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# Fiber Use for Textiles and China's Cotton Textile Exports

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## Abstract

New information about the role of recycling in the textile industry and updated estimates of efficiency in spinning lower estimates of the volume of cotton fiber exported by China in the form of textiles from those of an earlier study. China's textile industry not only meets domestic demand of the world's most populous country but is also the world's largest exporter. Consequently, China is the world's largest consumer and importer of cotton, but information about China's cotton consumption is incomplete. This analysis of China's textile trade offers important insights into trends in China's cotton use and imports. The revised textile trade estimates have implications for the outlook for China's cotton consumption and imports, which this study demonstrates with an econometric model of China's textile trade.

**Keywords:** Cotton, textiles, China, yarn, spinning, exports, efficiency.

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## Introduction

Cotton and other fibers are used to produce textiles. The United States is the largest exporter of cotton, and China is the world's largest importer. China is also the world's largest producer and consumer of cotton. However, data on China's domestic cotton market are considered unreliable, and new sources of information are needed.<sup>1</sup> Exports are important for China's textile industry, and shifts in textile export volume affect China's demand for fiber. To gain insight into the volume of cotton demanded by China's textile industry, MacDonald (2007) estimated the amount of fiber consumption embodied in China's textile trade. These estimates used conversion factors developed for the U.S. textile industry as long ago as 50 years (Lawler, 1985). Information from China, and a review of developments in the U.S. textile industry, indicated that these conversion factors overstated the amount of cotton fiber necessary to produce the products that China exports. In this study, revised estimates of the amount of fiber lost during yarn production are used to amend estimates of the cotton content of a number of textile products. These revisions are used to update estimates of the fiber-equivalence of China's textile trade. These changes replace an adjustment based on anecdotal evidence previously employed by MacDonald (2007).

<sup>1</sup>For more background on recent developments in data on China's cotton sector, see MacDonald (2007).

## Estimating Cotton Mill-Use Equivalents of Textile Products

USDA calculates the raw-fiber equivalents of U.S. textile import and export volumes (Meyer et al., 2007). For each textile product (at the 10-digit level of the *Harmonized Tariff Schedule of the United States*), a conversion factor is computed based on the amount of estimated waste or loss at each of three separate stages of production: spinning, weaving, and apparel construction (United States International Trade Commission, 2008). The conversion factor measures the changes from the weight of the final product to the weight of the fiber consumed in the course of creating that product. The conversion factor is then combined with information about the cotton fiber content of the product and with information about fiber's share of the product's weight to get an overall conversion factor.

Table 1 illustrates how the reported trade volume of one product, "Mixed Fabric,"<sup>2</sup> is converted into an estimate of the kilograms of cotton fiber consumed to produce 1 kilogram of the final product. Several decades ago, USDA determined that, to produce the yarn used in these fabrics, about 10 percent of the fiber used was lost or wasted during the spinning process. This loss is represented in the "Yarnwaste" factor of the formula by 0.9, assuming that 90 percent of the weight of the baled cotton used to make yarn is actually realized as yarn. Note that this 0.9 presumes that all of the fiber used to make yarn is from a newly opened bale, and the waste created from the spinning process is not used to make any other textile product. The estimated waste when making yarn into fabric ("Fabtrim") for Mixed Fabric is about 3 percent; this waste is documented in the Fabtrim column of table 1 as 0.97, meaning 97 percent of new cotton yarn input is successfully made into fabric. Because Mixed Fabric is fabric, the factor that captures the waste when fabric is used to produce apparel or another consumer product assumes there is no waste, which results in a "Cutloss" factor of 1 in the table.

