INTER-FIBER COMPETITION: COTTON'S DECLINING MARKET SHARE IN CHINA

Cheng Fang
Iowa State University
Hunter Colby
USDA/ERS
Bruce Babcock
Iowa State University

Abstract

After two decades of rapid development, China has emerged as the world's largest producer of chemical fiber. Consumption of chemical fiber has also grown rapidly, finally overtaking cotton in 1997. The share of cotton in total fiber consumption has declined from 83 percent in 1982 to about 40 percent in recent years. As a result, cotton consumption increased only slightly, while total fiber consumption increased more than 120 percent in the last two decades. With increased income and improved market accessibility, China has changed from a net cotton exporter to a net cotton importer since 1989. As China moves closer to joining the WTO, it is important to gain a better understanding of the competition between the two main inputs into China's textile industry. This paper examines China's chemical fiber and cotton production and availability, identifies the factors responsible for the decline in the cotton share, and quantifies the impact of these factors in order to provide a better understanding of China's current cotton and man-made fiber consumption and the likely future trends of cotton consumption and trade.

China's Chemical Fiber and Cotton Production and Availability

With a large population and limited land resources (arable land is only 7 percent of total world), it is difficult for China to produce enough clothing and food to meet domestic requirements. China developed its own chemical fiber industry in the 1970's to fill a perceived shortage of domestic cotton. The chemical fiber industry has received substantial government support because of its role in providing the materials for domestic clothing consumption and also because of the foreign earnings derived from textile and apparel exports.

In China, the development of the chemical fiber industry has focused on the construction of large core projects. The Government invested heavily in the seventies to build large production bases, using crude oil as raw material. The industry developed rapidly during the 1980s as China completed 20 large new facilities in the Eastern coastal provinces using imported materials, equipment and technology. Total chemical fiber production increased from 450,300 metric tons in 1980 to 6 million metric tons (MMT) in 1999 (Figure 1), making China the world's largest producer of chemical fibers. The expansion of the chemical fiber industry eased clothing shortages and provided over 3.6 million jobs. In addition, chemical fiber now makes up about 30 percent of the exports of textile fabrics and clothing, earning foreign exchange of more than US$ 10 billion.

In contrast to chemical fiber production, China's cotton output increased very slowly through the mid-1980s, finally reaching a record high of 6.26 MMT in 1984. Since that peak, cotton production has fluctuated around 4.2 MMT annually due to China's grain policy, the incidence of pests and diseases and other economic factors. Land devoted to cotton in China has declined in the 1990s in nearly every production region. The decline has been especially dramatic in East China. The only province that is devoting more land to cotton is Xinjiang, China's western-most province. There are sound economic reasons behind these changes. Cotton in China is a relatively labor-intensive crop. More non-farm job opportunities in East China are encouraging the cultivation of less labor-intensive crops. In addition, there are have been significant bollworm problems in the North China Plain, making cotton production less profitable relative to substitute crops (though preliminary reports indicate the introduction of BT cotton in Henan and Shandong provinces is spurring a recovery in cotton area in the North China Plain).

China's government controls cotton imports through a strict quota system. The system limits both the volume and the number of importers allowed to import raw cotton. Chemical fibers, however, have no such restrictions. Although there are higher tariffs for chemical fibers than cotton, chemical fiber imports for processing and re-export are duty-free. The government implemented a round of tariff cuts on all chemical fiber materials and products in 1997, then making further cuts for textiles in general in 1999. China has become a major importer of chemical fiber and the raw materials for domestic chemical fiber production. Imports increased by 18 percent annually between 1990 and 1997. Though affected by the Asian crisis, China still imported 1.73 MMT in 1998. China accounts for 17 percent of world chemical fiber imports.

Factors Determining Cotton Market Share

Cotton and chemical fibers compete for markets on the basis of both price and non-price factors. Several recent studies have investigated the impact of price and non-price competitiveness of cotton on the market share of cotton over the past decades. These studies show that the factors affecting cotton market share include: prices of cotton and man-made fibers, income, technology, and availability.

Price competition implies a drive for profit maximization. When the relative price of cotton increases, one would expect some cotton to be replaced by man-made fiber. It is argued that price competition is not strong for the final textile product due to the small proportion of the fiber cost in total production cost. However, studies have also shown that in many cases the cotton share of total fiber use is significantly affected by the prices of cotton and man-made fibers at the mill level. Figure 2 shows that the cotton price relative to the chemical fiber price in China declined rapidly from 1982 to 1989. Based on profit maximization, cotton share should rise as the relative price rises, but the cotton share of total fiber use, in fact, dropped from 83 percent to 64 percent during that period. During this period, cotton share was dominated by non-price factors. Since 1989, however, relative prices changes have become the dominant factor influencing cotton share.

