THE INFLUENCE OF MARKET STRUCTURE ON THE IMPACTS OF DOMESTIC SUBSIDIES ON INTERNATIONAL COTTON MAREKTS

Suwen Pan, Darren Hudson, Don Ethridge

Cotton Economic Research Institute
Texas Tech University
Lubbock, TX 79424

Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China, August 16-22, 2009

THE INFLUENCE OF MARKET STRUCTURE ON THE IMPACTS OF DOMESTIC SUBSIDIES ON INTERNATIONAL COTTON MAREKTS

Abstract

This analysis uses a residual demand elasticity model to measure market power of the international cotton market. The results indicate that both china and U.S. dominate the cotton price with a higher market power in china compared to the U.S. Those test results combined with a partial equilibrium model of the international cotton market are used to study the welfare consequences of U.S. cotton subsidy policies for major cotton exporters under alternative assumptions about global market structure. The results indicate that the effects of U.S. subsidies on world cotton price are much smaller under monopsony and double power (with china as a monopsony and U.S. as a monopoly) market assumption than those under complete competitive market scenarios.

Keywords

U.S. Cotton Commodity Programs; Global Market Structure; International Trade

Introduction

Cotton is a primary natural fiber which accounts for around 40 percent of the world's annual textile fiber production and has served as a source of economic growth, especially when combined with textile and apparel production (MacDonald, 2000). Cotton provides income to millions of farmers in both industrial and developing countries worldwide. For example, between 1-2 million households produce cotton in West Africa, with up to 16 million people deriving income from cotton indirectly (Hussein, Perret, and Hitimana, 2005). Cotton provides 3-5% of GDP in Benin, Burkina Faso, Mali, and Chad, and the cotton export share of total exports are

51.4%, 37.6%, 36.2%, 25% and 11.2% for Burkina Faso, Benin, Chad, Mali, and Togo, respectively, further illustrating the importance of cotton to these economies (Hussein, Perret, and Hitimana, 2005).

Because of the reliance of these developing countries on cotton, allegations were levied against the U.S. and other developed countries that their domestic and export subsidies caused significant impacts on world markets by encouraging excess production and trade and depressing world prices. Following these arguments, Brazil, with the support of Australia and the Western and Central African (WCA) countries, filed a petition challenging the U.S. cotton programs at the September, 2002 meeting of the World Trade Organization (WTO) Settlement Body. Brazil alleged that U.S. cotton subsidies were depressing world prices and were injurious to their farmers and the WCA countries [Benin, Burkina Faso, Chad and Mali] also claimed to be losing export earnings of US$ 1 billion a year, including both direct and indirect costs, as a result of the subsidies paid by the US and the EU (BBMC, 2003).

The issue of U.S. cotton subsidies has been studied and debated since it was first raised by Brazil in 2002 (ICAC, 2002; Sumner, 2003; Goreux, 2004 and Pan et al., 2006). The empirical estimates, summarized in Table 1, vary with type of analytical model, time period analyzed, and key assumptions, but world price effect estimates of US cotton programs on global prices ranged from 2% to 11%. Table 1 also provides estimated effects of the complete removal of all domestic subsidies and tariffs across countries. FAPRI (2002) estimated the impact of the removal of all subsidies and tariffs on all crops in all countries using the FAPRI world crops and livestock model. Results suggested a 13% increase in average cotton prices between 2001/02 and 2010/11. Poonyth et al. (2004) estimated that the long-term impacts of the complete elimination of domestic subsidies and tariffs in all countries would increase world cotton prices between 3.1%

and 5%, based on different supply and demand elasticities. That study claimed that 66% of the distortions on the world cotton market are attributable to the US subsidies. Pan et al. (2007a) estimated that under full trade liberalization (removal of all distortions) on cotton alone, the cotton price (A-index) increased by an average of 10.79% between 2006/07 and 2010/11. World cotton net trade increased by an average 1.73 million bales (about 4%) following the removal of all trade distortions in this simulation.

