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Chinese Tariff Rate Quota v.s. U.S. Subsidies: What Affects the World Cotton Market More?

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Abstract

This paper compares how eliminating the Chinese cotton tariff rate quota (TRQ) and the U.S. cotton subsidy program would affect the world cotton market. The results show China's TRQ has a greater negative impact on the world cotton market than U.S. subsidies. Compared to a base level estimate, the elimination of China's TRQ will increase the world cotton price and increase the quantity of world cotton traded whereas the elimination of U.S. cotton subsidies increases the cotton price (but less than under TRQ elimination) and decreases the world cotton trade. The combined effect of eliminating both programs is also shown.

Key words: cotton, international trade, subsidies, TRQ
JEL Classification: Q11, Q17

Trade Distorting Policies in the World Cotton Market:
Assessing the Impacts of the Chinese TRQ System and U.S. Subsidies

> We recall the long-term objective referred to in the Agreement to establish a fair and market-oriented trading system through a programme of fundamental reform encompassing strengthened rules and specific commitments on support and protection in order to correct and prevent restrictions and distortions in world agricultural markets. We reconfirm our commitment to this programme. Building on the work carried out to date and without prejudging the outcome of the negotiations we commit ourselves to comprehensive negotiations aimed at: substantial improvements in market access; reductions of, with a view to phasing out, all forms of export subsidies; and substantial reductions in trade-distorting domestic support.
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> --Ministerial Declaration, The Fourth WTO Ministerial Conference, Doha, Qatar, 2001

Introduction

As part of the Agreement on Agriculture referenced in the quote above, member nations of the World Trade Organization (WTO) during the Uruguay Round agreed to establish a more open, market-oriented agricultural trading system. The three main areas of concern, or 'pillars' on which the free trade agenda is built are (1) improved market access by reducing tariff rates and eliminating non-tariff barriers, (2) ending the subsidization of exports and improving export competition, and (3) reducing most internal governmental support given to producers. The goal of fair competition free from trade distorting policies will require progress to be made in each area. As the WTO General Council has affirmed, "[T]he reforms in all three pillars form an interconnected whole and must be approached in a balanced and equitable manner".

Recently, two of these pillars have become the focus of a challenge to U.S. commodity programs by the nation of Brazil. The basic argument of the Brazilian case is that the domestic farm and trade policies of the U.S. depress world market prices. The contention is that such policies allow the U.S. to subsidize cotton exports either explicitly or implicitly through production subsidies and "dump" them on world markets (Beghin and Fabiosa, 2002). In 2004, the WTO Dispute Settlement Body found against the U.S. in support of Brazil's position. In a ruling that has been upheld on appeal, U.S. cotton price-related programs (marketing loan, counter-cyclical payments, market loss assistance, step 2 payments) were found to have caused serious harm to Brazil's cotton producers in 1999-2002.

The U.S. cotton subsidy issue has been investigated and debated since it was first contested by Brazil in 2002. Many researchers (ICAC, 2003; Sumner, 2003; Goreux, 2004; Pan et al., 2004 and Poonyth et al., 2004) have concluded that the U.S. cotton program depresses the world cotton price but differ significantly on the magnitude of the effects. Meanwhile, in a study that compares the effects of subsidy policies and border protection, Hoekman et al. (2003) find that "…tariffs matter significantly more than subsidy policies—tariff reductions generate welfare gains that are substantially greater than reductions in support policies" (p. 1). It seems that a discussion of trade distorting policies will be incomplete without a consideration of all three mechanisms by which the WTO has agreed such distortions may arise. Much criticism has been directed at U.S. farm policy since the United States is the world's largest exporter of raw cotton, but what about market access restrictions of the world's largest importer of cotton, China. Might it be that Chinese tariff barriers have a significant impact on the world cotton price as well, perhaps even more so than U.S. domestic policy?

The United States is the largest cotton exporter in the world, accounting for 40 percent of the total trade and China is the largest cotton importer in the world with 25 percent of total imports. Both countries support their domestic cotton producers but via different policy instruments. The U.S. employs a domestic price support program (outlined above) while China relies on a two-tier tariff structure for cotton imports, popularly known as a tariff rate quota (TRQ)[1]. TRQs have been discussed for products such as sugar (Skully, 2001; Petrolia and Kennedy, 2002; and Vander et al., 2003), apples (Sreedharn et al., 2003), dairy (Balagtas et al., 2002; and Langley et al., 2003), and wheat (Koo, 2000) but very few studies focus on the Chinese cotton TRQ system. Although there is a broader body of literature on how China's WTO accession would impact the world cotton market (Wang, 1997; and Fang and Babcock, 2003), a study has not been done on how TRQ elimination would impact the world cotton market. This may be due to the fact that few countries such as China have import TRQs (FAO, 2002).

The purpose of this paper is to compare how the trade distorting mechanisms of U.S. domestic support and Chinese market access restrictions affect the world cotton market. The objective of this paper will be to investigate the effects of these two policies under three scenarios:

1. the elimination of the Chinese cotton TRQ system;
2. the elimination of all U.S. cotton programs such as direct payments and counter-cyclical payments, marketing loan, and Step-2 payments;
3. the elimination of both the U.S. cotton programs and China's TRQ for cotton.

The results obtained under these discontinuation scenarios are compared to a baseline projection that includes current U.S. farm programs and Chinese imports given its present WTO commitments.

Effects of Price Subsidies and a TRQ

Following standard texts of international trade, Table 1 summarizes the effects of domestic subsidy and TRQ (see Technical Annex: *Economic Analyses*) on domestic and world prices, the quantities supplied and demanded in both importing and exporting countries, and trade. The price subsidy increases the domestic price in the exporting country with the subsidy and lowers the effective price in importing markets and the rest of the world. The TRQ causes a price rise in the domestic importing nation and a lower price for exporters and the world market. Quantity traded increases with a price subsidy and decreases with a TRQ.

Table 1. Estimated directional effects of a subsidy and TRQ on prices and trade.