The inverses of the Yarnwaste, Fabtrim, and Cutloss factors are calculated to represent the total units of each input needed to create one unit of output. For example,  $1/0.9 = 1.111$ , meaning that 1.111 tons of cotton fiber are needed to produce 1 ton of yarn. The product of these three inverted factors is the volume of fiber in kilograms to create 1 kilogram of the final product's textile components. The product of the inverses is then multiplied by the "Blend" factor, which represents the percentage of cotton content in the commodity. Also factored into the equation is the fiber composition of the commodity, accounting for buttons, zippers, and other nonfiber-based components

Table 1

### Components of cotton mill-use equivalent conversion factor for Mixed Fabric, using previous methodology

Fiber in components (Perfib)	Share of cotton content (Blend)	Fiber lost in spinning (Yarnwaste)	Losses during fabric production (Fabtrim)	Losses during product construction (Cutloss)
<i>Conversion factor</i>				
1	0.5	0.9	0.97	1

Source: Calculated by ERS from industry information.

<sup>2</sup>HS5112909010: woven fabrics of combed wool/combed fine animal hair mixed mainly or solely with cotton (United States International Trade Commission, 2008).

(“Perfib”). The product of these components is the conversion factor for mill-use equivalents, by weight, per weight of final product exported or imported:

$$\text{Conversion factor for Mixed Fabric} = \frac{1}{0.9} \times \frac{1}{0.97} \times \frac{1}{1} \times 0.5 \times 1 = 0.573 \quad (1)$$

USDA’s system for converting U.S. textile trade data includes about 7,000 such conversion factors. International agreements have established the six-digit level of the harmonized tariff schedule as the level at which product definitions are comparable between countries. To aggregate to the 6-digit level, MacDonald (2007) created weighted averages of the 10-digit conversion factors by using U.S. import volumes. After aggregation, and then selecting only products that include some cotton in addition to other fibers, a set of 582 conversion factors was used to convert China’s textile trade into cotton mill-use equivalents, and the results were published by MacDonald (2007). Updates are calculated each month by USDA analysts to help track China’s cotton consumption.

This study examines the estimates for “Yarnwaste” used to derive these conversion factors. Consultation and discussion with a variety of industry experts in the United States and China indicated that the parameters that USDA has been using for “Yarnwaste” (0.86-0.9) are too low, thereby assuming an unrealistically high amount of waste. This study also reviews estimates of the cotton content of selected products, determining that USDA’s current estimates are too high. The next three sections describe how these estimates were revised and the implications of these revisions.

## Fiber Reuse and Its Effects on Consumption Estimates

Two types of spinning processes are widely used today in producing yarn: open-end spinning and ring spinning. Open-end spinning is a process that introduces twist into the yarn by rotating the end of the yarn at a break in the flow of fibers between the delivery system and the package that takes up the yarn (Hoechst Celanese, 1990). This type of spinning uses a wide variety of fiber lengths and creates yarns of slightly lower quality than other processes. Ring spinning uses a system in which the yarn is both twisted and wound onto the bobbin simultaneously, but more slowly than in open-ended spinning, due to the larger mass of the rotating material (Hoechst Celanese, 1990). Ring spinning usually results in a much stronger and higher quality yarn than does open-end spinning and is divided into two types of yarn (carded and combed) based on the quality of input fiber. Carding is a pre-spinning process in which the fiber is opened, cleaned, aligned, and formed into a single continuous sliver or strand. Carding results in the large majority of the nonspinnable waste and precedes both ring and open-end spinning. Ring spinning involves more steps in the transformation of the sliver, with fiber loss at each step and leading to more waste than open-end spinning. Combed yarn is produced using an additional step beyond carding, which extracts neps, foreign matter, and short fibers from the previously carded strand. This extra attention to fiber results in finer, more compact yarn than those already discussed, but with this extra processing, an even smaller proportion of the initial bale of cotton fiber is realized in the form of yarn, with more going to waste.

