EXPLORING POTENTIAL GROWTH IN END-USE DEMAND IN CHINA AND INDIA Jon Devine Kim Kitchings Cotton Incorporated Cary, NC Gary Adams Michelle Huffman National Cotton Council

Memphis, TN Abstract

The last two decades brought unprecedented growth in the world's economy. While the magnitude of this growth is important, it is also significant that much of this growth has occurred in emerging market economies in Asia. Emerging markets in Asia include the world's two most populous countries, China and India. The growth in these countries alone resulted in the addition of millions to the world's middle class. With expectations that China and India will continue to experience strong rates of economic growth in coming decades, it is important to understand what the growth potential might be for end-use consumption of cotton in these markets. The purpose of this research is to examine the potential for growth in both of these markets. Specifically, the objectives are to provide an overview of the nature of economic growth in China and India, to develop forecasts of potential consumption growth given assumptions regarding economic growth, and to describe challenges that could inhibit demand growth for cotton textiles and apparel in each country. While the statistics involved are designed to estimate elasticities of apparel demand relative to GDP, results are meant to be interpreted as a means of developing a framework for discussion rather than as predictions.

Introduction

After setting a record during the 2006/07 crop year, world cotton consumption has followed a slight downward trend. At 110.0 million bales, the current USDA estimate for the 2011/12 crop year is 13.9 million bales lower than the 123.9 million bales estimated to have been spun into yarn during the 2006/07 season. Several reasons could be cited as to why cotton consumption has not grown over the last six years.

Peak cotton consumption coincided with the peak in U.S. housing prices in 2006. The U.S. and global recession which followed were likely contributors to decreases in world demand for cotton textiles and apparel. With the modest recovery from global recession, there was some rebound in world cotton demand. However, the increase in demand from recessionary lows was accompanied by rising prices for cotton fiber. The record cotton prices experienced during the 2010/11 crop year are another likely reason why cotton fiber consumption growth has struggled recently. The magnitude of fiber price increases, along with rising labor, energy, and financing costs, have resulted in the first increases in retail textile and apparel prices in the U.S. and other developed economy markets in more than a decade.

While the trend in world cotton consumption over the last five years has been negative, the trend over the last fifteen years has been positive. Even with the declines since 2006/07, world cotton consumption in 2011/12 is currently estimated to be 22.1 million bales higher than it was fifteen years ago. To identify potential reasons for this demand growth, it may be instructive to consider general factors that define demand. At a basic level, demand could be defined as a result of two primary factors, the number of customers buying a particular product and how much each customer is spending. In the context of global commodity markets, the number of customers is essentially the world's population. Determining how much money each person in the world may be spending on specific commodities is challenging, but one way to approximate spending could be to use a proxy for income. At the world level, a common means of approximating income is GDP.

Over the last fifteen years, the time in which world consumption of cotton increased 25.1%, there has been significant growth in both the world's population and GDP. In 1996, the world's population was 5.7 billion people. In 2010, the world's population reached 6.8 billion, representing an increase of 1.1 billion people, or 18.7% (World Bank, 2011). This implies that for every five people alive in 1996, there are now nearly six. Over the same time period, the world's economy experienced what has been generally accepted as the period of most intense economic growth in human history. Between 1996 and 2011, the world's economy is estimated to have grown by 66% in

361

terms of purchasing power parity (PPP) (Maddison, 2008; World Bank, 2011). With the growth in the world's economy having occurred at a faster rate than the growth in the world's population, the implication is that not only are there more people on the planet than there were fifteen years ago, but that each person represents a higher average income level. Estimated by GDP in terms of PPP, per capita income is nearly 49% higher than fifteen years ago. These increases in population and income have the potential to result in significant demand growth for commodities like cotton.

This potential may be amplified if it is considered that most of the growth in the world's economy has taken place in emerging markets, like those in China and India, where an estimated 37% of the world's population lives (World Bank, 2011). Since both China and India were considered poor countries just a few decades ago, the recent arrival of industrialization and economic growth has effectively lifted millions out of poverty and into the world's middle class. The transition through industrialization is not unprecedented, but the scale and the speed at which it occurred in China and India are unprecedented.

Using the Organization for Economic Cooperation and Development (OECD) definition of global middle class, which includes people with spending power equal to more than \$10 and less than \$100 GDP per capita per day (2000 \$Int), there have been a series of other countries that have lifted their country to middle class status. China was able to double per capita spending power in a period of just 12 years, between 1983 and 1995. India was able to do so over a period of 16 years, from 1990 to 2006. Japan, which was the last large economy to bring average spending power within the definition of middle class, took 33 years (1906 to 1939). Immediately prior to Japan's industrialization and establishment of their middle class, Japan's population was 48 million. China's population in 1983 was 1.0 billion. India's population in 1990 was 822 million (Kharas, 2010; McKinsey, 2011).

Income growth in emerging economies like China and India is expected to continue in coming decades. While average spending power in both China and India is already estimated to be above the OECD definition of middle class, future growth could lift millions of individuals currently below the standard in each country to spending levels above \$10 a day. The OECD projects that the world's middle class, estimated to total 1.8 billion in 2009, could climb as high as 4.9 billion by 2030. Such growth, if realized, should imply dramatic increases in demand for a range of commodities.

