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China's Cotton Supply and Demand: Issues and Impact on the World Market

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Abstract

USDA has developed a new approach for estimating cotton consumption in China based on textile import and export data, supplementing the traditional methodology that uses yarn production data from China's National Bureau of Statistics. This analysis suggests USDA's historical estimates of China's cotton consumption are reasonable and USDA's August 2007 forecast may be conservative. These insights into the amount of cotton consumed by China's textile mills, combined with data on China's cotton exports and imports, suggest there may be problems with the official estimates of China's cotton production. Uncertainties regarding the level of production and consumption of cotton in China mean that the potential remains for unexpected changes in China's cotton import demand that could destabilize world commodity markets despite increased global communication. These unexpected changes highlight China's impact on world cotton markets and the lack of transparency in China's intervention in its domestic cotton markets and official cotton stock accumulation.

Keywords: cotton, China, textiles, trade, consumer demand, statistics

Contents

Approved by USDA's World Agricultural Outlook Board

Note: All references to forecasts in this paper refer to forecasts as of August 2007.

Introduction

China plays a dominant role in the world's cotton economy, but many basic facts about cotton in China remain uncertain. China's textile mills reportedly consume more than 40 percent of the world's cotton, but China's cotton statistics are unreliable. Since 2000, a chronic imbalance has developed in authoritative estimates of China's supply and demand for cotton. Therefore, it is likely that either consumption or production has been measured incorrectly in recent years, an error with significant implications. This study developed an alternative estimate of China's cotton consumption to determine if published estimates by USDA and others can be corroborated. China's textile trade was analyzed to determine its cotton content. Patterns of income growth and cotton clothing consumption, both in China and on a global level, were also analyzed. This analysis suggests that China consumed 50 million bales of cotton in marketing year 2006 (MY August-July), suggesting China's official cotton production is underestimated.

China's economy has moved toward a reliance on market signals rather than government fiat in recent years. In addition, the openness of the economy to international influences has increased, and the secrecy with which the government treats economic data has been reduced. China and the rest of the world now exchange goods and information to an extent that was unthinkable even a few years ago, but this exchange is still incomplete. China's economy is substantially less open than the economies of other developing and middle-income Asian countries (as measured by the ratio of trade to gross domestic product). This is partly a function of China's size, but it is also a function of policy. While foreign investment may flow into China and companies in China are beginning to invest elsewhere, restrictions on capital movement from China are well known, as is the role China's government agencies play in the allocation of bank lending (Gale and Collender, 2006). Perhaps even more well known is the government's role in determining the value of China's currency.

China has come a long way in opening channels for the exchange of capital, goods, and information. World cotton markets function more efficiently as a result of these changes—more timely knowledge is communicated about cotton supply and demand in China. However, the world still needs more information about China's cotton consumption, production, and stocks.

China's government does not provide estimates of mill use of cotton in China. Unofficial estimates from government agencies in China and estimates by USDA, the International Cotton Advisory Committee (ICAC), Cotton Outlook, and others outside of China have traditionally been derived from reports of total yarn production provided by China's National Bureau of Statistics (NBS). China's 2004 Economic Census revealed significant shortcomings in previous NBS yarn production reports, and the estimates of cotton's share of total yarn production have grown increasingly tenuous in recent years (Colby, 2006). These issues were recently surveyed in ICAC's *Review of the World Cotton Situation* (Colby and Gruere, 2007). Because of these problems, USDA has developed an alternative, two-part derivation of estimated mill consumption. The first part is an estimate of the volume of

cotton contained in the textiles China exports. The second part is an estimate of the volume of cotton contained in the textiles consumed by households in China.

This report uses the estimates of the cotton in China's textile exports as a springboard to examine the consumption of cotton fiber products by households in China. The first section estimates China's textile trade from 1999-2004 in terms of cotton fiber-equivalents at the mill consumption level. This analysis is used to establish an estimate of past household consumption of cotton within China. Subsequent sections address likely future developments in China's textile trade and consumption by households, the impact of those developments on world cotton markets, and the issues involved in estimating China's supply and demand of cotton (see box, "USDA's World Agricultural Supply and Demand Data").

USDA's World Agricultural Supply and Demand Data

USDA maintains a large database of agricultural supply and demand estimates for the United States and other countries. The data for major products are reviewed each month by USDA's Interagency Commodity Estimates Committees (ICECs). Each ICEC is chaired by an analyst from the World Agricultural Outlook Board (WAOB) and includes analysts from the Economic Research Service (ERS), the Foreign Agricultural Service (FAS), the Agricultural Marketing Service (AMS), and the Farm Service Agency (FSA). Monthly, ICECs meet to evaluate current forecasts, new data from USDA's National Agricultural Statistics Service (NASS) and other sources, new information on foreign markets from the FAS staff at foreign posts and other sources, and important U.S. policy developments.