Previously, yarn production was estimated by USDA to result in 10-16 percent waste from the initial bale of fiber. In addition to clearly nonspinnable components like leaves, bark, stems, and dirt, Clapp (2008) indicates that waste from each bale also includes reworkable fibers that can be sold or reused by the mill. Also, total waste—particularly reusable waste—varies with the type of spinning process. Open-end spinning tends to create about 5-6 percent waste, whereas ring spinning can produce, on average, around 8-10 percent, varying between carded and combed cotton (Clapp, 2008; Liu, 2008; Martin, 2008). When taking into account the amount of fiber waste that can be re-used either within the initial spinning mill or by other firms producing textiles, the estimates decrease further. The 5- to 6-percent waste estimate for open-end spinning decreases to about 3 percent because leftover “waste” fibers from the initial bale are mixed into bales of virgin fiber to be reprocessed into yarn. The 8- to 10-percent waste created from ring spinning can be reduced to about 5 percent, given that the waste from ring-spun cotton is of higher quality than that from open-end and thus can be more widely reused.<sup>3</sup> Ring-spun waste can not only be conjoined with other fibers to once again go through the same spinning process, but some can be used on its own to create lower quality yarns, depending on the quality and length of the waste fibers.

An appropriate waste estimate for China is derived based on the ratio between ring and open-ended spinning. An estimated 15 percent of Chinese yarn is produced through open-end spinning, leaving the rest to be primarily

<sup>3</sup>The 8- to 10-percent initial waste for ring spinning is an average of the waste for carded and combed yarn.

ring spun (Liu, 2008). Again using Mixed Fabric as an example, the change in Yarnwaste from 0.9 to a revised 0.952, to account for fiber reuse, results in a new 10-digit weighted cotton fiber equivalence factor of 0.541. By raising the estimated parameter for “Yarnwaste” in the conversion factor’s calculation, the estimated amount of fiber needed to produce the product is reduced. The new conversion factor of 0.541 is 5.6 percent lower than the previous estimate of 0.573. Most textile products have Yarnwaste estimates of 0.9, but a minority were previously estimated at 0.86, which would result in an even larger decline in the estimated conversion factor. For these products, revising Yarnwaste to 0.952 implies an even larger decline in the conversion factor. Therefore, in the absence of further adjustments, a corrected estimate of the mill-use equivalence of China’s textile trade would be about 6 percent lower than previous estimates. Because MacDonald (2007) applied an ad hoc adjustment factor, the actual change is less for a number of years, as will be discussed in the following sections.

## Recycling and Reuse of Textile Waste

Recycling by the textile industry is not confined to the use of fibers from spinning. A steady secondary market in textile has evolved to provide raw material to producers of lower quality textiles and nontextile products. What once was deemed disposable is now considered reusable waste in the form of fibers, slivers, scraps, and used clothing directly bought and sold on the open market between textile manufacturers. This reuse of textile waste was passed over in the original consumption calculations.

Almost all waste from spinning, weaving, and apparel production is used in some way, whether being reintroduced back into the textile industry or into the nontextile industry for items like cotton balls and paper. Within the textile industry, in addition to making new yarn, recycled textile products can be used for wadding and blanket and pillow stuffing if the length of the fiber is too short for yarn production. For example, garneting is a process in which new fabric scraps or old textiles are ground or scraped to break the articles back into fibers. This process has been very useful for man-made fibers like polyester, but when used on cotton products, the resulting fibers tend to be too short for adequate yarn production, so the recovered fibers are often used for stuffing or can be sold to firms outside the textile industry.

Weaving does not create a large amount of waste; the resulting effects mainly consist of bits of yarn not used by the loom. In the weaving process, about 3 percent waste is created, but this waste is not used outside the textile industry and the assumed waste figures for fabric production in the model do not warrant change. While this yarn is not wasted in the sense that it is discarded, it is waste in the sense that it does not appear as output for any textile product, instead ending up as batting or other nontextile product.

Compared with the amount of waste from weaving, a larger amount of waste is created in the process of apparel production and finishing. Computerized machines have improved productivity, but this process still leaves at least 10 percent of the initial fabric on the cutting room floor (Clapp, 2008). These scraps of fabric are often garneted and the fibers used for batting, insulation, and other nontextile products (Phillips, 2008). USDA's "Cutloss" estimates for cotton apparel products have a minimum of 0.86 and average 0.91, representing respective losses of 16 percent and 9 percent. After review, none of these estimates were determined to be in need of updating.