A key feature of all these modeling efforts is the assumption of a perfectly competitive global market structure. However, at least one analysis (Ethridge 2007) raises questions about the validity of that assumption. Since the U.S. is the dominant exporter of cotton and China is the dominant importer, the possibility that oligopoly and/or oligopsony power to influence prices may exist. However, we have no empirical evidence of the impacts of changes in market structure on the global cotton market and/or the impacts of market structure on the distribution of the effects of U.S. policy. This paper extends previous studies by beginning to develop an understanding of how alternative market structures alter the impact of U.S. farm programs on global cotton markets by establishing the impacts under the three scenarios—perfect competition, double power (U.S. as a dominant exporter and China as a dominant importer), and monopsony/monopoly.

Global Cotton Market Structure

The central market condition for enabling oligopoly/oligopsony power to influence market prices is that there are a sufficiently small enough number of sellers/buyers that any entity in the market is able to impact the price. There may or may not be a dominant entity (much larger or more influential than the rest) and the conditions enable the exertion of market power rather than dictate it. In recent years, cotton mill use has become more concentrated in

several countries: China (43%), India (15%), Pakistan (10%), Turkey (4 %), and US (4%). As a result, China imports around 31% of global cotton trade, while Pakistan and Turkey each import around 10%. Exports are slightly less concentrated with the US (36%), India (17%), Uzbekistan (11%), Brazil (7%), Western and Central African countries (Mali, Chad, Benin, and Burkina, 6%), and Australia (3%) (USDA 2008). The trend toward buyer concentration is a manifestation of expanded textile capacity in China and Southeast Asia, particularly since the expiration of the Multi Fiber Agreement, and China's dominance in that industry has increased, with a strong growth in restricted categories in 2007, while China's share had already reached 40-50% in non-restricted categories (Emergingtextile, 2008). The growth in concentration may mean that previous analyses of the global cotton market yield biased estimates. The issue is important because structure impacts market behavior (conduct), which in turn affects market outcomes (performance). Other studies have also recognized that there are possible strategic reasons for government intervention based on imperfect competition (Corden 1991). Also, the market impact of state trading agencies in cotton are a priority item in the next round of WTO negotiations (e.g, China's cotton imports are still controlled by several state owned companies (FAS 2008)).

Economic Analysis of Domestic Price Supports

To analyze how the world cotton sector would be impacted by the complete elimination of US domestic support mechanisms under different market structures, a multi-country, partial equilibrium model based on comparative advantage considerations was constructed. The analysis considers three different market structure scenarios under which all the U.S. domestic price subsidies directly affecting cotton supply are examined: open competitive markets with U.S. cotton programs, double power (U.S. as a dominant exporter and China as a dominant importer), and monopsony (China as a monopsony buyer) with U.S. cotton programs.

Viewing the U.S. as an oligopoly seller was considered, but rejected because U.S. behavior is inconsistent with oligopoly; an oligopolist would restrict the quantities of cotton offered for sale in order to increase prices and capture oligopoly rents. Instead, the U.S. policy attempts to increase the amount of cotton on the world market, thereby theoretically lowering price. China uses its Tariff Rate-Quota on cotton in order to exercise its monopsony power, which results from the combination of its relatively dominant size in the world market and its managing imports through central trading and import quotas, thereby lower its cotton import price (and support its internal cotton price), consequently lowering world price.

For graph simplification in the following conceptual analysis, we assume there are two countries/regions, which are relatively large (Importer and Exporter). The model of domestic price support presented here follows that of familiar three-panel diagrams of two-region, partial equilibrium static world trade models (Pan, et al 2006). In the competitive market scenario, the three panels of Figure 1 depict price-quantity graphs based on supply and demand interactions in the domestic markets of the U.S. (Figure 1a), and China, the major importing country (Figure 1c), as well as the trade market between the two. All other countries are assumed to be price takers in the trade market, so that world price is determined by the dominant importer and exporter (not true, but useful for the conceptual analysis of forces at work in the world market) (Figure 1b). Lines S_u and D_u represent initial supply and demand functions in the U.S. and lines S_c and D_c represent initial supply and demand functions in China, ES_1 and ED_1 represent initial excess supply and excess demand in the world market. The intersection of the excess supply (ES_1) and excess demand (ED_1) functions derived from the two regions indicate the free competitive market equilibrium world market price (P_W) in the absence of trade interventions, and the domestic prices in the two countries are equal to the world price.

