced textiles to fall. Since demand for cotton is a derived demand, rises in foreign textile exports may induce increases in demand for U.S. cotton exports, but decreases in demand for domestic outputs induce demand for cotton to fall. On the other hand, textile trade liberalization also induces changes in demand for other foreign cotton imports. Because there exists substitution between U.S. cotton and other foreign cotton, there may be an increase in demand for U.S. cotton. Obviously, without carefully empirical analysis effects on the demand for U.S. cotton of phasing out the MFA cannot be quantified.

Furthermore, effects on U.S. cotton producers' welfare of phasing out the MFA depend largely on government farm policy. If the current program provisions remain unchanged, there would be relatively small effect on cotton producers' welfare because about 85 percent cotton producers are protected by programs.

Given the high cost of farm programs and huge federal deficit, however, it seems unlikely for the government to bear all increase costs. Any downward changes in the target price will result in changes in cotton producers' welfare. To capture the different effects on cotton producers of phasing out the MFA, this study examines two extreme cases. One assumes that all cotton producers participate in the programs, and that there is no acreage adjustment if the current target price is fixed. Thus, phasing out the MFA has no effect on U.S. cotton producers' welfare under the assumption that the current farm programs remain unchanged. The second case considers free market adjustment. These two cases provide the upper estimates of changes in government expenditures and producers' welfare.

THE MODEL

This study classifies textile industries based on four-digit rather than two-digit SIC. The textile industry is defined as one that uses fibers along with other inputs to produce two types of final outputs: (1) household and industrial use items, and (2) semi-manufacturing textiles, called " fabrics", which are inputs to the apparel industry. The apparel industry includes all firms using domestic and imported fabrics along with other inputs to produce final products: apparel. The major advantage of this reclassification is that it gives a clear input-output relationship between fiber inputs and textile outputs without double-counting problems. All fiber inputs enter the textile production. Changes in apparel production causes changes only in demand for fabrics, which, in turn, induces changes in demand for fibers.

According to the coverage of the MFA and to the demand for U.S. cotton, the model includes two major developed countries, the United States, and other OECD countries including the EC, Canada and Japan, twenty-seven non-OECD countries, other U.S. cotton importing countries as a whole, and foreign cotton-supplying countries as a whole. The United States imports textiles and apparel but exports cotton. The other OECD countries import both textile products and cotton. Twenty-seven non-OECD countries are textiles and apparel suppliers and cotton importers. These countries are further classified into two subgroups according to whether they import U.S. cotton. Other cotton importing countries import both U.S. and other foreign cotton only for domestic consumption.

Countries' production, consumption and trade behavior can be modeled based on the modern firm and consumer theory. Conventionally, homothetic preferences, identical firms and competitive markets are

assumed for the aggregation of demand and supply of diverse consumers and firms. Thus, the country's demand and supply for domestic goods and trade goods are assumed to be derived from the representative's utility and profit maximization by duality theory. Since this study involves multi-output production and most of supply-side parameters are unknown, an additional assumption, nonjointness technology, is made for all textile production.

To center on effects of on the U.S. cotton industry of phasing out the MFA, some additional assumptions are made in this study.

1. Domestic and foreign textiles and cotton are not perfectly substitutable.

2. To reflect the existence of product differences from different sources of exports, an Armington structure is assumed for the demand for the developing textile exports. Thus, the world market textile price is a composite price.

3. Firms can hire any amount of other inputs such as manmade fibers, labor, capital, energy, and other materials at the going price in every country.

4. All exports of textiles in unrestricted categories, and textile trade among OECD countries and among non-OECD countries are unaffected by removal of the MFA.

Following Muth, the model solves for changes in endogenous variables induced by exogenous shocks (tariff and quota removal). The equilibrium displacement model in log differential form ($EX=d\log X$) is written as (variables and parameters are defined in Table 1):

1. **Textile End-Uses and Apparel**

   Consumption

   (1) $ETD_i = \eta_T TiEPT_i + \eta_T TIiEPT_i^D$, (demand for domestic textiles)

   (2) $EAD_i = \eta_A AiEPA_i + \eta_A AIiEPA_i^D$, (demand for domestic apparel)

   (3) $ETMD_i = \eta_T ITiEPT_i + \eta^*_T TiEPT_i^D$, (demand for imported textiles)

   (4) $EAMD_i = \eta_A I_A iEPA_i + \eta^*_A AiEPA_i^D$, (demand for imported apparel)

   Production

   (5) $EPT_i = \delta_T CiEPC + \delta_T OiEPO$, (domestic textile supply)