The textile recycling industry also uses a significant amount of post-consumer textiles. According to the Council for Textile Recycling (1997), about 25 percent of total post-consumer textile waste is now recycled. About 48 percent of that textile waste is recovered as secondhand textiles, while 20 percent is made into wiping and polishing cloths, leaving another 26 percent to be converted back into fibers by the garneting process discussed previously. Although it is important to consider post-consumer recycling to reach an understanding of the role of recycling in the textile industry, post-consumer recycling does not affect estimates for China. China undertakes little trade in used clothing, and the majority of the remaining post-consumer recycling is used to create nontextile products.

## Fiber Blends

A review of cotton's share in the fiber content of traded textile products also resulted in a downward adjustment in the estimated cotton, mill-use equivalence of China's textile trade. However, due to the two-way nature of trade in some of these products, the impact of the adjustment on net textile trade varies over time. A review of the 2008 Harmonized Tariff Schedule (and of previous years' schedules, to account for changes over time) revealed that a subset of products had been assigned significant cotton fiber shares even though they contain no cotton. Examples include Woven Fabric of Filament Yarn (HS540791), Woven Fabric of Polyester Staple (HS551511), and articles of Manmade Fiber (MMF) Wadding (HS560122). In some cases, these products had been assigned cotton fiber shares as high as 100 percent. A group of 22 products related to those listed had cotton fiber shares reduced to 0, but the impact of these changes was small. China's imports in 2007 would be 1 percent lower in estimated cotton mill-use equivalents, and exports 0.4 percent lower if all of these products had been excluded. Prior to 2000, however, China was a large net importer of MMF Wadding. As a result, the impact on net exports of these revisions is significantly different at various times, an issue that will be addressed below.

In addition, the study of recycling flows in the textile industry led to a reassessment of cotton fiber's share of product with a larger trade impact. Bedding (HS940490, articles of bedding excluding mattresses, but including quilts and cushions) was initially assumed to be comprised of 52 percent cotton fiber. However, most of this product's cotton is in the form of stuffing, which is primarily made from recycled textiles. Therefore, mill consumption of much of the cotton in these products has already been accounted for in the waste estimates for other products derived from new bales of raw cotton. Even though bedding may be largely made of cotton, all of that cotton is not new, and including it would be double counting. To adjust for this discrepancy, a new conversion factor was constructed to account for only the new cotton contained in the product, considerably reducing the estimated cotton composition estimates for this specific commodity. In 2007, these bedding products accounted for 3.6 percent of China's exports under the previous estimates, an amount revised down to 0.3 percent as a result of the adjustment to remove double counting. In 2007, China's imports of these products were negligible.



## Trends in China's Textile Industry Waste

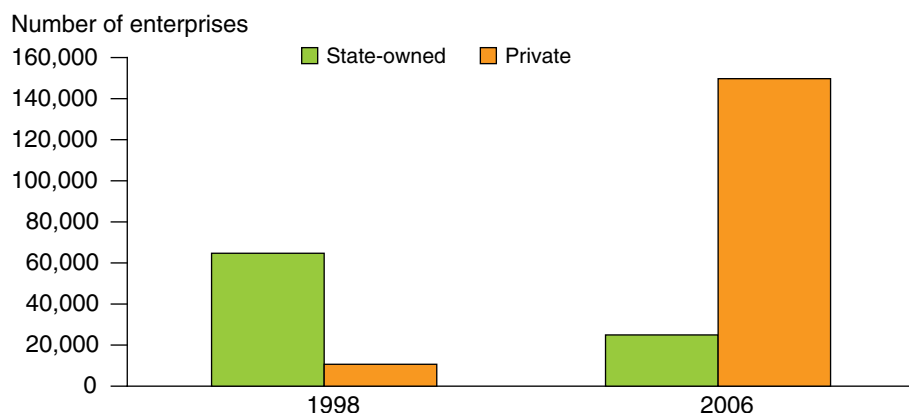
With the adjustments described above, a weighted average of the conversion factors across all 560 6-digit product categories is 0.968, which implies that the appropriate current estimate for an overall “waste factor” for China’s textile industry is little more than 3 percent. The most recent comparable estimate by China’s Government was a 1994 figure of 7.1 percent from the National Bureau of Statistics of China (NBS). Between 1983 and 1994, the NBS reported a fairly constant estimate of cotton waste, ranging from 6 percent to 8 percent. But several developments in China’s textile industry since 1994 suggest that the efficiency should have improved since 1994 and that 7 percent was therefore a reasonable estimate for waste in 1995, even given a current estimate of 3.3 percent.