When the U.S. cotton program is imposed on this system, the target price and counter-cyclical payments serve to create a new U.S. "kinked" supply curve, X_4S_U. This results in an increase in the excess supply curve to in the trade market to a kinked curve, ES_2 ES_1, kinked at P_L. Consequently, the world market price declines to P_{W1} and an increase in world trade. This is the theoretical argument used in the WTO case and the point where most analyses of the trade effects of policy stop.

Next, consider the impact of China exercising its monopsony power in the world cotton market. Through its central authority, policy makers would achieve this through setting its import tarrif (through the TRQ). To simplify the analysis, we adopted the graph presentation presented by Enke (1944).

In the right side of figure 2, D_d is the Chinese cotton domestic demand, S_d is the Chinese domestic supply and S_f is the imports. S_d+S_f is a combination of foreign and domestic supplies (AC-BC=DC). In the left side of the diagram, MC_f is the marginal cost of importation. The main idea here is that China is benefited by importing cotton only when the marginal cost of the "last" unit from aboard is just equal to the supply price asked by domestic producers for their marginal output. One of the equilibrium prices is AQ_1, Chinese total consumption is OQ_1, domestic production is OQ_2 and imports Q_2-Q_1. However, the marginal cost of the imported supply is greater than its unit cost. Because China has the monopsony market power in the cotton market, the Chinese government would regulate the consumption, production and imports so that the least marginal cost to the economy of obtaining cotton (S_d+MC_f) is equal to its marginal value in consumption (D_d). Therefore, China would impose an import tariff IH to force lower its import level at Q_4-Q_3, domestic production at OQ_4, and domestic consumption at OQ_3.

A main point is that if the hypothesis that China is exerting monopsony power in the market, there is an additional impact on the global price of cotton (in addition to the influence of U.S. cotton programs).[1] This result implies that while there are clearly effects from domestic subsidies on world markets, those effects are unambiguously altered by the import policies of large importers with oligopsony/monopsony power in the market. The relative impact of these different effects is an empirical question.

Methods

Cotton Market Power Test

Based on literatures, the residual demand elasticity (RDE) model is broadly used to measure market power in an imperfect market (Baker and Bresnahan 1988; Goldberg and Knetter 1999; Carter et al. 1999; Poosiripinyo and Reed 2005; Song, Marchant, and Reed 2007). Following their approaches, we assume that both China and U.S. was a cotton firm separately. A two-country partial equilibrium trade model is applied to U.S.-China cotton trade. The specific equations include:

$$(1) P_U^{XPT} = \beta_0 + \beta RS_{US}^{CH} + \beta_1 INC_{US} + \beta_2 T + \beta_3 XPT_{US}^{OTH} + \beta_4 \mathrm{P}_{\mathrm{US}}^{\mathrm{corn}} + \beta_5 STK_{US} + \varepsilon_{US}$$

$$(2) P_{CH}^{IMP} = \alpha_0 + \alpha RD_{CH}^{US} + \alpha_1 INC_{CH} + \alpha_2 T + \alpha_3 IMP_{CH}^{Au} + \alpha_4 IMP_{CH}^{OTH} + \alpha_5 P_{CH}^{corn} + \alpha_6 WTO_{CH} + \varepsilon_{CH}$$

$$(3) P_{CH}^{IMP} = d_0 + d_1 P_{US}^{XPT} + \varepsilon_p$$

$$(4) RD_{CH}^{US} = RS_{US}^{CH}$$

[1] Technically speaking, if China is a pure monopsony, there would be no impact of U.S. programs because China would set the world price. We recognize that the Chinese monopsony is the extreme case and serves as the "minimum" impact of U.S. policies, whereas the competitive case represents the "maximum" impact of U.S. policies on world markets.