	Subsidy	TRQ
P_{DX} (policy price effect in exporting country)	↑	
P_{DM} (policy price effect in importing country)		↑
X_S (quantity supplied in exporting country)	↑	↓
X_D (quantity demanded in exporting country)	↓	↑
M_S(quantity supplied in importing country)	↓	↑
M_D(quantity demanded in importing country)	↑	↓
ES(excess quantity supplied to world market)	↑	-
ED(excess quantity demanded in world market)	-	↓
Q_T(world quantity traded)	↑	↓
P_W(world price)	↓	↓

From this discussion it is possible to develop hypotheses in regard to the world market for cotton and the domestic policies of the two largest trading entities and their respective market restricting policies:

> *Hypothesis 1: the elimination of U.S. subsidies for cotton will raise the world cotton price, decrease U.S. cotton exports, decrease China's imports of U.S. cotton, and decrease the quantity of world cotton traded.*
>
> *Hypothesis 2: the elimination of China's TRQ will increase the world cotton price, increase U.S. cotton exports, increase China's imports of cotton, and increase the quantity of world cotton traded.*
>
> *Hypothesis 3: the elimination of both U.S. subsidies for cotton and China's TRQ will raise the world cotton price.*

Whether the simultaneous discontinuation of both policies will increase or decrease the quantity of trade (Q_T) is not determined by the conceptual model since the directional arrows show contrary indications.

The discussion to this point has hypothesized the expected direction of changes relevant to the international trade of cotton. Critical to this analysis is a quantification of these effects. The magnitudes of these changes may be determined by the various supply and demand elasticities in these markets. Moreover, the effects of policy schemes such as TRQ and subsidy programs are dependent on the baseline level of price expectation and the quantity of world trade. If market prices are anticipated to be higher than the loan rate, there is no effect from the subsidy programs. The same holds for China's TRQ. The effects disappear if China imports cotton less than their quota. In order to ascertain the effects of each policy as well as their combined impacts, a model will be constructed that estimates cotton demand and a baseline provided from which projections of the magnitude of each policy might be estimated (see Technical Annex: Basic Model Structure).

Simulation Results

The baseline simulation is conducted with a set of assumptions about the general economy, agricultural policies, and technology changes in net exporting and net importing countries for the period 2004/05-2008/09. The baseline projections assume the continuation of current agricultural policies for the five years under analysis. Alternative scenarios are run on the basis of eliminating China's cotton

TRQ (Scenario 1), eliminating U.S. cotton subsidy programs (Scenario 2), and eliminating both Chinese TRQs and U.S. cotton subsidy programs (Scenario 3). The results of the three scenarios compared to the baseline are summarized in tables 2 through 5. Table 2 displays the effects on the cotton A-index, U.S. cotton farm price, the Chinese domestic cotton price, and the U.S. polyester price. Table 3 summarizes the effects on world cotton production, consumption, ending stocks, and trade. Tables 4 and 5 provide the effects on main cotton importing and exporting countries and regions, respectively.

The International Cotton Market under the Base

In the base scenario, the cotton A-index is expected to increase by about 1.5 ¢ per pound per year over the projected time frame. World cotton production is expected to decrease 12% in 2005/06 from historic highs in 2004/05 and is expected to recover thereafter. Cotton consumption (mill use) is expected to increase 6% between 2004/05 and 2008/09. As a result, world cotton trade is projected to increase around 1.6 million bales in the time period.

Scenario 1: Elimination of China's TRQ

The liberalization of China's cotton market via the elimination of the TRQ system will increase the world cotton price by 5.17% in the first year and 1.92% at the end of the scenario period compared with the base. The Chinese cotton market price is expected to decrease 4.48% in 2004/05 and -1.68% in 2008/09, while the U.S. farm price is expected to increase 2.87% in 2004/05, and 1.27% in 2008/09.

World cotton production is expected to increase initially by .20% and average a .18% increase over the entire scenario. World cotton mill use is expected to increase in the first four years with a small decrease after that. This is mainly due to the textile adjustment from China and the rest of the world. The world trade of cotton increases around 1.70% with the elimination of the TRQ. For specific countries, China is expected to increase cotton imports 8%, Japan is expected to decrease imports by about 3%, Pakistan and Taiwan are expected to decrease between 1 and 2%, and India, South Korea, Mexico, and the European Union decrease less than 1%. Cotton exports from Australia and Brazil are expected to increase by about 2% and 3% respectively, while exports from Uzbekistan, Western Africa, and the U.S. are expected to increase less than 1%.

Scenario 2: Elimination of the U.S. Cotton Subsidy Program

The effects of eliminating the U.S. cotton subsidy in this scenario are roughly equivalent to the findings of an earlier study (Pan, et al. 2004). The world cotton price is estimated to increase by 2.39% in 2005/06 due to a 4.51% reduction in exports from the United States. The fall in U.S. exports reflects the net change in U.S. production, consumption, and inventories. Foreign producers respond to these high prices by expanding their cotton production. Brazil is the biggest beneficiary from the elimination of U.S. cotton programs with exports increasing around 2% followed by Australia (+0.78%). Western Africa and Uzbekistan also have gains in exports, but by less than 1%.

By the end of the analysis period, world cotton price changes relative to the baseline are down considerably after the second-year highs. Adjustments by competitors who boost production take away most of the price increase. For example, the increase in the A-index price is approximately 0.48% in 2008/09 as compared to 2.39% in 2005/06 (Table 2). In the initial year, the world cotton trade declines by approximately 250 thousand bales (-0.76%) from the baseline level. However, the trade effects lessen by the end of the projection period, when the decline in trade is about -0.5%.

Scenario3: Elimination of both the Chinese TRQ and the U.S. Subsidy Programs

When both China and the U.S. liberalize their cotton trades, the world cotton price is expected to increase 5.72% in 2004/05 and 2.30% in 2008/09. The increased price is mainly due to an overall decrease in cotton exports from the U.S. (-1.99%) and an increase in Chinese imports of about 8%, resulting in decreased supply and increased demand in the world market. The U.S. farm price under this scenario is expected to increase 8.64% in 2005/06 compared with the base scenario, which is much larger than both *Scenario 1* and *Scenario 2*.