The growing change from state-owned to private entrepreneurship among China’s textile mills has affected the efficiency of production. For decades after 1949, most textile factories in China were state-owned, working only to fulfill government fiat. Producers suffered no threat from rivals, nor did they experience the opportunity for independent expansion. It was not until more privately owned producers took hold of the Chinese textile industry that a real market system began to develop and producers had larger incentives to improve efficiency and production standards to expand sales and boost profit. (Brandt, 2008). The number of state-owned industrial enterprises decreased from 64,737 in 1998 to 24,961 in 2006, whereas privately owned enterprises grew from 10,667 in 1998 to 149,736 in 2006 (National Bureau of Statistics of China, 2007, tables 14-8 and 14-12) (fig. 1). In fact, by 2006, the Chinese textile industry had 15,491 private firms and 742 state-owned enterprises (National Bureau of Statistics of China, 2007, tables 14-10 and 14-6). Another development that likely spurred increased efficiency was the growth in foreign direct investment in China’s industry. This integration of foreign-invested enterprises stimulated movement to standard international practices and more multinational trade (Brandt, 2008, p. 575).

With growing market-based competition, efficient use of inputs has become more of a focus. In China, raw materials account for at least 60 percent of

Figure 1

### Ownership of China's industry shifts to private sector



Source: National Bureau of Statistics of China, various issues.

production costs, so using waste and reusable fiber offers potentially significant returns (Clapp, 2008). Increasing concerns for environmental policy have led to more efficient practices and standards as well.

Anecdotal evidence has become available in recent years that corroborates the downward shift in waste. Colby and Gruere (2007) discussed estimates of waste in cotton yarn production in China, which have ranged from 8 percent to as low as 1 percent. As Colby and Gruere indicate, the standard practice when estimating current cotton consumption based on NBS yarn production statistics is to assume a waste factor closer to 3 percent than to 7 percent. USDA's previous estimates of the cotton mill-use equivalents of China's textile trade had included an adjustment factor to account for the difference between the larger waste implied by the 0.9 values in "Yarnwaste" and the widely accepted evidence that 3-7 percent waste was a better estimate for the 1995-2008 period. Removing this adjustment factor offsets some of the changes in estimated mill-use equivalents for textile trade that result from the changes in conversion factors previously detailed. The next section summarizes the changes in textile trade estimates resulting from these adjustments.

## Revised Estimates of Textile Trade in Cotton Mill-Use Equivalents

The revised estimates for yarn waste and cotton fiber share lower the estimated volume of textile trade in mill-use equivalents by varying degrees, depending on the year (fig. 2). Some of this reduction is offset by removing the adjustment previously imposed on the estimates to mimic the smaller yarn waste, but this previous adjustment also varied by year because waste was believed to have been higher in earlier years.