where $P_U^{XPT}, RS_{US}^{CH}, INC_{US}, T, XPT_{US}^{OTH}, \mathrm{P}_{\mathrm{US}}^{\mathrm{corn}}, STK_{US}, \varepsilon_{US}$ is the logarithm of U.S. cotton export price to China ($/mt); U.S. residual cotton supply for China (mt); U.S. personal disposable income ($); time trend; U.S. cotton exports to the other countries (mt), U.S. corn price ($/mt), U.S. cotton beginning stocks (bales), and error term, respectively.

$P_{CH}^{IMP}, RD_{CH}^{US}, INC_{CH}, IMP_{CH}^{AU}, IMP_{CH}^{OTH}, P_{CH}^{corn}, WTO_{CH}, \varepsilon_{CH}$ is the logarithm of China's cotton import price from the United States ($/mt); China's cotton import quantity from the United States; China's personal disposable income ($); China' s cotton import from Australia (mt); China's import from other countries (mt); corn price in China; a dummy variable for Chinese world trade organization membership (equaling 0 before 2002 and 1 otherwise) and error term, respectively. All the α, β, d's are parameters to be estimated.

Estimation of the policy effects

A partial equilibrium world fiber model was used to estimate the effects of U.S. cotton subsidy programs 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 the linkage between raw fiber and textile sectors (Pan et al., 2004). 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 was 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 U. S. cotton and non-cotton textile mill use was solved endogenously with the domestic textile demand and textile net trade (net imports). All these equations were 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 was 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, 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.

Western and Central African countries and other countries were assumed to be price takers in the cotton market. The elasticties used in the study are presented in Table 1 (Pan et al., 2006). The short run elasticities of cotton acreage response range from 0.10 to 0.54, with Mexico having the highest value. The long-run acreage response elasticities range from 0.21 to 1.15, with the highest in Australia. These elasticties have been used in several studies such as Chinese currency evaluation (Pan et al., 2007b) and cotton in a free trade scenario (Pan et al., 2007a).

To analyze the different scenarios, we adjusted the model based on the following two assumptions: Chinese domestic cotton price determine world price (A-index) in monopsony case; world cotton import and export determine world cotton price under the open, competitive market case.

Results

Empirical Estimation of Cotton Market Structure

Table 3 reports the parameters of the simple two country partial equilibrium model estimated by the SAS Seemingly Unrelated Regression (SUR) method. For the U.S. inverse residual cotton supply function, only the U.S. cotton residual supply for China, U.S. corn price, and time trend variable is statistically significant. The estimated parameter of the U.S. cotton export to China is the price flexibility of the U.S. cotton inverse residual supply function. It can be used to measure the market power of Chinese cotton importers. $\hat{\beta} = 0.05$ implies that the marketing margin for Chinese cotton importers (the difference between the Chinese domestic cotton price and the cotton import price from the U.S.) is 5.04% of the import price from the united states plus tariffs and transaction cost of Chinese cotton importers.

For the Chinese inverse demand function, the Chinese residual demand for U.S., Chinese disposable income per capita, time trend, Chinese domestic corn price, WTO membership dummy are statistically significant. $\alpha_1 = -0.028$ indicate that market margin for U.S. cotton exporters (the difference between the U.S. cotton export price and the U.S. farm level cotton prices plus transaction costs) is 2.80% of the U.S. farmer level price plus transaction costs.

However, the results did not support any significant effects from other cotton exporters such as Australia. There are several reasons can be used to explain this result: other cotton major exporters in the history such as Australia and Uzbekistan become less important in the exporter market due to irrigation and other social economic issues; emerging cotton exporters such as India and Brazil did not have enough data to show their market power due to the less time period.

Comparing these estimated price flexibilities, we found that the market power of Chinese cotton importers (5.04%) was stronger than that of the U.S. cotton exporters (2.80%) and all other cotton exporters.