The data cover the period beginning as early as 1960, extend to the present, and include a forecast of the coming year. The data are partly made available through the monthly publication of the W*orld Agricultural Supply and Demand Estimates* by the WAOB. For cotton, a subset of current data are also published by ERS in the *Cotton and Wool Outlook* and by FAS in *Cotton: World Markets and Trade*. An updated version of the entire database is available at Production, Supply, and Distribution Online (http://www.fas.usda.gov/psdonline/). This paper uses the historical data and forecasts distributed by USDA in August 2007.

Estimating the Fiber-Equivalence of Textile Trade

China is the world's largest textile exporter. According to the World Trade Organization (WTO), China accounted for 25 percent of the world's textile and clothing export value in 2005. The $110 billion of textiles and clothing China exported in 2005 contained millions of bales of cotton, and USDA has undertaken an effort to calculate this amount. Ultimately, all estimates depend on the data used to develop them, and there are many questions concerning economic data from China. It is plausible, however, that China's trade data are more reliable than its data on domestic economic activity. As China has opened its economy to outside influences, its trading partners have at times become concerned about the competition China's exports have offered on world markets. This has been particularly true for textiles, which was one of China's first growth sectors in the post-1978 economic reorientation. The volume of China's textile trade has been an issue at the highest levels of government, and China's trading partners have scrutinized data on textile imports from China extensively, providing incentives for China to maintain high standards in its textile trade reporting.

USDA has been estimating the raw-fiber quantity of U.S. textile imports and exports since 1960. For each product with a 10-digit code in the Harmonized Tariff Schedule of the United States (HTSUS), USDA has obtained information from contacts in the textile industry to develop factors for conversion from textile-product weight. These conversion factors were applied to China's trade after some adjustments.

As an example, consider one specific group of women's sweaters, HTSUS 61109090 (see Appendix for details). Without buttons or zippers, they are 100 percent fiber and, on average, 45 percent cotton. Therefore, 1 kilogram of sweaters includes 450 grams of cotton fiber. There is waste, however, involved in producing yarn products and other fabrics. Even though lost fibers are recycled, some proportion is still lost. Assuming that 3 percent of the cotton fiber used to spin the sweater's yarn is lost, and given further losses in knitting and assembling, a total waste factor of 22 percent is applied. The result is a total of 549 grams as the cotton fiber-equivalent of 1 kilogram of sweaters. If each sweater weighs 403 grams, on average, the per sweater, cotton fiber-equivalent is 549 grams * 0.403 = 221 grams.[1]

Such calculations show that, in 2006, China exported almost 41 million bales (fiber-equivalence) of cotton in the form of textiles and imported more than 8 million bales. Therefore, about 32 million bales of the cotton spun in China's textile mills in 2006 were used to supply the rest of the world with textile products (table 1).

Similar calculations have been undertaken by the International Cotton Advisory Committee/Food and Agriculture Organization (FAO) and PCI Fibres, among others. Of these, FAO has published the most extensive discussion of its methodology, which is similar to USDA's, and its aggregate results are

[1]Errors are inevitable in various estimates at the detailed product level. It is assumed, over a large number of products, that errors are in offsetting directions, and the aggregated estimate of fiber-equivalence is reliable.

similar. While USDA and FAO estimates for total net exports are virtually identical for 2004, USDA's estimated net exports averaged 825,000 bales higher from 2000-2005. USDA's estimates for clothing trade are typically lower than FAO's, but USDA's fabric trade estimates are typically higher. PCI Fibres' 2004 estimate is lower than both USDA's and FAO's, but is close to some unpublished estimates.

Table 1
China's textile trade in cotton mill use equivalents, 2006

	Exports	Imports	Net exports
Million bales			
Yarn	3	4	-2
Fabric	11	3	8
Clothing, etc.	27	1	26
Total	41	8	32
Percent increase from 2005			
Yarn	19	14	-6
Fabric	11	-2	17
Clothing, etc.	17	-8	18
Total	15	5	18

Totals may not add due to rounding.
Source: ERS calculations based on data from China Customs.

Domestic Demand for Cotton Textiles in China

While China is the world's largest textile exporter, it also has the world's largest population and is the world's second largest economy.[2] China is itself a significant consumer of textiles, and it is not uncommon for analysts to conclude that China's domestic demand for cotton textiles is greater than its export demand. Furthermore, overall demand for textiles in China is growing. Economic growth in China has, in recent years, surpassed that of any other country, fueling consumers' demand for textile products. NBS reported that real expenditures for clothing rose 23 percent in China in 2005. However, clothing expenditures undoubtedly included increased value-added by retailers and purchases of products comprised of all fibers, not just cotton. The measurement of household textile consumption is a difficult undertaking in any country. In China, these measurements are hampered by rapid structural change, gaps in the application of laws, and a legacy of official secrecy.