Nevertheless, the competition between natural and manmade fibers is influenced by non-price factors. The chemical fiber industry constantly strives to develop new fibers with characteristics appealing to consumers, or with specific properties applicable to industrial use. Research and development expenditures on fibers greatly affect consumption, particularly of manmade fibers. Such expenditures have been sharply greater for manmade than for natural fibers.

The availability and quality of supply is important in determining fiber demand, particularly at the mill level. Generally, this has been an advantage for manmade fiber in competition with natural fibers. Prior to the recent energy shortage, mills were generally assured of a predictable supply of manmade fiber of a constant quality and at relatively stable, predictable prices. However, production and quality of cotton is much more variable. Such factors as weather, insects, and government programs, none of which can be predicted with certainty, affect the quality, quantity, and prices of cotton.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:275-277 (2001)
National Cotton Council, Memphis TN

Econometric Model and Results

Two different approaches were taken in examining cotton use in China. The first approach looked at the cotton share of total fiber use. The other is cotton share calculated at the mill use level—in other words, the share of cotton in total yarn output (hereafter referred to as "yarn use"). The cotton share in total fiber use declined much faster than the cotton share in yarn use. Total fiber use includes yarn use, but also includes industrial use, medical use, military use, and modest amounts of household use (as a stuffing for blankets and winter jackets). Both approaches were estimated by a single equation with double-log function in an ordinary least square (OLS) approach.

Cotton and chemical fiber prices, cotton production, real GDP, and technology were selected as the variables most likely to impact cotton share (see Figure 3 and Figure 4). Cotton share was specified as a function of the price ratio (cotton price over chemical fiber price), current year cotton production, lagged one year cotton production, lagged two year cotton production, real GDP, and a time trend. However, this specification was not successful for either of the two approaches (total fiber use and yarn use), since changes in income from year to year were highly correlated with technology (the time trend). Therefore, we estimated two models for each cotton share equation, using real GDP as an explanatory variable in one, and time trend as an explanatory variable in the other.

The results for lagged one- and two-year cotton production were insignificant in the yarn use cotton share equations and were dropped from the models. Similarly, the results of current and lagged one-year cotton production were insignificant in the total fiber use equations and were dropped from the models.

The estimation results of the share equations in the yarn use models are given in Table 1. Model 11 (with a time trend as an explanatory variable) explains about 90% of the sample variations and model 12 (with real GDP as an explanatory variable) explains about 91% of the sample variation.

In the first yarn use model (model 11), the price ratio was highly significant with a t-value of –4.69 and gave a price (ratio) elasticity of demand estimate of –0.27. Cotton share declined consistently throughout the estimation period. This was captured by a time variable, and was found to have a negative sign and be significant with a t-value of –2.14. Current year cotton production was significant at the 10 percent level. The estimated elasticity suggests that cotton share of total yarn output would increase 0.12 percent when cotton production increases 1 percent.

In the second yarn use model (model 12), real GDP is used an explanatory variable. The estimated elasticity for real GDP is –0.085, indicating a 1 percent increase in real GDP would result in a –0.085 percent decrease in cotton share. Compared to model 11, the differences in the estimated elasticities for both the price ratio and cotton production factors are relatively small.

The estimation results of the equations for cotton share in total fiber use are reported in Table 2, again with one model (21) incorporating a time trend as an explanatory variable and the other model (22) using real GDP as an explanatory variable. Both models (21 and 22) explain about 98% of the sample variation. Compared to the estimation results in the yarn use model, the response of cotton share in total fiber use to the price ratio was slightly less, with a price elasticity of about –0.22. The income elasticities ranged from 0.1 to 0.16 in the two total fiber use models, bracketing the income elasticities in the yarn production model.

In contrast to the results in the yarn use model, cotton share in the two total fiber use models has a much higher response to the time trend and real GDP variables (with elasticity –0.39 for real GDP). The difference may be due to rapid growth in the use of chemical fiber in the non-yarn textile industry.

Conclusion

Since 1980, China's chemical fiber industry developed rapidly as numerous new, modern factories were completed using imported materials, equipment and technology. Total chemical fiber production increased from less than one-half million metric tons in 1980 to 6 MMT in 1999, making China the world's largest producer of chemical fibers.