Estimation of Policy Effects

Table 4 presents change comparison of the world A-index, Chinese cotton import expenditure, and export income in US and Western & central Africa countries between with US commodity programs (Target price, direct payments, and loan rate) and without these programs under different market structure assumption. The percentage is derived from a comparison between with these programs and without these programs under different market structure assumptions. It indicates that price effects of US commodity programs would be much less under monopsopny or double power market scenario than complete competitive market. If the world market is determined by open market as most of the analysis indicated, the difference of world A-index would be significant, compared with monopsony or double power market assumption. The results further suggest that removal of US commodity programs would gain more benefits for western central Africa countries under complete competitive market than monopsony or double power market. In the realty, since cotton international market is dominated by China and U.S. as shown before, the effects would be much smaller than most of the studies available in the literatures under assumption of complete competitive scenarios.

Conclusion

In this study, we first use the elasticity of the residual demand model to measure market power in the international cotton market and then evaluate the effects of cotton subsidy programs on the cotton market based on difference market structure assumption.

The results of market power estimation support the proposition that the international cotton market is imperfectly competitive. In particular, the results indicate that both China and U.S. dominates the international cotton price with a higher market power in China (5.04%) compared to the U.S. (2.80%). The results indicate that U.S. market share in the Chinese cotton import market cannot be further expanded though the export quantity may continue to increase.

The effects of cotton subsidy programs have been a topic during the last several years. Most of the studies agree that these programs cause the world cotton price decrease. However, the magnitudes of the effects are significant different in the literature. The main reasons for the difference include cotton market structure difference as well as the elasticity difference. This study indicates that the removal of trade restrictions in the world cotton markets would increase global net welfare. The magnitude would dependent on the market structure assumption: the effects would be much smaller under monopsony or double power (china as a sole buyer and U.S. as a sole seller) market structure than the effects under completely competitive market scenarios. The results further suggest that the effect of market structure on world cotton price is bigger than the US commodity programs.

References

Enke, S. (1944). "The Monopsony Case for Tariffs." *Quarterly Journal of Economics* : 229-245.

Benin, Burkina Faso, Mali, and Chad (BBMC). "Poverty Reduction: Sectoral Initiative in Favor of Cotton." World Trade Organization, May 2003.

Baker, J. B. and T. F. Bresnahan (1988). "Estimating the Residual Demand Curve Facing a Single Firm," *International Journal of Industrial Organization* 6: 283-300.

Carter, C.A., D. MacLaren, and A. Yilmaz (1999). "How Competitive is the World Wheat Market." Working Paper No. 99-002, July 1999, Department of Agricultural and Resource Economics, University of California Davis.

Corden, W. M. (1991). "Strategic Trade Policy." In D. Greenaway, M. Bleaney and I. Stewart (eds.), Companion to Contemporary Economic Thought. London: Routledge.

Emergingtextile (2008). "US Apparel Imports from China in 2004-2007 (Statistics Report)," Available at http://www.emergingtextiles.com/?q=art&s=080226-apparel-us-import-china.

Ethridge, D.. "Changes in Global Cotton Markets: Causes and Effects." Plenary Paper, World Cotton Research Conference-4, Sept 10-14, 2007, International Cotton Advisory Committee, Wash., DC, 26 pp. (on CD).

FAPRI (2002). "The Doha Round of the World Trade Organization: Appraising Further Liberalization of Agricultural Markets." Working Paper 02-WP 317, Center for Agricultural and Rural Development, Iowa State University, November 2002.

FAS (2008). "China, Peoples Republic of Cotton and Products Annual 2008." Available at http://www.fas.usda.gov/gainfiles/200805/146294733.pdf.

Goldberg, P., and M. M. Knetter (1999). "Measuring the Intensity of Competition in Export Markets." *Journal of International Economics*, 47: 27-60.

Goreux, L (2004). "Cotton after Cancun." Mimeo, World Bank, March 2004. Available at http://www.oecd.org/dataoecd/38/48/30751318.pdf.