This study looks at estimates of China's domestic demand (also referred to as "end-use") of cotton textiles in two steps. The first step is the broadest, establishing a reasonable range for estimates of per-capita end-use of cotton in recent years. The second step examines how end-use might be growing, specifically addressing the implications of this growth for estimated mill use of cotton in China in MY 2007.

Estimated Cotton End-Use, 1999-2004

Traditionally, the household end-use consumption of cotton in China was determined as a residual of the difference between total mill use and products exported, with the work by FAO being the most well-known example (see equation 1):

(1) End-use consumption by = China's total − Fiber-equivalence
households in China   mill consumption   of textile net exports

Total mill use has been estimated using official government statistics of yarn production in China and a combination of official statistics and unofficial estimates of the share that cotton accounted for in yarn (Colby and Gruere). Drawbacks to this approach include the fact that, for a number of years, the estimated cotton share has been subject to a great deal of uncertainty, and in 2004, an economic census of the textile industry exposed significant errors in the statistics for total yarn production (Colby). The rapid growth in the industry hindered the ability of the government to maintain up-to-date information necessary for accurate surveys. Furthermore, countries with extensive government regulation are prone to develop an underground economy. Corruption is acknowledged to be widespread in China, although not necessarily in the textile industry (Pei). Nonetheless, tax avoidance and other concerns affect the quality of the yarn production data, calling into question estimates of household end-use that are a function of the yarn-based consumption data.

If China published data on cotton stocks, assuming China's cotton production and trade statistics were reliable, the estimates of total China mill use could be checked as a residual from the rest of the balance sheet. Unfortunately, cotton stocks were long considered a state secret in China, and the legacy of this practice remains. While it is evidently no longer a crime to publish estimates of total cotton stocks in China, the size of the government's substantial reserve stocks remains confidential.

As a result, existing estimates of China's mill use of cotton provide the initial basis for deriving an estimate of the consumption of cotton textile products by consumers in China, despite these estimates' shortcomings. USDA's mill use estimates from 1999-2004 were typically similar to those of ICAC and Cotlook, as well as estimates provided unofficially from China (see box, "Alternative Sources of Cotton Supply and Demand Data"). On average, USDA's estimates ranged between the ICAC and Cotlook estimates. The maximum and minimum of these three differed by less than 4 percent (or less than 250,000 tons) on average. Given this consensus, it is reasonable to estimate end-use by consumers in China by subtracting estimated net trade from USDA's estimate of mill use. This estimate of end-use or domestic consumption will be referred to as "USDA implied."

According to USDA implied estimates, China's end-use of cotton textiles averaged about 12 million bales annually from 1999-2004. This was approximately 12 percent of the world's total cotton consumption and is equivalent to about 2.0 kilograms per capita. In the United States, per capita end-use is estimated at 15.6 kilograms over that same time period.

Alternative Sources of Cotton Supply and Demand Data

Cotlook Limited is an independent Merseyside-based company that has been engaged in publishing cotton news for approximately 80 years. For over 25 years, it has compiled and published the *Cotlook A Index* of raw cotton values. The *A Index* is widely regarded as the reliable barometer of world cotton values and used as a key price indicator in U.S. farm legislation. Cotlook also publishes estimates of world cotton production and consumption by major country in its weekly *Cotton Outlook*. In this report, all references to Cotlook forecasts are forecasts as of August 2007.

The International Cotton Advisory Committee (ICAC) is an association of governments formed in 1939 of cotton producing, consuming, and trading countries. The mission of the ICAC is to assist governments in fostering a healthy world cotton economy. The ICAC serves as a clearinghouse for technical information on cotton production, as well as a forum for discussing cotton issues of international significance. ICAC publishes estimates of world cotton production and consumption by country in its *Cotton this Month* and its annual *World Cotton Statistics*. In this report, all references to ICAC forecasts are forecasts as of August 2007.

PCI was formed in June 1988 as a consultancy to monitor fibers and plastics markets together with the related petrochemical feedstocks and intermediates. Within the PCI Consulting Group, PCI Fibres offers a range of specialized services on a single- and multi-client basis, through monthly, annual, and special reports.

This estimate for China is slightly lower than FAO's estimate for 2004, which was 2.2 kilograms per capita, but the difference is not significant. The difference between USDA and PCI's 2004 estimate of 3.1 kilograms per capita is larger, but appears to be well within the bounds of expected variation (table 2).

Table 2
China cotton textiles, 2004

	Net exports	Mill use	End use	
	----------------------Million bales----------------			Kg/capita
PCI Fibres	17.5	35.8	18.3	3.1
FAO	23.0	36.2	13.2	2.2
USDA*	22.9	16.0	12.9	2.2

*Not official USDA data.
Sources: ERS calculations, USDA, FAO, and PCI Fibres.