   (6) $EPA_i = \delta_A FiEPF_i + \delta_A FIiEPF_i^D$, (domestic apparel supply)

(7) $EPT_j^S = \delta_T CjEPC + \delta_T OjEPO,$ (textile export supply)

(8) $EPA_j^S = \delta_A CjEPC + \delta_A OjEPO,$ (apparel export supply)

2. Fabrics

Demand

(9) $EFD_i = \mu_F AiEAS_i + \tau_F FiEPF_i + \tau_F FIiEPF_i^D,$ (demand for domestic fabrics)

(10) $EFMD_i = \mu_F IAiEAS_i + \tau_F IFiEPF_i + \tau_F^* FiEPF_i^D,$ (demand for imported fabrics)

Supply

(11) $EPF_i = \delta_F CiEPC + \delta_F OiEPO,$ (domestic fabric supply)

(12) $EPF_j^S = \delta_F CjEPC + \delta_F OjEPO,$ (fabric export supply)

3. Cotton

Demand

(13) $ECD_i = \mu_C TiETS_i + \mu_C FiEFS_i + \tau_C CiEPC + \tau_C OiEPO,$ (demand for U.S. cotton)

(14) $EDO_i = \mu_O TiETS_i + \mu_O FiEFS_i + \tau_O CiEPC + \tau_O OiEPC,$ (demand for foreign cotton)

(15) $ECD_j = \mu_C TjETMS_j + \mu_C AjEAMS_j + \mu_C FjEFMS_j + \tau^C CjEPC + \tau_C OjEPO,$
(textile exporters' demand for U.S. cotton)

(16) $EOD_j = \mu_O TjETMS_j + \mu_O AjEAMS_j + \mu_O FjEFMS_j + \tau_O CjEPC + \tau_O OjEPO,$
(textile exporters' demand for foreign cotton)

(17) $ECD_h = \tau_C ChEPC + \tau_C OhEPO,$ (other cotton importers' demand)

(18) $EOD_h = \tau_O ChEPC + \tau_O OhEPO,$ (other cotton importers' demand)

Supply

(19) $ECS = \epsilon_C CEPC;$ (U.S. cotton supply)

(20) $EOS = \epsilon_O OEPO;$ (other foreign cotton supply)

4. World Textile Export Market Price Formation

(21) $EPT^S = \Sigma \alpha_j^T EPT_j^S,$ (supply price of textile export)

(22) $EPF^S = \Sigma \alpha_j^F EPF_j^S,$ (supply price of fabric export)

(23) $EPA^S = \Sigma \alpha_j^A EPA_j^S,$ (supply price of apparel export)

5. Trade Restrictions and Equilibrium Conditions

$$(24)\ EPT_i^D = EPT^S + [T_i^T/(1+T_i^T)]ET_iT,$$

$$(30)\ \Sigma\alpha_j^T ETMS_j = \Sigma s_i^T ETMD_i,$$

$$(25)\ EPF_i^D = EPF^S + [T_i^F/(1+T_i^F)]ET_i^F,$$

$$(31)\ \Sigma\alpha_j^F EFMS_j = \Sigma s_i^F EFMD_i,$$

$$(26)\ EPA_i^D = EPA^S + [T_i^A/(1+T_i^A)]ET_i^T,$$

$$(32)\ \Sigma\alpha_j^A EAMS_j = \Sigma s_i^A EAMD_i,$$

$$(27)\ ETS_i = ETD_i,$$

$$(33)\ ECS = \Sigma\pi_i ECD_i + \Sigma\pi_j ECD_j + \Sigma\pi_h ECD_h,$$

$$(28)\ EFS_i = EFD_i,$$

$$(34)\ ECSO = \Sigma\phi_i EOD_i + \Sigma\phi_j EOD_j + \Sigma\phi_E OD_h,$$

$$(29)\ EAS_i = EAD_i,$$

where subscript i refers to the United States and to other OECD countries, j refers to twenty-seven textile exporters, k refers to other cotton exporters and h refers to cotton importing countries without textile exports.

The system of equations is solved for relative changes in the endogenous variables induced by policy shocks. Given all parameter and share values, the solution gives how the equilibrium quantity and price are affected by phasing out the MFA.

Most demand-side parameter estimates obtained in the existing literature (e.g., Cline and Duffy, Wohlgenant and Richardson). Most estimates of price elasticity of textile mill demand for cotton in the literature, however, are based on consumption theory or from a single demand equation. These estimates are not consistent with the theory underlying our model so we estimate a complete input demand system for the U.S. textile industry. The input demand system is derived from representative firm's cost-minimization behavior, and incorporates the impact on the derived demand for fibers of technical changes in the textile industry as well as substitution effects among all inputs. The econometric model is a linear logit cost share function augmented to incorporate dynamic adjustment processes. it is estimated using time-series data from 1950-1987. The estimated own price elasticity of demand for natural fibers is -0.8527, which is relatively elastic compared to most previous estimates.