Hertel, T. (2005) "Regional Poverty Impacts of Alternative Doha Scenarios," Paper presented in 2005 American Agricultural Economics Association meeting, Providence, RI.

Hussein, K., C. Perret, and L. Hitimana (2005). "Cotton in Western Africa," available at http://books.google.com/books?id=Py5pPZKeRvcC&pg=PA106&lpg=PA106&dq=Hussein,+Perret,+and+Hitimana+2005&source=bl&ots=xWbLVx0o37&sig=7gkT155feqGBbo_1j5pZlUyeGxk&hl=en&sa=X&oi=book_result&resnum=1&ct=result#PPA5,M1.

International Cotton Advisory Committee (ICAC, 2002). "Production and Trade Policies: Affecting the Cotton Industry", 2002. Available at http://www.icac.org/icac/Meetings/cgtn_conf/documents/icac_ccgtn_report.pdf.

MacDonald, S. (2000). "The New Agricultural Trade Negotiations: Background and Issues for the U.S. Cotton Sector." Economic Research Service: US Department of Agriculture, CWS-2000, November 2000.

Pan, S., M. Fadiga, S. Mohanty, and D. Ethridge. "Structural Models of the U.S. and the Rest-of the-World Natural Fiber Market." CER # 04-03, Cotton Economics Research Institute, Texas Tech Univ., Mar. 2004.

Pan, S., S. Mohanty, D. Ethridge, and M. Fadiga (2006). "The Impacts of U.S. Cotton Programs on the World Market: An Analysis of Brazilian WTO Petitions." *Journal of Cotton Science* 2006(10): 180-192.

Pan, S., M. Fadiga, S. Mohanty, and M. Welch (2007a), "U.S. Cotton in the Free World." *Economic Inquiry* 2007(45): 188-197.

Pan, S., S. Mohanty, M. Welch, D. Ethridge, and M. Fadiga (2007b), "The Effects of Chinese Currency Appreciation on World Cotton Market." *Contemporary Economic Policy* 2007 (25): 185-205.

Poonyth, D., A. Sarris, R. Sharma, and S. Shui (2004). ''The Impact of Domestic and Trade Policies on the World Cotton Market.'' Food and Agriculture Organization of the United Nations Commodity and Trade Policy Research Working Paper No. 8, 2004.

Poosiripinyo, R. and M. Reed (2005). "Measuring Market Power in the Japanese Chicken Meat Market" *Journal of International Agricultural Trade and Development* 1: 135-48.

Reeves, G., D. Vincent, and D. Quirke. "Trade Distortions and Cotton Markets: Implications for Australian Cotton Producers. "Narrabri, New South Wales, Australia: Cotton Research and Development Corporation, 2001.

Song, Baohui , M. A. Marchant, and M. R. Reed (2007). " Market Power and Competetive Analysis of China's Soybean Import Market." Contributed paper presentation for the Internatinoal Agricultural Trade Research Consortium, July 8-9, 2007, Beijing, P. R. China.

Sumner, D. A. (2003). **"**A quantitative simulation analysis of the impacts of U.S. cotton subsidies on cotton prices and quantities." Department of Agricultural and Resource Economics, University of California, Davis, 2003. http://www.fao.org/es/esc/common/ecg/47647_en_.pdf **.**

Suranovic, S. M. (2008).**"**Monopoly/Monopsony Power in Trade. " International Trade Theory and Policy. Available at http://internationalecon.com/Trade/Tch100/T100-6.php.