Interestingly, the effects on world cotton production and cotton consumption are relatively small. World cotton production is expected to decrease an average of .07% over the time frame and mill use is predicted to decline by .12% over the same time horizon. However, the world trade of cotton increases by more than 1% as a net effect of removing both China's TRQ and U.S. subsidy programs. This is mainly due to the decrease in U.S. exports and the increase of Chinese cotton imports.

The effect of liberalizing the world cotton market is expected to decrease U.S. exports (as shown) but increase exports from other major cotton producing regions. Using average values, exports from Brazil will likely show the biggest increase (+4.99%) followed by Australia (+2.69%), Uzbekistan (+1.49%), and Western Africa (+1.30%). While China is shown to significantly increase cotton imports, the rest of the nations in this model report decreases. These range in magnitude from -3.74% in Japan to -.59% in India.

Table 2. Estimated impact of eliminating China's TRQs (scenario 1), U.S cotton subsidies (scenario 2), and both (scenario 3) on U.S. cotton prices, Chinese cotton prices and the U.S. polyester price.

		2004/05	2005/06	2006/07	2007/08	2008/09	Average
A-index	Base (cents/lb)	51.87	53.78	56.98	57.94	58.19	55.75
	Scenario 1	5.17%	2.73%	1.94%	1.92%	1.92%	2.74%
	Scenario 2	0.18%	2.39%	1.63%	0.79%	0.48%	1.10%
	Scenario 3	5.72%	5.54%	3.24%	2.53%	2.30%	3.87%
U.S. Farm Price	Base (cents/lb)	42.42	44.53	49.42	53.00	53.06	48.49
	Scenario 1	2.87%	1.89%	1.87%	1.35%	1.27%	1.85%
	Scenario 2	0.38%	6.97%	3.11%	3.03%	2.31%	3.16%
	Scenario 3	3.78%	8.64%	5.62%	4.04%	3.53%	5.12%
Chinese Market Price	Base (yuan/lb)	5.81	6.50	6.39	6.63	6.58	6.38
	Scenario 1	-4.48%	-3.12%	-2.53%	-2.14%	-1.68%	-2.79%
	Scenario 2	0.02%	0.33%	0.10%	0.03%	0.03%	0.10%
	Scenario 3	-4.45%	-2.92%	-2.50%	-2.10%	-1.65%	-2.72%
U.S. Polyester Price	Base (cents/lb)	62.33	62.70	62.79	62.82	63.50	62.83
	Scenario 1	0.05%	0.08%	0.11%	0.42%	0.20%	0.17%
	Scenario 2	0.07%	1.34%	0.52%	0.17%	0.07%	0.43%
	Scenario 3	0.12%	1.42%	0.63%	0.59%	0.25%	0.60%

Table 3. Estimated impact of eliminating China's TRQs (scenario 1), U.S cotton subsidies (scenario 2), and both (scenario 3) on the world cotton market.

		2004/05	2005/06	2006/07	2007/08	2008/09	Average
		----------Million bales----------					
Trade	Base	32.60	33.07	33.50	33.95	34.20	33.46
	Scenario 1	1.93%	1.52%	1.58%	1.71%	1.75%	1.70%
	Scenario 2	-0.20%	-0.76%	-0.56%	-0.51%	-0.44%	-0.49%
	Scenario 3	1.85%	0.89%	1.08%	1.24%	1.35%	1.28%
Production	Base	115.64	102.16	106.56	109.73	111.82	109.18
	Scenario 1	0.20%	0.27%	0.16%	0.18%	0.11%	0.18%
	Scenario 2	-0.08%	-0.75%	-0.15%	-0.17%	-0.14%	-0.26%
	Scenario 3	0.12%	-0.48%	0.02%	0.00%	-0.03%	-0.07%
Mill Use	Base	104.43	104.94	105.75	108.23	110.61	106.79
	Scenario 1	0.23%	0.11%	0.10%	0.05%	-0.02%	-0.09%
	Scenario 2	-0.03%	-0.40%	-0.30%	-0.22%	-0.18%	-0.23%
	Scenario 3	0.18%	-0.28%	-0.17%	-0.15%	-0.18%	-0.12%
Ending stock	Base	47.12	43.74	44.28	45.55	46.77	45.49
	Scenario 1	-0.49%	-0.64%	-0.97%	-1.42%	-1.85%	-1.07%
	Scenario 2	-0.02%	-0.58%	-0.14%	-0.09%	-0.06%	-0.18%
	Scenario 3	-0.57%	-1.21%	-1.06%	-1.41%	-1.72%	-1.19%

Table 4. Impact of eliminating China's TRQs (scenario 1), U.S cotton subsidies (scenario 2), and both (scenario 3) on cotton imports by major importing countries and regions.