Comparing China's End-Use with Other Countries'

It is a challenge to estimate the domestic end-use of textiles in China or any country. The best source of information is the FAO consumption survey, which provided estimates of consumer end-use in 2004 for more than 100 countries, allowing comparisons with China. These initial comparisons are restricted to the relationship between end-use of cotton and income, and the comparisons indicate that a wide range of estimates are reasonable for China.

A cross-sectional analysis of the relationship between income and per capita cotton consumption using the FAO data for 2004 indicates that China's income is consistent with an estimated consumption of 1.5 kilograms/per capita (see equation 2):

(2) $\$5,115 * 0.291725 \text{ kg}/\$ + \$5,115^2 * 0.001557 \text{ kg}/\$^2 = 1.533 \text{ kilograms}$
     (6.414)   (0.983)   (t-statistics in parentheses)

> $\$5,115$ is China's 2004 nominal GDP/capita (market exchange rates converted to purchasing power parity (PPP) basis to account for the lower price of services in China compared with the United States).

> $R^2 = 72\%$

> Standard error (SE) of the China estimate = 2.196 kilograms

However, the large variability of per capita cotton consumption from country to country, even when incomes are similar, means widely ranging estimates for China are reasonable based on income level (fig. 1). There-fore, the difference between FAO's reported 2.2 kilograms per capita and the 1.5 kilograms per capita implied by the average global relationship between income and cotton consumption is not important, nor is the differ-

Figure 1
Income and cotton consumption by country, 2004

Kilograms of cotton per capita

GDP per capita (thousand U.S. dollars, adjusted for purchasing power parity).
Source: ERS calculations based on data from FAO, Global Insight, and the World Bank.

ence between the 2.2 kilograms and the 3.1 kilograms estimated by PCI. PCI's estimate is also within one standard error of the regression-based estimate, which is the best benchmark USDA has developed to date. Further research is necessary to account for other factors and determine if current estimates for China can be corroborated with respect to expectations derived from fundamental economic principles.

This wide range also means that this analysis cannot rule out a much larger share for cotton in China's yarn production than has been assumed by USDA and ICAC. Uncertainty regarding cotton's share of China's total yarn production is one of the drawbacks of the traditional estimates of China's cotton consumption. The last estimate published in 1991 by China's government was 71 percent. Conventional wisdom among officials, industry, and analysts in China is that the share is 64 percent. However, USDA and ICAC have been using lower estimates in recent years, as China's low net imports of raw cotton have exposed inconsistencies in cotton supply and demand balance estimates. USDA's mill consumption estimates are currently consistent with the assumption that cotton's share of total yarn production in China is approaching 55 percent.

If USDA assumed a 64-percent share for MY 2006, China's cotton consumption would be estimated 7 million bales higher than current estimates. Since this assumption has no bearing on the estimated level of exports, estimated consumer end-use in China would bear the entire adjustment. In per capita terms, the end-use estimate would go from 2.5 kilograms to 3.6 kilograms. This would create a 45-percent increase, but would still be within one standard error of the 1.5 kilograms per capita derived from the international cross-sectional analysis. The fact that PCI Fibres estimated per capita consumption at 3.1 kilograms in 2004 and China's economy has grown strongly since then, means a higher estimate for 2006 was even more plausible.

This analysis has established a broad initial range for per capita end-use of cotton textiles by Chinese consumers. While an average global relationship with income indicates that an estimate of 1.5 kilograms per capita would be appropriate for 2004, most analyses specific to China favor a higher estimated level of consumption. This suggests 2 kilograms per capita is a reasonable estimate as a 1999-2004 average. Given the rapid growth in China's economy, cotton end-use is probably growing, indicating that the estimate for 2004 should be even higher.

Forecasting China's Domestic Cotton Textile Consumption

Rather than developing models for consumer end-use of all fibers in China and cotton's share of these fibers, this study will address cotton consumption directly. In effect, income will be assumed to determine the net impact of changes in both total fiber demand and in cotton's share[3] (see MacDonald, 2006a, for changes in shares of consumption by fiber).

Two income variables are applicable to cotton end-use consumption: real consumer expenditures on clothing (CEC) and GDP. China's economy is investment driven compared with more developed economies like the United States. Furthermore, even developed economies find much of their GDP variation stemming from changes in investment rather than from consumption. This adds to the intuitive appeal of using CEC as the variable to forecast cotton end-use. On the other hand, CEC is based on data from NBS, which is the source of yarn production data that recently underwent such profound revisions. Concerns about NBS's yarn production estimates could just as well apply to its clothing expenditure estimates. Finally, CEC is available only on a lagged basis, while forecasts of China's GDP are available from several sources. Although China's GDP estimates have not been without controversy in recent years, this study will emphasize cotton end-use estimates implied by GDP (figure 2).