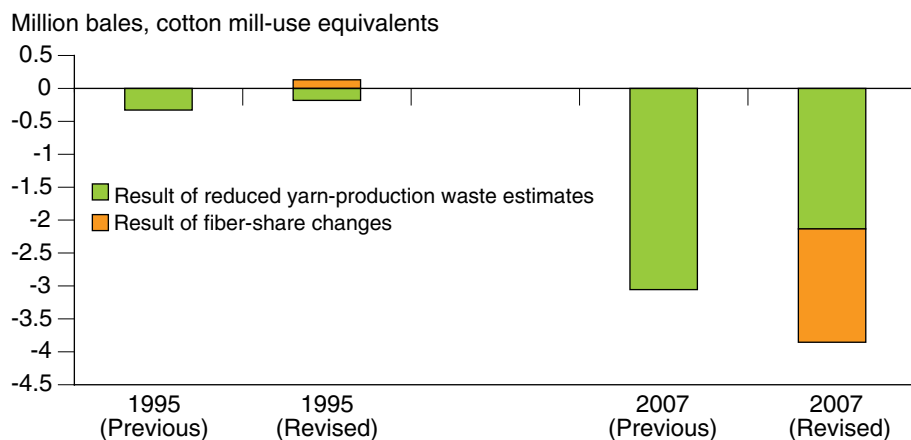
Estimated textile imports are 8 percent lower in 1995 following the revision, but the revised estimates for 2007 are virtually the same as the previous estimates. The removal of MMF Wadding accounts for much of this variation. Imports of MMF Wadding accounted for 8 percent of China's total mill-use equivalent imports in 1995 in the original estimates. Between 1998 and 2002, the share of MMF Wadding imports dropped from 7 percent to 1.5 percent, and by 2007, it had fallen to 0.6 percent.

Estimated textile exports are about 2 percent lower after the revisions. The impact of the revisions is much more stable for exports than imports, with a range of 1-4 percent over the entire 1995-2007 period. Net exports are actually higher in the revised data between 1995 and 1999, due to the large reduction in estimated imports. After 2000, the revised estimates average 2.6 percent lower than the original estimates, with a range of 1-4 percent.

The implication of these estimates is that China's net textile exports in marketing year 2006/07 were equivalent to 38 million bales of cotton mill use, which is about 700,000 bales below USDA's previous estimate and equals 77 percent of USDA's estimate for total mill use that year. Since 1999, China's net textile exports have been growing strongly, with fluctuations corresponding to changes in world economic growth and trade policy. The final section of this report reviews how China's textile trade has changed since 1995 and the factors influencing it.

Figure 2

### Corrections to estimates of China's net textile exports



Note: Previous corrections were those used in MacDonald (2007).

Source: MacDonald (2007), and calculated by ERS based on data from China Customs.

## Factors Affecting China's Textile Trade

To represent China's textile trade, an annual forecasting model was constructed that regressed cotton prices, exchange rates, World Trade Organization (WTO) membership, and world gross domestic product (GDP) on China's net textile exports between 1995 and 2006. The following model was estimated using ordinary least squares regression:

$$Y_{\text{Net exports}} = \beta_0 + \beta_1 X_{\text{Cotton prices}} + \beta_2 X_{\text{Exchange rate}} + \beta_3 X_{\text{WTO}} + \beta_4 X_{\text{World GDP}} + \varepsilon \quad (2)$$

Independent variables:

**Cotton prices**—Cotlook's A-Index was used to capture the impact of changing input prices on China's textile exports (Cotlook, 2008). The A-index averages the five least-cost cotton varieties in circulation, offering an accurate estimate of the market by portraying the most competitively traded volumes. As input prices rise, the profits in textile production and the volume decline, in both China and the rest of the world. If production declines faster in China's competitors than in China, then  $\beta_1 > 0$ .

**Exchange rate**—Since the costs of labor and capital for China's textile producers are in local currency (renminbi, or RMB), but exports are purchased in other countries priced in their local currencies, exchange rates also have an impact on China's textile trade. This model employs trade-weighted, real exchange rates calculated by the International Monetary Fund (2008). These exchange rates measure the value of the RMB, adjusted for relative inflation by country, and average this across China's trading partners, weighting by the amount of trade. The exchange rate is measured in units of non-Chinese currency per RMB, so increases correspond to real RMB appreciations. Since an appreciation would reduce the competitiveness of China's exports, the expected sign of  $\beta_2$  is negative.