		2004/05	2005/06	2006/07	2007/08	2008/09	Average
		----------Thousand bales----------					
China	Base	8822.09	9484.27	10360.13	10804.30	10877.71	10069.70
	Scenario 1	9.88%	8.54%	8.02%	8.08%	8.05%	8.51%
	Scenario 2	-0.02%	-0.42%	-0.17%	-0.09%	-0.05%	-0.15%
	Scenario 3	9.86%	8.44%	7.99%	8.06%	8.04%	8.48%
India	Base	650.01	605.52	766.21	886.81	931.61	768.03
	Scenario 1	-0.27%	-0.36%	-0.40%	-0.43%	-0.50%	-0.39%
	Scenario 2	-0.01%	-0.21%	-0.26%	-0.25%	-0.25%	-0.20%
	Scenario 3	-0.30%	-0.60%	-0.66%	-0.67%	-0.73%	-0.59%
Pakistan	Base	1000.01	1442.99	1486.91	1559.46	1595.56	1416.99
	Scenario 1	-0.97%	-2.40%	-2.20%	-2.03%	-1.89%	-1.90%
	Scenario 2	-0.42%	-1.51%	-0.83%	-1.15%	-1.07%	-1.00%
	Scenario 3	-0.85%	-2.28%	-3.18%	-3.17%	-2.90%	-2.48%
Japan	Base	700.00	693.79	642.30	604.35	575.90	643.27
	Scenario 1	-1.73%	-2.22%	-2.86%	-3.61%	-4.47%	-2.98%
	Scenario 2	-0.02%	-0.50%	-0.75%	-0.99%	-1.24%	-0.70%
	Scenario 3	-1.82%	-2.82%	-3.67%	-4.65%	-5.75%	-3.74%
South Korea	Base	1275.01	1233.13	1217.21	1203.66	1175.53	1220.91
	Scenario 1	-0.75%	-0.64%	-0.58%	-0.55%	-0.52%	-0.61%
	Scenario 2	-0.02%	-0.41%	-0.27%	-0.19%	-0.15%	-0.21%
	Scenario 3	-0.81%	-1.07%	-0.83%	-0.73%	-0.66%	-0.82%
Taiwan	Base	1100.01	1064.43	1032.32	1009.21	991.24	1039.64
	Scenario 1	-3.05%	-1.10%	-0.84%	-0.82%	-0.82%	-1.33%
	Scenario 2	-0.07%	-1.57%	-0.46%	-0.18%	-0.13%	-0.48%
	Scenario 3	-3.28%	-2.73%	-1.12%	-0.97%	-0.91%	-1.80%
Mexico	Base	1600.01	1627.09	1612.95	1575.20	1510.55	1585.16
	Scenario 1	-0.63%	-0.74%	-0.79%	-0.73%	-0.74%	-0.73%
	Scenario 2	-0.01%	-0.30%	-0.47%	-0.48%	-0.41%	-0.33%
	Scenario 3	-0.67%	-1.08%	-1.28%	-1.21%	-1.13%	-1.07%
European Union	Base	2888.04	2615.15	2299.21	1994.47	1701.38	2299.65
	Scenario 1	-0.28%	-0.45%	-0.61%	-0.81%	-1.08%	-0.65%
	Scenario 2	-0.01%	-0.22%	-0.34%	-0.43%	-0.53%	-0.31%
	Scenario 3	-0.31%	-0.70%	-0.97%	-1.26%	-1.62%	-0.97%

Table 5. Impact of eliminating China's TRQs (scenario 1), U.S cotton subsidies (scenario 2), and both (scenario 3) on cotton exports by major exporting countries and regions

		2004/05	2005/06	2006/07	2007/08	2008/09	Average
		----------Thousand bales----------					
U.S.	Base	12700.12	12945.50	13264.36	13388.50	13694.17	13198.53
	Scenario 1	0.73%	0.45%	0.36%	0.40%	0.31%	0.45%
	Scenario 2	-0.66%	-4.51%	-3.01%	-2.73%	-2.40%	-2.66%
	Scenario 3	0.19%	-3.54%	-2.40%	-2.25%	-1.95%	-1.99%
Australia	Base	1700.02	2539.32	2798.95	3000.31	3108.88	2629.50
	Scenario 1	2.94%	2.52%	1.35%	1.94%	2.33%	2.22%
	Scenario 2	0.10%	1.41%	0.46%	0.81%	1.12%	0.78%
	Scenario 3	3.24%	2.12%	1.76%	2.85%	3.49%	2.69%
Brazil	Base	2000.02	2026.77	2673.04	2844.50	2953.66	2499.60
	Scenario 1	0.13%	3.01%	4.20%	4.60%	4.27%	3.24%
	Scenario 2	0.47%	2.58%	2.58%	3.03%	2.72%	2.28%
	Scenario 3	0.15%	3.44%	6.69%	7.73%	6.94%	4.99%
Uzbekistan	Base	3405.03	3317.88	3062.96	2979.62	2905.40	3134.18
	Scenario 1	1.14%	1.02%	0.96%	0.85%	0.87%	0.97%
	Scenario 2	0.04%	0.89%	0.83%	0.55%	0.34%	0.53%
	Scenario 3	1.27%	1.96%	1.73%	1.33%	1.15%	1.49%
Western Africa	Base	2925.02	2817.19	2829.58	2860.57	2905.62	2867.60
	Scenario 1	0.56%	0.70%	0.97%	1.08%	1.11%	0.88%
	Scenario 2	0.02%	0.39%	0.44%	0.56%	0.55%	0.39%
	Scenario 3	0.61%	1.15%	1.42%	1.66%	1.64%	1.30%

Sensitivity Analysis

A sensitivity analysis was conducted to ascertain the limit of variation of the results due to changes in the elasticity estimates. Two scenarios were considered: first, the estimated elasticities were halved and second, the elasticities were doubled. The results are reported in Table 6. By reducing elasticities by one half, the average A-index price under scenario 3 increases by an average 4.57% compared to initial estimates of 3.87%. By doubling the elasticities, the average A-index price increase under scenario 3 is 3.29%, slightly less than the initial estimate.

Table 6. Sensitivity analysis of price index for cotton.

		2004/05	2005/06	2006/07	2007/08	2008/09	Average
Export elasticities reduced by 50% for U.S., Australia, Brazil, Uzbekistan, and Western Africa							
A-index	Scenario 1	5.29%	3.05%	2.26%	2.15%	2.11%	2.97%
	Scenario 2	0.50%	2.54%	1.81%	1.11%	1.06%	1.40%
	Scenario 3	5.79%	6.70%	3.99%	3.23%	3.13%	4.57%
Export elasticities doubled for U.S., Australia, Brazil, Uzbekistan, and Western Africa							
A-index	Scenario 1	5.09%	2.23%	1.68%	1.67%	1.64%	2.46%
	Scenario 2	0.09%	2.04%	1.06%	0.34%	0.32%	0.77%
	Scenario 3	5.68%	4.05%	2.75%	2.01%	1.96%	3.29%

Conclusions

U.S. cotton production has been protected by federal subsidy programs under farm bills while the Chinese cotton market has been protected by TRQs under their WTO commitments. As a result, both the U.S. cotton farm price and the Chinese domestic cotton price are higher than the A-index. These policies separately and conjointly depress the world price for cotton. Brazil, along with other cotton exporting nations, has called for major reforms in the trade of cotton. In seeking support from the WTO Dispute Settlement Body, these reforms have been aimed solely at U.S. farm policy with the demand that the U.S. eliminate its cotton subsidies. This paper confirms the negative impact of U.S. farm policy on the world cotton trade, but also takes an interconnected perspective with regard to the other "pillars" of overall agriculture negotiations that relate to cotton. A much larger negative impact on cotton prices is shown to be China's system of TRQs for cotton that restricts market access.