For this analysis, estimates of China's end-use of cotton were developed based on both CEC and GDP for comparison purposes. For additional comparison, historical estimates replicated the path end-use would have taken from 1999-2004 if it had been determined simply by changes in CEC or GDP, while also realizing the same average as the implied USDA estimate for the same years (table 3). After the 2005 calendar year, CEC-based estimates are based on estimated (1999-2005) income elasticity of 1.2 for

[3]FAO data show cotton's share of all fibers consumed by households in China was 23 percent, compared with 45 percent for the United States.

Figure 2
China's clothing expenditures and GDP
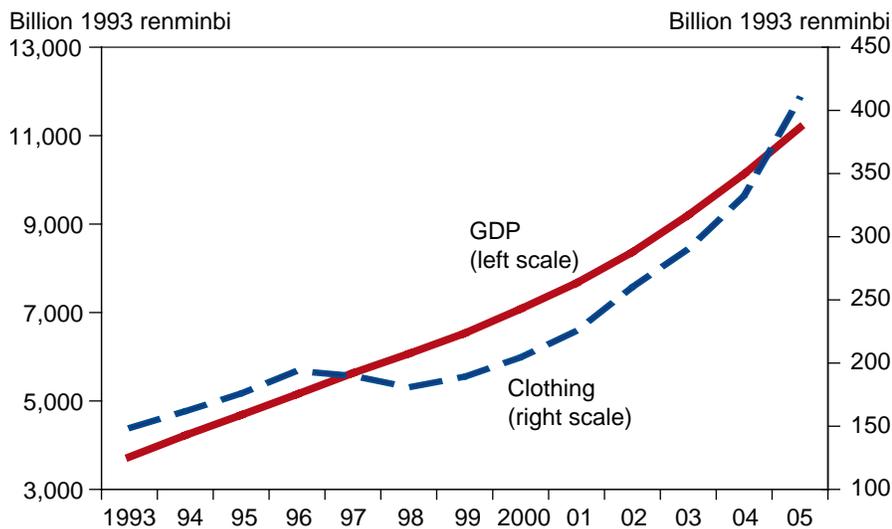
Source: ERS caclulations based on data from Global Insight and National Bureau of Statistics (China).

Table 3
China's cotton mill use for domestic consumption

Marketing year	USDA Implied	Estimated: GDP-based	Estimated: expenditure-based	Estimated: 64% share
		Million bales		
2004	13.9	14.6	16.0	17.6
2005	15.6	16.0	18.7	22.0
2006	15.5	17.6	20.8	25.8
2007	12.4	19.3	23.7	29.5

Sources: USDA and ERS calculations.

clothing expenditures. Calendar year GDP-based estimates are based on the assumption that the income elasticity of cotton end-use demand is 0.86, based on a previous USDA study (Seale et al.). Estimates are made on a calendar year basis to correspond to the availability of macroeconomic data and weighted averages (lagged 2 months) used for marketing years.

The GDP-based estimates start from a MY 2004 level about the same as USDA's implied estimates, and the two grow at about the same rate in MY 2005. In MY 2006, however, USDA's implied end-use consumption declines 8 percent. In contrast, China's rapidly expanding economy drives the GDP-based estimate up 9 percent. That pattern repeats itself in 2007, showing a 4.7-million-bale gap between the two estimates. The pattern is even more pronounced for the CEC-based estimates, with a 9-million-bale gap in MY 2007. Finally, if China's total cotton mill consumption is estimated with the assumption that cotton's share of yarn production is fixed at 64 percent, China's MY 2007 end-use would be more than twice the 12.4 million bales implied in USDA's MY 2007 mill use estimate.

Trends in China's Textile Trade

In order to examine the implications of various end-use estimates on the level of estimated mill use, it is necessary to determine the amount of cotton spun for exported textiles. This analysis relies on two broad assumptions. The first assumption is that the methodology for converting textile trade into fiber-equivalents is valid. The second is that the trends observed in China's textile trade through December 2006 will continue to hold through July 2008 (table 1). The latter assumption is supported by the economic and policy environment facing China's exporters between August 2007 and July 2008.

Forecasting China's exports for the rest of 2007 and 2008 involves consideration of a number of factors. World economic growth is expected to slow slightly from 2006's unusually strong level, China's currency—the renminbi—is appreciating 3-4 percent annually, and China recently made its value-added tax rebates for exporters less favorable. A Ministry of Commerce official in China indicated at the end of 2006, however, that China's textile exports were expected to grow 15-20 percent in 2007. China's NBS regularly reports on investment in China's textile industry, and investment during 2006 was supportive of continued growth in textile production, faster than rates of domestic consumption during 2007. If the volume of net fiber-equivalent exports remains on the same trend as the last 10 years, 15-16 percent growth can be expected through 2008. More sophisticated time-series analysis (ARIMA modeling) of the data suggests 19-percent growth (fig. 3). These forecasts are not statistically different, so an unweighted average of the two was used.