**WTO membership**—Until 2005, the Multi-Fiber Arrangement (MFA) permitted WTO members to apply quantitative restrictions to textile imports (MacDonald and Vollrath, 2005). In 1995, the Agreement on Textiles and Clothing (ATC) established a mechanism to gradually eliminate MFA quotas on WTO members between July 1, 1995, and July 1, 2005. China became a WTO member in December 2001, and 2002 marked its first year of participation in the liberalizing ATC trade regime. Labor-intensive manufacturing sectors of China, and textiles and apparel in particular, profited greatly from the reduced barriers on exports to North America and Western Europe (MacDonald and Vollrath, 2005). To account for this difference in trade policy, China's accession to the WTO is represented in this model as a dummy variable. For all pre-WTO years  $X_{\text{WTO}} = 0$ , while starting in 2002, following China's accession to the WTO,  $X_{\text{WTO}} = 1$ . WTO membership is expected to have increased China's opportunity to export and that  $\beta_3$  is positive.

**World GDP**—The final variable used in this model is a measure of real world GDP obtained from the January 14, 2009, update of Global Insight's *World Overview*. An increase in world disposable income would warrant

greater demand, especially of normal goods like textiles, and the expected sign of  $\beta_4$  is positive.

This estimated model explains 98 percent of the variation in China's net exports, with a root mean squared error equal to 7 percent of the average level of trade during 1995-2006. The parameter values all had the expected signs. The parameter for price effects was significantly different from zero at the 10-percent level, and the parameter for income effects different from zero at the 1-percent level (table 2).

Since time series data are often subject to autocorrelation, the above model was tested to see if the observations had independently distributed errors to ensure they were not correlated with each other. A Breusch-Godfrey LM test for first-order autocorrelation was performed, resulting in a test statistic of 0.003 (Quantitative Micro Software, 2007). One cannot reject the null hypothesis of no autocorrelation with any appropriate level of significance based on this statistic.

To ensure the model is appropriately specified and that misspecification does not have an effect on the autocorrelation results, the model was tested for omitted variables with the Ramsey RESET procedure (Quantitative Micro Software, 2007). The RESET procedure tests functions of the dependent variable to gather insight on whether the error term represents any omitted variables. Testing against the null hypothesis of no omitted variables in the model, the Ramsey RESET procedure produces an F-statistic of 3.62. The probability of getting this F-statistic, given that the null hypothesis is true, is 0.1229. Although, this probability is not very large, it is not small enough to reject the null hypothesis of no omitted variables with a sufficient level of significance. Based on the Ramsey RESET procedure, the Breusch-Godfrey LM test for autocorrelation holds on the basis that no overt misspecification exists within the model.

To test the forecasting accuracy of this model, predicted net exports for 2007 and 2008 were calculated, using Global Insight's January 2009 forecasts of exchange rates and world GDP (fig. 3). The error for 2007 net exports was 11 percent, and 2008 exports are likely to have a similar error. Even though the forecasts are not extremely precise, the model is still appropriate enough to make suggestions on what factors influence China's textile trade. In particular, the current outlook for world economic activity in 2009 suggests that China's net textile exports might decline for the first time since 1996.

Although this is a forecasting model and not a model constructed to test the impact of individual factors in the determination of China's net textile exports, note that world GDP has a very important role in determining China's textile trade in this analysis.