Under the trade liberalization scenario in which the United States eliminates its subsidy programs while others maintain their current policies, the maximum A-index is expected to increase 2.39% and this in the second year of the scenario. The overall price effect is estimated to be about +1%. Of the exporting nations included in this model, Brazil would be the greatest beneficiary of such a plan, with their exports increasing 2%. The cotton producing nations of Western Africa, who have additionally complained of the negative impacts of U.S. farm subsidies, would see their levels of cotton exports

increase by about ⅓ of one percent (0.39%). However, the overall world trade for cotton will decline by about ½ of one percent (-0.49%).

Alternatively, when China eliminates TRQs and others keep their programs, the A-index is expected to increase 5.17% in the first year and level off to an overall average of +2.74%, more than twice the benefit of eliminating U.S. farm subsidies. The U.S. would see its cotton exports increase by 0.45% over the long term and Brazil would expect its exports to increase by 3.24%, 1% higher than the effect of eliminating U.S. cotton subsidies. The nations of Africa in this model are predicted to increase exports by about 1 percent (0.88%), roughly two times the benefit of reforming U.S. cotton programs. Rather than decease the world trade of cotton, this policy change would increase the amount of cotton traded by 1.70% over the life of the 5 year model presented here.

If both China and the U.S. liberalize their cotton markets, the A-index is expected to increase 5.72% in the first year and sustain a 5-year average of almost a 4% gain (+3.87%). China will increase its cotton imports (+8.48%) and the overall amount of world cotton traded will increase by about 1¼ % (+1.28%). The U.S. will see a decrease in cotton exports (-1.99%) but gains will be shown by all other exporters in this model. Specifically, Brazil will see an increase of cotton exports of about 5% and Western Africa will see a 1.30% increase.

If trade negotiations are to proceed in a "balanced and equitable manner" as called for by the WTO General Council, changes must be discussed in regard to each dimension of trade, rather than focus only on a single policy in a single nation. This study indicates that the removal of trade restrictions in either the U. S. or Chinese cotton markets would increase global net welfare. At the same time, the elimination of both the U.S. subsidy programs and Chinese TRQs is a desirable option for the world's cotton producers. This scenario would provide radical reform in the trade of cotton and promote free, fair, and open access to the world's markets.

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Endnotes

[1] The TRQ system was adopted by China after its admission into the WTO in 2001.Under the agreement, China agreed to raise the in-quota import levels from 7,400,000 metric tons in 2002 to 8,900,000 metric tons in 2004 with a tariff of one percent. The out-of-quota tariff, which was 76% above 7,800,000 metric tons in 2002, is scheduled to drop to 67% above 8,200,000 metric tons in 2003, 58% above 8,600,000 metric tons in 2004, 49% above 8,900,000 metric tons in 2005, and 40% above 8,900,000 metric tons in 2006 (FAS, 2001).

Technical Annex

Trade Distorting Policies in the World Cotton Market: Assessing the Impacts of the Chinese TRQ System and U.S. Subsidies

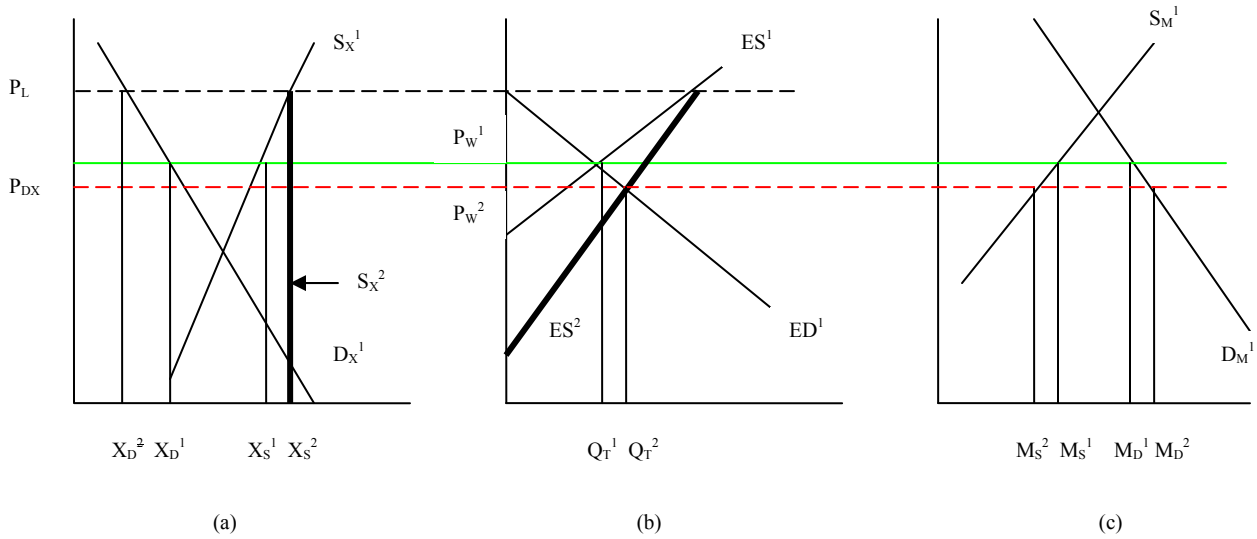
Economic Analysis of Domestic Price Supports