The safeguards on China's textile exports permitted by the Agreement on Textiles and Clothing and applied by the European Union are in effect through 2007, and those applied by the United States are in effect through

Figure 3
China cotton textile net exports, 2004-08

Million bales (fiber-equivalence)
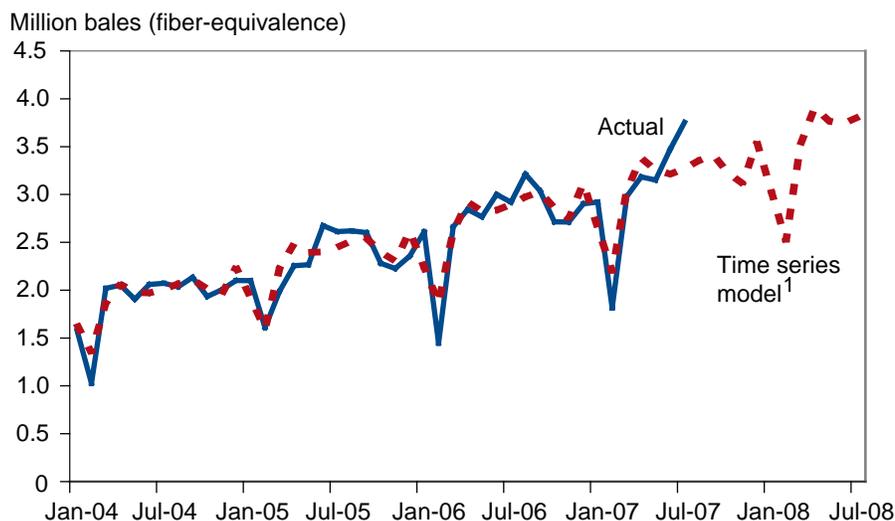
[1]Auto-regressive integrated moving average (ARIMA) model, with p = d = q = 1.
Source: ERS calculations based on data from China Customs.

2008 (MacDonald and Vollrath). Since these safeguards were present in 2005 and 2006 as well, this situation does not represent a change. The authority to utilize these safeguards expires at the end of 2008, per the provisions of China's 2001 WTO accession agreement. This suggests stability in the current policy environment for the coming year, supporting the theory that, with continued favorable global economic growth, it is reasonable to expect China to continue its current export pace.

If the average of the monthly forecasts produced by the 10-year trend and the ARIMA models is used to forecast monthly fiber-equivalent cotton net exports of textile products, and if mill use is assumed to have occurred 2 months preceding shipment, then China would be expected to consume 34.9 million bales of cotton in its textile mills for textile exports in MY 2006. This would be 5.5 million bales or 19 percent more than in MY 2005. For MY 2007, the estimate would be 41.1 million bales, a 6.2-million bale (18-percent) increase. This estimate for exported textiles alone would be more than double what USDA estimates China consumed in MY 1999 for all purposes. It would also be a 400-percent increase in net exports since 1999.

If the assumptions behind the 41-million-bale estimate of MY 2007 cotton textile net export fiber-equivalence are accepted, then expected total mill use becomes a function of China's MY 2007 domestic cotton textile end-use estimate. USDA's estimate of 54 million bales of mill use implies that end-use consumption of cotton textiles in China will fall to its 2004 level. The lowest alternative end-use estimate developed in this study, the GDP-based estimate, implies MY 2007 mill use of 60 million bales, 6 million bales more than USDA's estimate (table 4).

Table 4
China's total cotton mill use (by estimate and source)

Marketing year	USDA	Estimated: GDP-based	Estimated: expenditure-based	ICAC	Cotlook
		Million 480-pound bales			
2004	38.5	39.1	40.6	37.8	38.1
2005	45.0	45.4	48.1	43.4	43.2
2006	50.0	52.1	55.2	48.2	47.1
2007	54.0	60.9	65.2	50.7	49.4

USDA, ICAC, and Cotlook estimates and forecasts as of August 2007.
Sources: USDA, ERS calculations, ICAC, and Cotlook.

Conclusions and Implications

This exercise highlights the conservative nature of USDA's MY 2007 forecast of China's cotton mill use. By this same measure, ICAC and Cotton Outlook's estimates of China's mill use seem even more conservative. If we assume that the analysis of China's textile trade is correct, then these forecasts imply that consumers in China can be expected to purchase 29-33 percent less cotton textiles in MY 2007 than in the previous year (fig. 4). USDA's estimate implies a 15-percent decline. A comparison with the United States gives one pause: U.S. end-use of cotton has declined only once in the last 10 years—during 2001 when real GDP growth fell to its lowest in the last 15 years.

Caveats are always important in any China forecast. Given the vast uncertainties about developments within China—and the volatility of estimates for textile end-use in any country—it is possible that end-use is falling. Possibly, changes in cotton's fiber share at the household level are keeping household end-use of cotton constant while changes in bank lending drive large swings in textile inventories, in turn driving apparent end-use upward and then down from 2003-2007.