Table 2

**Estimated parameters for variables in China textile trade model**

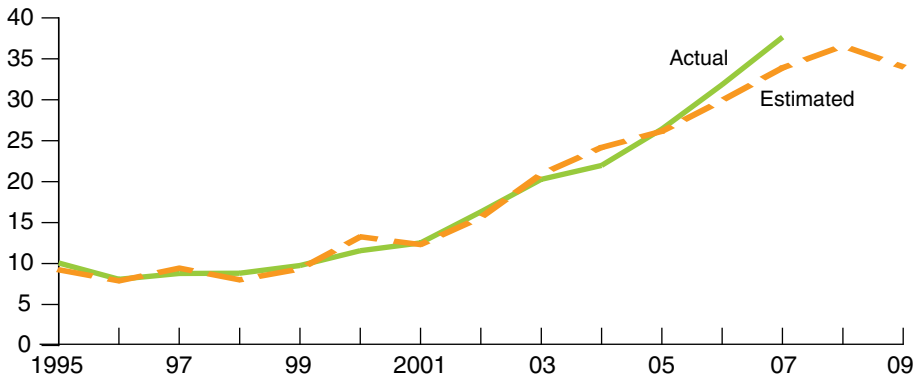
Variable	Coefficient	Standard error	t-statistic	P>t
Cotton prices	2706108	1288338	2.10	0.074
Exchange rates	-1975450	2528044	-0.78	0.460
WTO	3.36e+07	3.36e+07	1.10	0.309
World GDP	43244.35	5795.749	7.46	0.000
_constant	-1.11e+09	4.32e+08	-2.56	0.037

WTO = World Trade Organization.  
GDP = Gross domestic product.

Figure 3

**China's net textile exports, 1995-2009**

Million bales, cotton mill-use equivalents



Source: ERS calculations based on data from China Customs and Global Insight.

## Conclusion

The amount of fiber lost between the opening of a new bale of cotton and the delivery of finished cotton textile products is less than MacDonald (2007) previously calculated. Outdated estimates of the amount of fiber lost to textile production during spinning result in an overstatement of the current amount of cotton needed to produce China's net textile exports by about 5 percent. Outdated estimates of fiber content for a number of products lead to an additional 4-percent overstatement for current usage. Using anecdotal information, published estimates by MacDonald (2007) had revised the estimates for much of this error, but still, estimated cotton fiber needs for China's net textile exports are about 2 percent too high.

The analysis of the revised estimate of the cotton spun to produce China's exports has some implications for estimates of China's total cotton consumption. On the one hand, it establishes a minimum for the amount of cotton that China's textile mills consume. On the other hand, the textile trade estimates from this study are consistent with a wide range of estimates of total cotton consumption, given the lack of information about domestic consumption in China. Using USDA's estimate of total mill consumption of cotton, at 38 million bales in 2007/08, spinning for export is estimated to account for 77 percent of all of China's cotton consumption. This estimate would suggest that China's cotton consumption is primarily used to supply finished products to consumers outside of China rather than within China.

An econometric model of textile trade combined with forecasts of world economic activity and exchange rates suggests that China's textile exports might fall in calendar year 2009. If exports account for the majority of spinning, cotton consumption and imports by China could fall in 2008/09. USDA is forecasting lower cotton consumption for China in 2008/09, but the forecast is based on a variety of information. Press and industry reports from China suggest a slowdown in cotton spinning, but slowing domestic demand may be the reason for the decline.

This study leaves unanswered the question of how much cotton is being consumed by households within China in the form of clothing and household products. If China's textile industry is domestically oriented, then total mill use of cotton may be significantly higher than USDA estimates. MacDonald (2007) addresses estimates of China's domestic consumption and finds evidence for a broad range of estimates. Therefore, although this study suggests that China's textile trade in cotton mill-use equivalents is smaller than previously estimated, this study does not offer strong evidence that estimates of total cotton consumption should be reduced.

Many questions about cotton consumption in China are still unanswered at both the industrial and household levels. Furthermore, this study by no means resolves every question about converting data on textile trade to mill-use equivalents of cotton fiber. A particularly important issue that this study does not address is the implication of this research for USDA's estimates of consumer demand for cotton by U.S. households (Meyer et al., 2007, app. table 25). Although further research on how to translate trade volumes into textile mill activity in both the United States and China is necessary to refine

the estimates that this study addresses, the much larger questions about consumer demand and industrial consumption in China are not addressed here. Analysis of China's trade data can help advance that larger research agenda.



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