The model of domestic price support presented here follows that of familiar three-panel diagrams of two-region, partial equilibrium static world trade models. The three panels of Figure 1 depict price-quantity graphs based on supply and demand interactions in the domestic markets of the exporting country (Figure 1a), the rest-of-the-world (Figure 1c), as well as the world market as a whole (Figure 1b). Lines S_X^1 and D_X^1 represent initial supply and demand functions in the exporting country and lines S_M^1 and D_M^1 represent initial supply and demand functions in the rest-of-the world. The intersection of the excess supply (ES^1) and excess demand (ED^1) functions derived from the two regions indicate the equilibrium world market price (P_W^1) in the absence of trade interventions. The domestic prices in the two countries are equal to the world price and the quantity of world trade, Q_T^1, is equal to exports (X_S^1-X_D^1) in panel (a) and imports (M_D^1-M_S^1) in panel (c).

In the example presented here, the exporting nation implements a minimum domestic price support of P_L (i.e., the U.S. loan rate for cotton). This policy will result in an increase in the supply (X_S^2) of the affected commodity by creating a perfectly inelastic supply function up to the established minimum price. This increase in domestic supply in (a) will kink the excess supply curve in the world market to ES^2. The new world market price will decline to P_W^2. The effect of the policy will result in a lower domestic price in the exporting country, a lower world market price, and an increase in world trade (from Q_T^1 to Q_T^2) due to increased exports from (a) (X_S^2-X_D^2> X_S^1-X_D^1) and increased imports in (c) (M_D^2-M_S^2> M_D^1-M_S^1) due to lower supply in the rest-of-the world.

Though not depicted here, an additional impact of this policy will be felt by other exporting countries that do not interfere in their domestic markets for the commodity in question. The lower world price will lower their production and exports. The net effect of the policy will be to increase the market share of the exporting country with the policy of domestic price support at the expense of other non-subsidizing competitors.

Figure 1. The effects of a minimum price support subsidy.



Economic Analysis of Tariff-Rate-Quotas

The basic economic concept of a TRQ is to allow a specified quantity of imports to enter a country at a minimal tariff ('with-in quota tariff'), while charging a much higher tariff on any additional imports ('above-quota tariff'). Gaisford and Kerr (2001) refer to TRQs as a hybrid of import quotas and tariffs. Import quantities are not limited or restricted as with conventional

quota systems, but the allowance for an above-quota tariff may affectively serve to limit import volume to the same levels as a traditional quota.

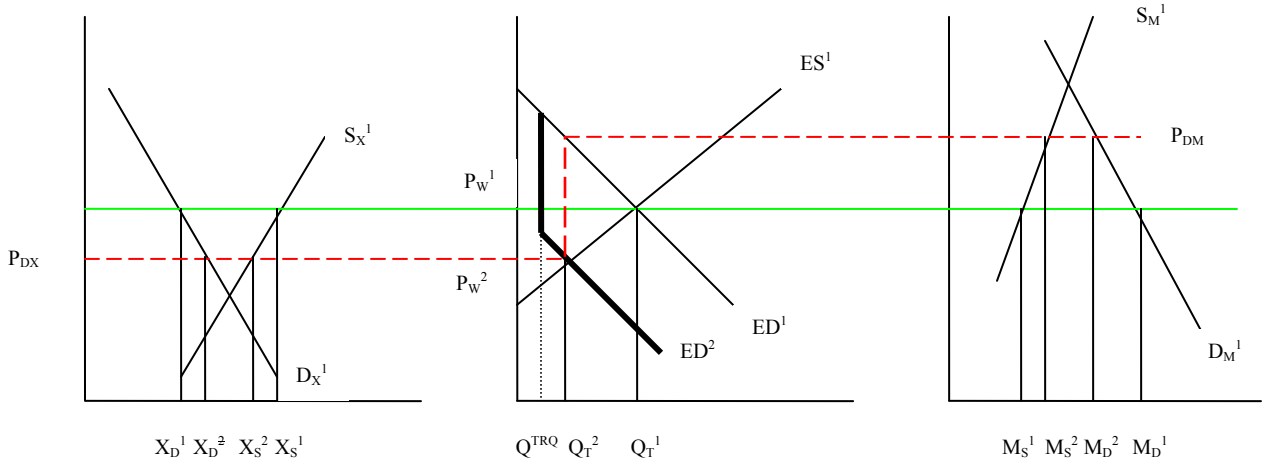
Following the same format as Figure 1, Figure 2 demonstrates the effects of a TRQ by a large importing country on the world market. The supply/demand interactions of the domestic importing country are shown in panel c of Figure 2, the rest of the world market by panel a, and the world market interchange is shown if panel b. Again, initial equilibrium conditions of supply, demand, quantities, and prices are given by superscript 1. The imposition of a TRQ by the importing country is shown by the inelastic portion of the excess demand curve in the world market. A TRQ makes the import demand curve discontinuous at the quota level in panel b (Q^{TRQ}). At this import quantity and above, the TRQ serves as a pure tariff that increases the import price of the commodity (P_{DM}) and decreases demand. At import levels below the specified quantity (Q^{TRQ}), the TRQ is not binding and normal supply and demand interactions hold. Under a TRQ policy, the effective excess demand function becomes ED^2. The vertical line segment on demand function ED^2 represents the level of the TRQ, below and beyond which there is a supply and demand response by domestic producers and commodity users in both the importing country and the exporting nations.

With lower demand in the world market due to the TRQ, the rest of the world market will be affected. The TRQ in the importing country lessens demand in panel (b) as shown by the kinked excess demand curve (ED^2). This results in a lower world price (P_W^2) and a higher price in the domestic importing country, P_{DM}. The lower world price causes an increase in the quantity demanded in the exporting country (X_D^2), a decrease in the quantity supplied (X_S^2), and a net decrease in the amount of exports ($X_S^2-X_D^2<X_S^1-X_D^1$). In the importing country, the higher domestic price causes an increase in domestic supply (M_S^2) and a decrease in import demand (M_D^2). The effect on net imports is negative to match decreased exports from the rest of the

world (M_D^2-M_S^2<M_D^1-M_S^1). This affect is additionally shown by the decrease in world trade from Q_T^1 to Q_T^2.