Ultimately, we are left with the uncertainty that, in the not too distant future, China's demand for cotton imports could differ by millions of bales from the consensus forecasts of only a few months earlier. The implications of such a shock for world cotton prices, households consuming textiles around the world, and U.S. commodity programs would be significant. The continuing possibility of this shock is an uncertainty that imposes costs on the world's cotton sector, including China.

In recent years, USDA and ICAC responded to the persistent gap between cotton production and consumption in China by including an adjustment in their balance sheets. This adjustment could conceivably represent errors of

Figure 4
China's domestic end-use consumption of cotton textiles
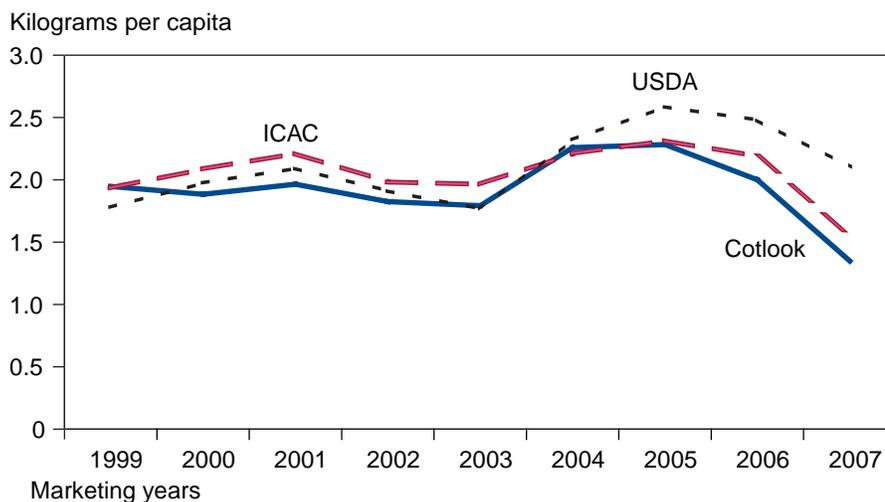
Sources: ERS calculations based on August 2007 data from USDA, Cotlook Ltd, the International Cotton Advisory Committee, and China Customs

underestimation in production or overestimation in consumption on a net basis. In July 2007, ICAC determined that its adjustment was the result of underestimated production and revised its production estimates for MY 1994 through 2007 accordingly. USDA also revised its MY 2005 through 2007 estimates upward and revised its adjustment downward by a small amount. That was the first time USDA had published a China agricultural production estimate that deviated from the estimate provided by NBS.

China's role in the world economy has grown significantly in recent years, and its already large role in world cotton markets has also expanded. Investment in infrastructure, higher incomes, and economic development has transformed trade, communication within China, and communication between China and the rest of the world. The benefits of improved understanding of cotton production and consumption in China will be reaped at home and abroad, setting the stage for further gains. Possible further research endeavors to this end include surveys of household consumption in China, better understanding of the factors driving cotton production in China, and studies of China's markets for textile products. (see box, "The Importance of Information about China's Cotton Sector")

The Importance of Information about China's Cotton Sector

The aspect of China's cotton market that most interests world cotton markets today is China's likely demand for imports. While large, China's textile exports and their impact on cotton spinning outside of China are relatively well established. Trends in production are important when trying to anticipate imports, and China has a longstanding system for publishing production estimates. China's economy is also sufficiently open so that informed discussion is possible concerning the validity of those estimates, particularly those for Xinjiang, the source for 40 percent of China's domestically produced cotton. China also has a longstanding system for publishing yarn production data and information about cotton yarn. If the issues revealed by the 2004 Economic Census are addressed, more light can be shed on the perennial question of the cotton share of China's yarn production. Altogether, this means there is a significant amount of information about production and consumption on the outlook for imports.

Information on the level of stocks in China needs additional breadth and depth. Surveys of industrial stocks and commercial stocks are increasingly available from non-government sources. The reform of China's cotton sector, starting in 1999, involved a shift from micro-economic decision-making to a policy of "macro-control," in part implemented through the acquisition and disposal of cotton stocks. Government stock-holding is a fairly common policy instrument around the world. Secrecy regarding the level of these stocks is less common. When a country consumes 40 percent of the world's cotton, withholding such information can have a significant impact on world markets.

Transparency is one of the principles guiding the multilateral efforts to develop the international trading system over the last several decades. Through research and continued increases in the availability of economic information, the world may gain a better understanding of China's cotton sector, and avoid the disruption of unexpected, large changes in China's import demand.