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

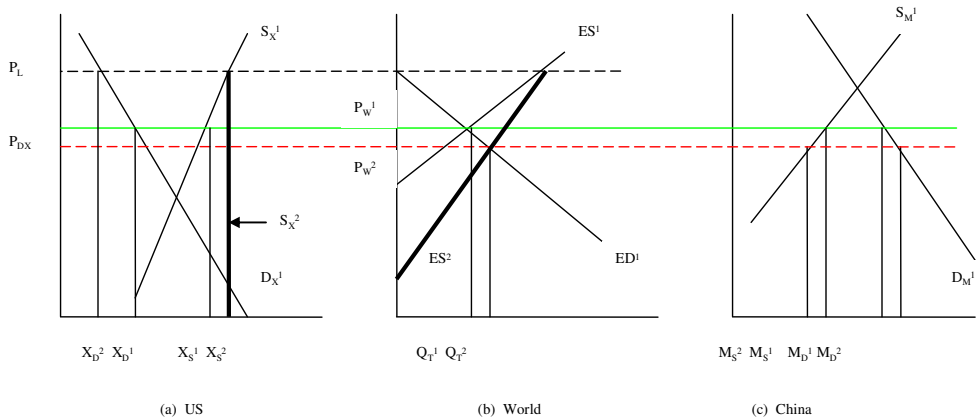
U.S. Department of Agriculture (USDA, 2008). "Production, Supply, and Distribution." Available at http://www.fas.usda.gov/psdonline/psdHome.aspx**,**

Table 1. Literature Summary of the Effects of Trade-Distorting Support on the World Cotton Price

Study	Method	World Price Effects of Removing U.S. subsidies (Domestic Support and Export Subsidies)	World Price Effects of Removing all Trade Distorting Support (Domestic Support, Tariffs, and Export Subsidies)
FAPRI (2002)	Partial Equilibrium		+11.44% average from 2002/2003 to 2011/12
Goreux (2004)	Partial Equilibrium		+12% in 2000/01
ICAC (2003)	Partial Equilibrium		+70% in 2001/02 and +15% in 2002/03
Pan, et al. (2004)	Partial Equilibrium	+2.14% in 2005/06 to +0.86% in 2013/14	
Pan et al (2007)	Partial Equilibrium		Average +10.79% between 2006/07 and 2010/11
FAO (Poonyth et al. 2004)	Partial Equilibrium		+3.1% from baseline average (1996-2000)
Reeves, Vincent, and Quirke (2001)	Partial Equilibrium		+2.2% in 1999
Summer (2003)	Partial Equilibrium	+12.6% in 1999-2002 and +10.8% in 2003-2007	
IMF (Tokarick, 2003)	Partial Equilibrium		+2.8% and +2.0% (remove production subsidies only)

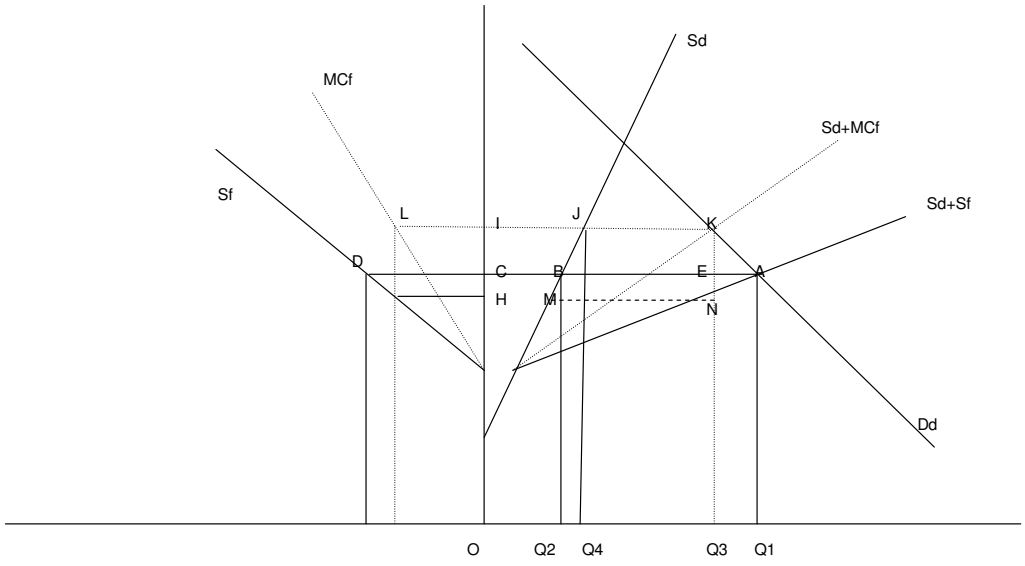
Source: Pan et al. (2007a)

Figure 1. Effects of US Cotton Programs on World Cotton Price under Competition Market



(a) US (b) World (c) China

Figure 2. Effects of Monopsony on World Cotton Price



Source: Enke (1944).