As this model demonstrates, the degree to which a TRQ restricts market access is dependent on several factors: 1) the level of demand, 2) the with-in quota tariff, 3) the above-quota tariff, and 4) the quota or import level (which defines the volume of imports to which the with-in quota tariff applies). The establishment and administration of a TRQ may allow for the accomplishment of open market access per the goals and purposes of the WTO or may continue to inhibit trade much as traditional import restricting quotas.

Figure 2. The effects of Tariff rate quota.



Basic Model Structure

A partial equilibrium world fiber model is utilized to estimate the effects of both U.S. cotton subsidy programs and China's TRQ on the world market. This model incorporates the regional supply response of cotton, different competing goods in different producing regions, substitutability between cotton and competing fibers, and linkage between raw fiber and textile sectors. As shown in Figures 3, 4, and 5, the China and U. S. textile models include supply, demand, ending stocks, and market equilibrium for cotton and man-made fibers. Cotton A-index, Chinese domestic cotton price, U.S. cotton textile price index, U.S. non-cotton price index, U.S. farm price, and polyester prices are endogenously solved in the models by respectively equalizing world exports and imports, Chinese domestic cotton supply and demand, U.S. cotton and non-cotton textile supply and demand, U.S. domestic cotton supply and demand, and man-made fiber supply and demand.

Chinese cotton mill use (see Figure 3) is estimated following a two-step process in which total textile fiber mill use is first estimated as a residual of textile fiber consumption and the net trade of textile fiber, followed by allocations among various fibers such as cotton, wool, and man-made fibers (represented by polyester) based on their relative prices. The United States cotton and non-cotton textile mill use (see Figure 4) is solved endogenously with the domestic textile demand and textile net trade (net imports). All these equations are estimated based on the cotton textile price index, non-cotton textile price index, cotton domestic price, and non-cotton domestic price.

U.S. cotton production (see Figure 4) is modeled using separate acreage and yield equations. Cotton production is a function of last year's cotton net returns and the relative net return(s) of competing crops. As part of the total U.S. cotton supply (see Figure 4), imports and exports are functions of domestic price, international price (A-index), exchange rates, tariff rates, and quota

restrictions. Similarly, the U.S. man-made fiber model is modeled using capacity and utilization. The capacity and utilization equations are estimated by the man-made fiber price and petroleum spot price.

Model Estimation and Validation

A complete list and definition of all variables in the model as well as parameter estimates and calculated supply, demand, and price transmission elasticities for the major countries/regions are available from the authors. For more information on parameter estimates and diagnostic statistics, please see World Fiber Model Documentation by Pan et al. (2004).

The Mean Square Error, its components, and Theil inequality coefficients for the variables included in the U.S. and Chinese models were calculated. Based on the results, most of the bias and regression components' values are close to zero, indicating that the simulated values do not tend to be higher or lower than their actual values. The disturbance components for most variables are close to one, which indicates that most of the errors in the simulated values are associated with randomness in the actual data series. Most of the Theil inequality coefficients are close to 0, which indicates the model performs well.

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Figure 3. Schematic Representation of the Chinese Fiber Model

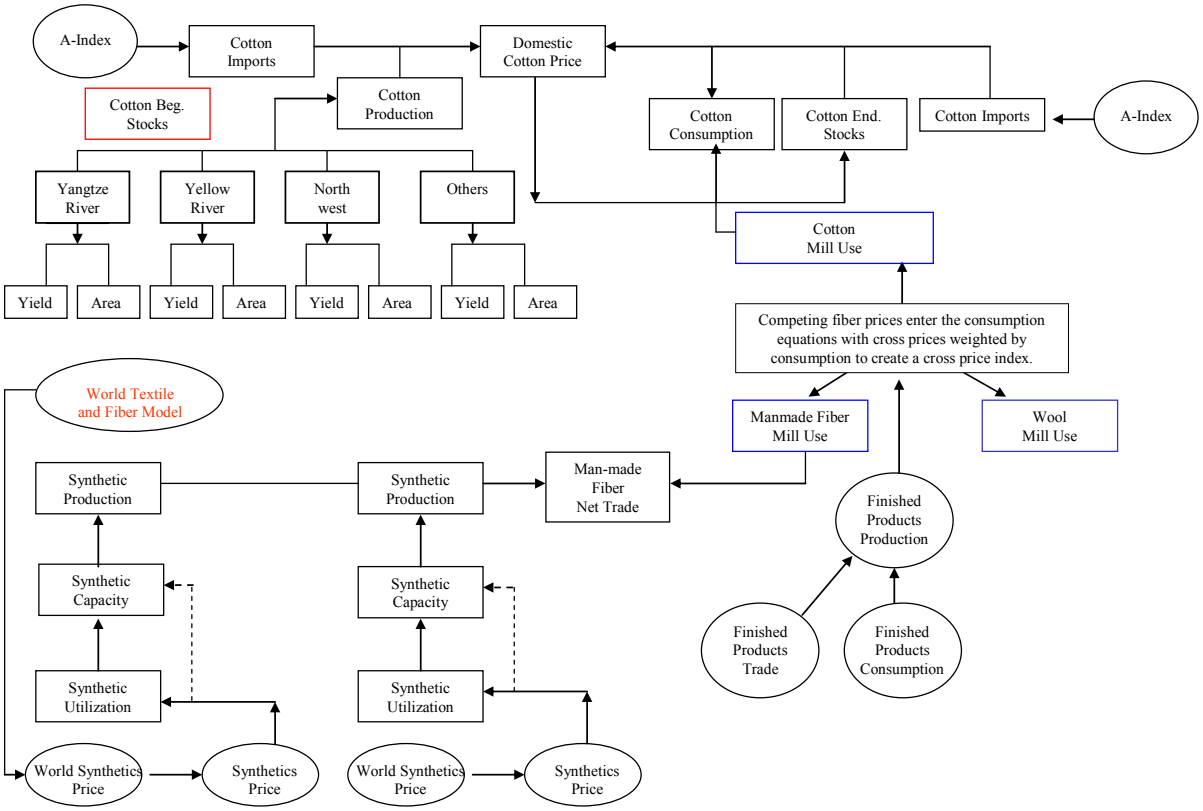

Figure 4. Schematic Representation of the U.S. Fiber Model.