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Appendix: Calculating Fiber-Equivalents

USDA has been estimating the raw-fiber quantity of U.S. textile imports and exports since 1960 (Lawler and Johnson). For each product with a 10-digit code in the Harmonized Tariff Schedule of the United States (HTSUS), USDA has obtained information from contacts in the textile industry to develop factors for conversion from textile-product weight. For each product, USDA determined:

1. Fiber's share of the product's weight,
2. Cotton's share of the product's fiber content,
3. Waste resulting from yarn manufacture,
4. Trim waste from the weaving and knitting of fabric, and
5. Cutting loss in apparel and other finished product operations.

This information is combined to create a conversion factor for estimating the quantity of raw fiber needed to make the various textile products, beginning with the bales of raw fiber opened at the spinning mill. There are approximately 7,000 import conversion factors and 2,000 export conversion factors. The last extensive revision of these factors occurred in 2001.

Existing U.S. import conversion factors were used to develop conversion factors for China's exports and imports. Developing an entirely new set of conversion factors was not feasible. Furthermore, the conversion factors for China's largest market for textile exports (the United States) are a good estimate of the factors that apply to China's trade. The U.S. conversion factors were first converted to trade-weighted averages at the 6-digit HTSUS level to ensure product concordance with China's trade data. By averaging to the internationally harmonized product level, and focusing only on products that contain cotton, the number of conversion factors was reduced to 569.

Global Trade Information Service (GTIS), which publishes data from China Customs, provided the import and export data from China used in this analysis. The GTIS World Trade Atlas reports some data in kilograms and other data in non-weight units, such as meters and square-meters for fabric and pieces or numbers for clothing. China reports most of its trade in kilograms and these other units, but GTIS distributes only non-kilogram data for a large number of products. However, GTIS data is available back to 1995 and is updated each month. This makes GTIS an appropriate data source despite the need to develop additional conversion factors. Units of measure conversion factors into kilograms for the products reported in non-weight units were developed using data published by China's National Bureau of Statistics (NBS) at the 8-digit level, supplemented with data on U.S. imports for products which China does not report in kilograms. The 6-digit conversion factors are trade-weighted averages.

Continuing the example of sweaters developed previously, China's trade data shows that for HS 61109090, each article weighs 403 grams. Given the same example, each sweater would have 0.4 * 450 grams or 180 grams of cotton at the textile product level. The amount of fiber consumed by textile

mills to produce this would be 1.22 * 180 grams or 220 grams. Note that the 6-digit HS 611090 includes a number of other products in addition to 61109090, and on average, each sweater has a cotton fiber-equivalence of only 70 grams (app. table 1).

Researchers' estimates of the same country's fiber-equivalence of textile trade can differ for a variety of reasons. Variation in product coverage is one reason. Textiles are included in a very large number of products, and resource constraints often dictate that researchers limit their data acquisition and analytical efforts, with different studies selecting different products on the margin. Another reason is differences in conversion factors. Again, the information requirements are enormous, especially for studies involving large numbers of countries over long spans of time. Some studies use standardized conversion factors for groups of products, while others emphasize product detail. Waste factors can also vary, with some China-specific research indicating that cotton spinning in China has a smaller amount of waste than embodied in USDA's estimates for the United States. In this study, estimated spinning waste was adjusted downward to concord with the historical estimates USDA and others have been using in the conversion of NBS yarn production data into estimated cotton consumption.

Finally, China reports significant imports of textiles from itself, and the treatment of this trade can affect estimates of total trade. In 2006, 15 percent of China's textile imports were reportedly from China. China has extensive export processing zones and differing tariff and tax treatment depending on whether the output of plants is intended for consumption within China or for export elsewhere. Possibly, these imports from China are from export processing zones or from firms legally obliged to export. Keeping these imports in an estimate of China's total imports may skew calculations of net

Appendix Table 1
China's 2006 textile exports in cotton fiber-equivalence

HS Code	Description	Cotton per piece	Exports in 2006	Fiber-equivalence of 2006 exports
		Kilograms	*Number*	*480 lb bales*
611090	Sweaters, Pullovers etc, Knit etc, Textiles	0.07	265,190,652	79,290
610342	M/B Trousers, Overalls, Shorts, etc. Cotton, Knit	0.32	96,796,759	144,376
620520	Men's or Boy's Shirts	0.35	235,567,309	374,729
....	....	....	....	....
(566 other products, including yarn, reported in kilograms and fabric reported in meters)				
....	....	....	....	....
—	Yarn	—	—	2,694,228
—	Fabric	—	—	11,112,087
—	Clothing and other products	—	—	26,759,370
—	Total	—	—	40,565,685

Source: ERS calculations based on China Customs data.

exports or end-use demand if these "imports" are goods actually located in China. Alternatively, these imports could be from bonded warehouses with unknown original sources. Or, they could be products initially recorded as exports to other destinations for tax purposes, but actually only traveled short distances on coastal shipping and are acknowledged as having been sourced in China. Currently, USDA does not adjust its trade data to account for imports from China, relying on the total figures for imports from all destinations supplied by China Customs for its calculations.