Table 2. Cotton Price Transmission and Supply Elasticities

Country	Income Elasticities	Price Elasticities	
	Textiles	Cotton	Polyester
US	0.15	-0.24	0.07
Australia	0.13	-0.05	0.00
South Korea	0.11	-0.57	0.24
Taiwan	0.11	-0.50	0.35
Japan	0.14	-0.57	0.37
EU-15	0.12	-0.39	0.15
Mexico	0.58	-0.27	0.10
Brazil	0.53	-0.15	0.12
China	0.69	-0.57	0.16
India	0.56	-0.44	0.10
Pakistan	0.52	-0.28	0.18
Africa	0.55	-0.74	0.24
World	0.30	-0.28	0.15

Source: pan et al. (2004).

Table 3. Estimation Results of the Two-country Partial Equilibrium Model

Equation	Variable	Parameter	Standard Error
US	Intercept	17.70	10.15
	RS_{US}^{CH}	0.05*	0.02
	INC_{US}	-1.08	1.00
	T	0.002	0.008
	XPT_{US}^{OTH}	-0.017	0.02
	$\mathrm{P}_{\mathrm{US}}^{\mathrm{corn}}$	0.33*	0.11
	STK_{US}	-0.18*	0.09
China	Intercept	0.25*	2.55
	RD_{CH}^{US}	-0.03*	0.01
	INC_{CH}	0.95*	0.45
	T	-0.03*	0.01
	IMP_{CH}^{Au}	0.009	0.01
	IMP_{CH}^{OTH}	-0.02	0.01
	$\alpha_5 P_{CH}^{corn}$	0.16*	0.06
	WTO_{CH}	0.14*	0.07
Price Relationship	Intercept	2.66*	0.61
	P_{US}^{XPT}	0.63*	0.09

* 5% significance level.

Table 4. The Effects of US Commodity Programs on World A-Index and Trade Income, Expenditure

	2008/09	2009/10	2010/11	2011/12	2012/13	Average
A-Index		Cents per Pound				
Effects of U.S. Program Removal Under Completely competitive market	8.10%	6.94%	3.77%	3.31%	1.69%	4.76%
Effects of U.S. Program Removal Under Double Power Market	3.25%	3.27%	2.11%	0.95%	0.95%	2.11%
Effects of U.S. Program removal Under Monopsony Market	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
China Import						
Effects of U.S. Program Removal Under Completely competitive market	-0.55%	-0.25%	-0.12%	-0.11%	-0.08%	-0.22%
Effects of U.S. Program Removal Under Double Power Market	-0.22%	-0.05%	-0.02%	0.00%	0.00%	-0.06%
Effects of U.S. Program removal Under Monopsony Market	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
U.S. Export Income						
Effects of U.S. Program Removal Under Completely competitive market	-2.94%	-1.95%	-1.10%	-1.09%	-1.01%	-1.62%
Effects of U.S. Program Removal Under Double Power Market	-1.21%	-1.12%	-1.10%	-0.90%	-0.82%	-1.03%
Effects of U.S. Program removal Under Monopsony Market	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WCA Countries Export Income						
Effects of U.S. Program Removal Under Completely competitive market	4.98%	4.37%	2.80%	2.21%	1.28%	3.13%
Effects of U.S. Program Removal Under Double Power Market	1.81%	1.60%	1.35%	1.31%	1.23%	1.46%
Effects of U.S. Program removal Under Monopsony Market	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%