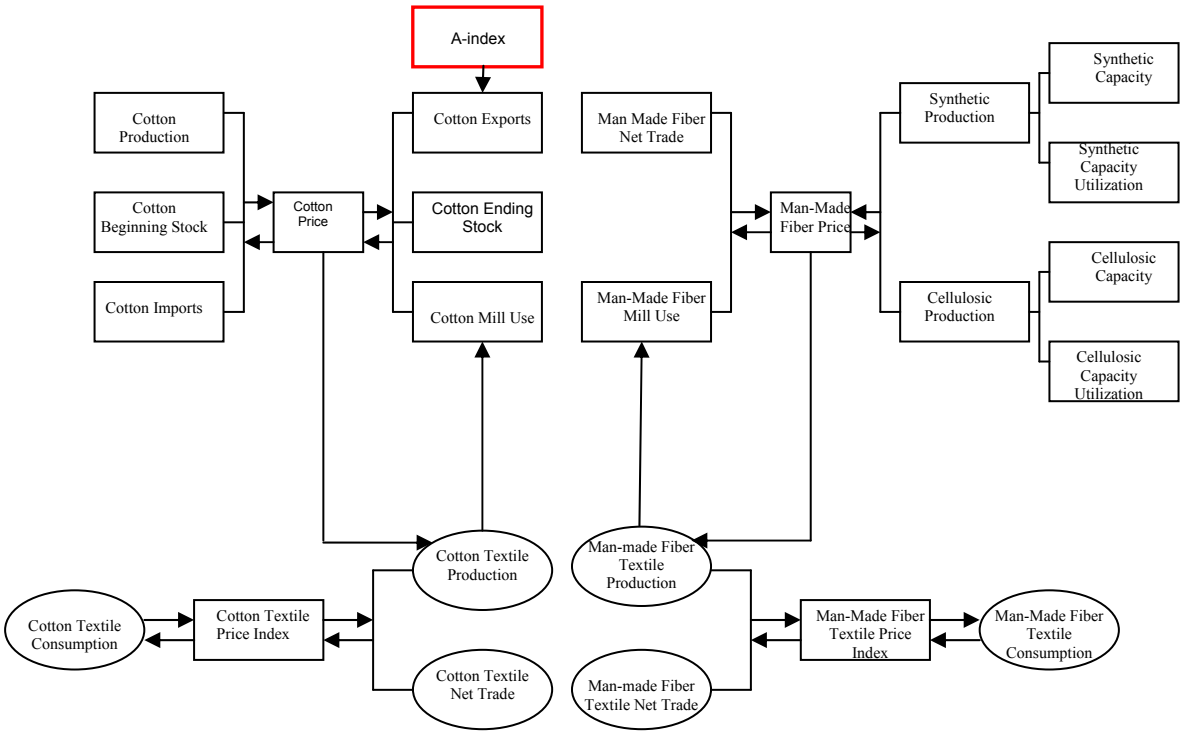

Table 1. Standard specifications of behavioral equations.

Equation	Variable	Behavior Equation
1	Per capita fiber consumption	$PC_f = \alpha_0 + \alpha_1 P_x + \alpha_2 I$
2	Fiber net trade	$T = \alpha_{00} + \alpha_{01} PI_d + \alpha_{02} PI_w$
3	Fiber mill use	$FM = \alpha_{11} + \alpha_{11} PI_d + \alpha_{12} P_c + \alpha_{13} P_m$
4	Share of cotton mill use	$DS_c = \beta_0 + \beta_1 (P_c / P_s)$
5	Share of man-made fiber mill use	$DS_m = \beta_0^m + \beta_0^m (P_c / P_s)$
6	Cotton supply	$S_{c,t} = \kappa_0 + \kappa_1 (P_{c,t-1} / P_{o,t-1})$
7	Man-made fiber supply	$S_{m,t} = \kappa_0^m + \sum_{k=1}^{5} \kappa_1^m (P_{m,t-k}) + \sum_{k=1}^{5} \kappa_2^m (P_{g,t-k})$
8	Cotton imports	$I_c = \phi_0 + \phi_1 (P_c / WP_c (1+T))$
9	Cotton exports	$E_c = \phi_{e0} + \phi_{e1} (P_c / WP_c (1-\tau))$
10	Cotton ending stock	$K_{c,t} = \rho_0 + \rho_1 (S_{c,t}) + \rho_2 (P_c) + \rho_3 K_{c,t-1}$
11	Marketing clearing cotton	$\sum_n I_c = \sum_n E_c$
12	Marketing clearing man-made fiber	$\sum_n (S_{m,t}^e + S_{m,t}^i) = \sum_n (DS_m * PC_f * PO)$

Note: The superscript e and i refers to a country which is assumed to export and import cotton and man-made fiber, respectively. The capital letter PC, T, FM, PI, S, D, DS, P, WP, I ,E, K, and PO represents per capita consumption, textile net trade, fiber mill use, price index, supply, share of mill use, domestic price, world price, imports, exports, ending stock, and population respectively. The subscripts x, *f, d, c, m, w, o* represent textile, fiber, domestic, cotton, man-made fiber, world, competing crops respectively. *t, t-1, t-k* represent current time period, one lag, and *k* lags. T, τ represent tariffs rate and export subsidy rate. n represents number of countries included in the model. α, β, κ, ϕ, and ρ's are estimated coefficients.