Most existing estimates of price elasticity of U.S. cotton supply are obtained under the consideration of farm program effects so the long-run supply elasticity of U.S. cotton is considerably smaller than that of foreign cotton exports. It is inappropriate to directly use it when the free market adjustment is assumed. This study assumes that the U.S. long-run supply elasticity is the same as foreign exporters'. The sensitivity

analyses are performed for all assumed parameter values and suggest results are not sensitive to changes in elasticity values.

The selection of all other parameters and computation of all market shares are described in more details in Shui.

THE POLICY SIMULATIONS

Phasing out the MFA in all OECD countries implies only partial liberalization of trade because in addition to quota restrictions, the textile trade long has been protected by tariffs. This study presents two policy reform scenarios: (1) completely liberalizing textile trade and (2) phasing out the MFA only. Since textile trade liberalization can be only achieved gradually, long-run cotton supply elasticities are used to reflect the long-term adjustment process in the cotton industry.

Results of all simulations predict moderate changes in net total demand for U.S. cotton caused by textile trade liberalization. The adjustment process is as follows. Both completely or partially liberalizing textile trade induce considerable declines in textile import prices in the United States and other OECD countries. As demand for textile imports increases, their demand for domestic textile products decreases which, in turn, induces a large drop in derived demand for cotton. On the other hand, the demand for U.S. cotton by developing textile suppliers increases because their textile exports increase. Since the long-term cotton supply responses are taken into account, the substitution effect is relatively weak. As a result, the total demand for U.S. cotton decreases but the magnitude is relatively small for the free market adjustment case, only about 1 percent for complete textile trade liberalization and 0.7 percent for partial liberalization for the free market adjustment case. Since there is no cotton supply adjustment under the farm program, changes in the U.S. cotton price are relatively larger than those in the free market adjustment case.

However, the model predicts a considerable change in cotton demand structure. As textile trade restrictions are removed, the domestic cotton market contracts. The U.S. textile mill demand for cotton decreases about 25 percent when all textile trade restrictions are removed and decreases about 15 percent when only the MFA is phased out. There is a substantial increase in textile exporters' demands for U.S. cotton, which is about 43 percent if textile trade completely liberalized and about 30 percent if only the MFA is removed. The change in demand structure makes U.S. cotton producers be more exposed to world competitive

forces and market risk because export demand represents the lion's share of total demand. Table 2 summarizes all results of effects on the U.S. cotton demand and its structure of textile trade liberalization.

Textile trade liberalization causes changes in the U.S. cotton demand price and quantity, which have important economic implications for farm program costs and U.S. cotton producers' welfare. If the current farm program is assumed to be unchanged, textile trade liberalization causes changes only in farm program costs and have no effect on cotton producers' welfare. If the free market adjustment is assumed, changes in demand and price induce only changes in U.S. cotton producers' welfare. To evaluate producers' welfare consequences, two measurements are used in this study. One is the change in the cotton industry's total revenue of and the another is the change in producers' surplus. The percent change in the total revenue is just the sum of percent change of price and quantity under the assumption of the linear demand and supply curve. Correspondingly, producers' surplus can be estimated by the equation

$$EW = \eta PC/PC_0 + (1/2)*\epsilon_{CC}*(\eta PC^2/PC_0),$$

where EW is the change in producers' surplus expressed as a proportion of the total value of cotton production, subscript 0 refers to the initial equilibrium cotton price and ϵ_{CC} is the U.S. cotton supply elasticity. Since supply is fixed under the fixed target price, the percent change in the farm program cost can be evaluated by the product of the percent change in market demand price and the ratio of the market demand price to the difference between the target price and the market demand price, that is,

$$EC = -[PC_0^d/(PC_0^t - PC_0^d)]*EPC^d,$$

where EC is the percent change in farm program costs, and PC^d and PC^t are the target price and market demand price of cotton respectively.

Since it is useful to consider these changes in terms of dollar value, Changes in dollar values of producers' total revenue and surplus, and farm program costs are estimated. At 1986 constant prices, the annual average total revenue of the U.S. cotton industry during 1982-87 was $3489.79 million and farm program costs (deficiency payments) were $672.34 million.