On the other hand, limited land, a grain self-sufficient policy, and weather and pest induced variations in yield have caused cotton production to be relatively stagnant over the long run, though with extremely high variability on a year-to-year basis. And the state import quota system limits the availability of imported cotton. The simple models used in this paper indicate that in China, availability is one important factor determining cotton share in fiber use. The decline in cotton share would persist if China's chemical fiber industry continues to develop rapidly. However, China's accession to the WTO could have a positive impact on cotton share as cotton imports are expected to increase in response to the liberalization of China's cotton trading system.

The empirical results indicate that the relative price of cotton, technology, and income are also important factors contributing to the decline in cotton share. Therefore, China's new cotton policy in 2000, and the resulting decline in domestic cotton prices to a level more in line with international prices, should support an increase in cotton share relative to chemical fiber.

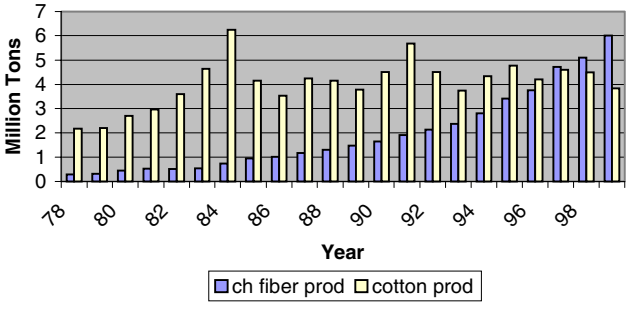

Figure 1. Chemical Fiber and Cotton Production (mmt) in China.

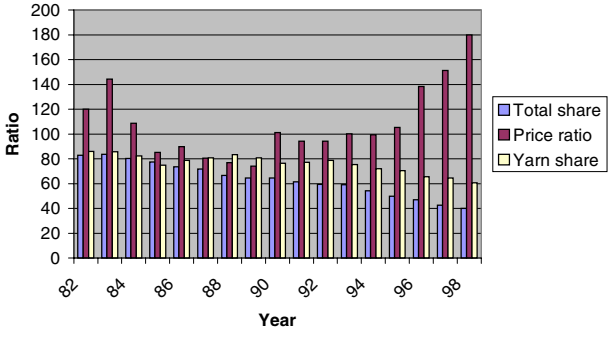

Figure 2. Cotton Use Ratio and Cotton/Polyester Price Ratio.

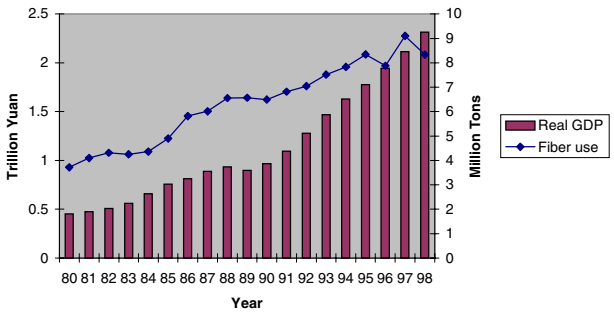

Figure 3. Real GDP and Total Fiber Use.

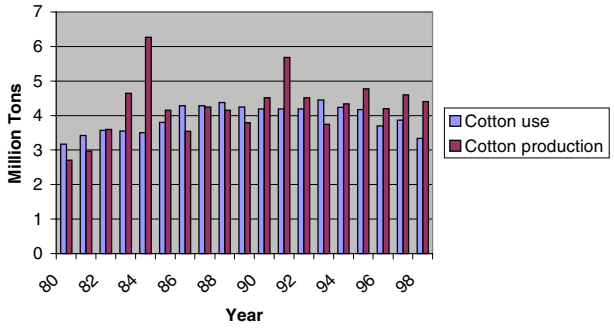

Figure 4. Cotton Use and Production.

Table 1. Cotton Share (Yarn Use) Equation Results.

Parameters	Model 11	t-values model 11	Model 12	t-values model 12
Intercept	4.655	9.11	5.414	9.07
Log price ratio	-0.269	-4.69	-0.250	-4.21
Log real GDP			-0.085	-2.37
Log cotton production	0.117	1.77	0.102	1.55
Time trend	-0.007	-2.14		
R2	0.90		0.91	
Durbin-Watson	2.37		2.36	

Table 2. Cotton Share (Total Fiber Use) Equation Results.

Parameters	Model 21	t-values model 21	Model 22	t-values model 22
Intercept	4.698	8.43	7.42	10.42
Log price ratio	-0.223	-2.91	-0.213	-2.43
Log real GDP			-0.389	-6.57
Log cotton production (lag 2 year)	0.100	1.47	0.156	2.12
Time trend	-0.035	-7.46		
R2	0.98		0.98	
Durbin-Watson	1.73		2.06	