Table 3 shows how textile trade liberalization affects U.S. cotton producers' total revenue and surplus. Since complete or partial textile trade liberalization induces a decrease in both price and quantity of U.S. cotton under the assumption of the free market adjustment, the U.S. cotton industry would lose some revenue in any trade policy changes. The percent range is from -0.47 to -4.97 and the dollar value range is from -$16.47 to -

$173.55 million in the total revenue. Correspondingly, producers' surplus would decrease by 0.28 and 3.66 percent respectively. In terms of dollar value this is -$9.67 and -$127.94 million.

The last two columns in Table 3 report increases in farm program costs when textile trade partially or completely liberalized. Compared with the loss in producers' surplus in the free market adjustment case, increases in costs are relatively larger because there is no supply adjustment under the program. The largest increase in program costs is $169.91 million which is larger than the loss of the producers' surplus, $127.94 million.

CONCLUSIONS

This study identified substantial impacts on the U.S. cotton industry of textile trade liberalization. Strong tendencies emerged from our simulations. Textile trade liberalization induces moderate changes in total demand for U.S. cotton but brings about considerable changes in the U.S. cotton demand structure, which makes U.S. cotton growers more dependent on the world market. Our simulations predict also a relatively small welfare loss for the U.S. cotton producers. Such a result is obtained under the assumption that U.S. cotton producers do not face increasing competition on world markets. Given the emergence of new cotton producers on world markets (Pakistan, China), U.S. producers are likely to face increased competition. Although not accounted for in this study, the cost of adjustment associated with the changes in U.S. cotton demand structure is likely to be substantial while U.S. producers work their way through new export channels. The expected adjustment costs may reinforce the aversion of cotton producers for less distorted textile trade.

Table 1.   Definitions of Endogenous, Exogenous Variables and Parameters

Symbol	Definition
Endogenous Variables:	
TD	demand for domestic textiles
AD	demand for domestic apparel
TMD	demand for textile imports
AMD	demand for apparel imports
PT	price of domestic textiles
PA	price of domestic apparel
PT^D	demand price of textiles imports
PA^D	demand price of apparel import
TS	domestic supply of textiles
AS	domestic supply of apparel
TMS	export supply of textiles from country j
AMS	export supply of apparel from country j
PT_j^S	export supply price of textiles from country j
PA_j^S	export supply price of apparel from country j
FD	demand for domestic fabrics
FS	domestic supply of fabrics
FMD	demand for import fabrics
FMS	export supply of fabrics from country j
PF	price of domestic fabrics
PF^D	price of import fabrics
PF_j^S	price of export fabrics from country j
CS	U.S. cotton supply
PC	price of U.S.cotton
COS	foreign cotton export supply
PO	price of other foreign cotton
PT^S	average textile export supply price
PF^S	average fabric supply price
PA^S	average apparel supply price

Exogenous Shocks:

T	the total ad-valorem tariff and the ad-valorem equivalent of the quota

Parameters:

η	output demand elasticities
δ	production cost shares
μ	input demand elasticities
τ	cotton demand elasticities of other cotton importers
ϵ	supply elasticities
α	textile export market shares
s	textile import market shares
π	U.S. cotton import market shares
ϕ	other foreign cotton import market shares

Table 2:   Changes in Demand for U.S. Cotton Under Different
            Textile Trade Policies and Reactions

(Percent change)

	PRICE	TOTAL DEMAND	U.S. MILLS	TOTAL EXPORT	EXPORTS TO		
					OECD	TEXTILE EXPORTER	OTHER
LIBERALIZING TEXTILE TRADE							
(A) Free Cotton Market Adjustment							
U.S. and OECD	-0.37	-0.89	-24.63	23.75	-12.69	42.75	2.23
(B) Under the Farm Program							
U.S. and OECD	-1.62	0.00	-22.73	23.01	-11.86	41.86	3.21
PARTIALLY LIBERALIZING TEXTILE TRADE							
(A) Free Cotton Market Adjustment							
U.S. and OECD	-0.29	-0.68	-14.47	15.45	-6.52	29.90	2.38
(B) Under the Farm Program							
U.S. and OECD	-1.04	0.00	-12.87	13.08	-5.67	26.74	1.86

Table 3: Changes in Revenue, Producer Surplus and Program Costs

	REVENUE		SURPLUS		PROGRAM COST	
	Percent	Value[a]	Percent	Value[a]	Percent	Value[a]
LIBERALIZING TEXTILE TRADE						
U.S. & OECD	-1.62	-56.60	-0.99	-34.41	5.96	40.07
PARTIALLY LIBERALIZING TEXTILE TRADE						
U.S. & OECD	-0.47	-16.47	-0.28	-9.67	3.28	22.05

[a] in 1986 million dollar.

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