This research is designed to explore how potential economic growth could translate into cotton consumption growth. To motivate this research, a brief overview of previous research is presented. Next, a series of simple statistical models, with a range of functional forms, are applied to a range of data sources in order to develop a series of estimates for elasticities that relate changes in apparel spending to changes in per capita GDP. As is the case with many forecasting exercises, the purpose of these models is not to develop point estimates for eventual elasticities, but rather to inform discussion of potential growth trajectories and the factors that could influence them.

Previous Research

Recent economic growth has generated additional interest in estimating end-use consumption in China and India for several years. Most commonly, existing approaches for modeling end-use consumption around the world are based on net apparent consumption. Net apparent consumption is defined as the sum of domestic mill consumption, plus the bale equivalence of textile imports, less the bale equivalence of textile exports. While this approach likely generates accurate estimates for developed countries like the U.S., data limitations in both China and India may limit the approach's ability to produce accurate figures for emerging markets like China and India.

Questions regarding the reliability of Chinese data are widespread (The Economist, 2008). While the trade data have been recognized as being among the most reliable of Chinese statistics, their effectiveness in developing net domestic consumption estimates may be complicated by the way that textile trade data are reported in China. To support international trade, China is home to multiple free trade zones. These free trade zones enjoy certain privileges, such as easier access to imported raw materials and lower tariff rates.

Given the separation of free trade zones from other, general, manufacturing areas, any commerce that is conducted from a free trade zone with a general area is reported as being international trade. Due to the volume of commerce that is conducted across these free trade zones, China is reported as the largest source of apparel imported into China. Combined with financial incentives related to the differences in prices for raw material in free trade zones compared to general areas, there are both potential incentives for misrepresentation of the data as well as opportunity for shipment data to be confused when reporting movement in and out of free trade zones.

Further complicating the estimation process for net apparent consumption in China is that mill consumption figures for China also difficult to estimate. Among the major sources of publicly available estimates for cotton production, consumption, and trade, including the USDA, the ICAC, and Cotlook, the largest single source of inconsistency is for Chinese consumption estimates. As much as 20% of Chinese gin operations are described as operating unofficially, in a "grey market" (Skelly & Colby, 2010). With these gins operating unofficially, it is difficult to obtain accurate data regarding the volume of cotton they process and make available to spinning mills.

Around the world, approximately 80% of cotton end-use consumption is in the form of apparel. Assuming a similar proportion for China, it should be expected that estimates regarding consumer spending on apparel in China and net apparent consumption would follow a similar pattern. However, as shown in Figure 1, there is a disagreement between the estimates for net apparent consumption from the USDA (MacDonald S. , 2007) and apparel spending (National Bureau of Statistics, 2011). In combination, factors related to both trade figures and mill consumption may be one reason why estimates based on net apparent consumption for China do not follow the same pattern as other macroeconomic data, such as those related to GDP, or income growth, and apparel spending. The discrepancy of these two approaches for describing changes in end-use consumption in China presents a challenge.



Figure 1. Net apparent consumption of cotton and per capita clothing expenditures in China. Sources: USDA ERS (net apparent consumption) and China National Bureau of Statistics (NBS, per capita clothing expenditures).

Given that cotton is generally considered a normal good, end-use consumption of cotton, which would be primarily in apparel form, could be expected to increase with GDP, or income. As a result, it could be expected that actual apparel consumption in China increased between 2005 and 2009, as described by clothing expenditure estimates, rather than decreased, as estimated by net apparent consumption figures. This assumption could be supported by the China National Bureau of Statistics data regarding Chinese consumer prices for apparel. Apparel prices were reported as declining between 2005 and 2009. If these figures are to be believed, this would imply an increase in apparel consumption since 2005, as estimated by net apparent consumption. The assumption that apparel expenditure data are able to reflect changes in end-use consumption of cotton in China is accepted throughout this research.

A similar assumption is also made for India, although the discrepancy between clothing expenditure figures and net apparent consumption figures for India is considerably smaller than it is for China (Figure 2).



Figure 2. Net apparent consumption of cotton and per capita clothing expenditures in India. Sources: National Cotton Council Economic Services (net apparent consumption) and Euro Monitor (per capita clothing expenditures).

Theoretical Model

The determination of a workable data source to describe cotton end-use consumption in China and India was required to explore potential patterns for future growth. Given a representation of how end-use demand changes over time, these estimates could be combined with GDP forecasts to develop forecasts of future end-use consumption. Basic consumer demand theory can be used to relate end-use consumption to GDP, or income, in simple models including price data. Generally, these equations can be written as follows

End - Use Consumption = f (income, price oppored, price other goods)

Using the data regarding apparel spending as a proxy for end-use consumption and per capita GDP (constant local currency) as a proxy for income, estimates for elasticity can be derived to describe the relationship between income and end-use consumption of cotton. Elasticity describes the percentage change in one variable given a percentage change in another variable. For the purposes of this research, an objective is estimating elasticities that describe the relationship between GDP and end-use consumption so that GDP forecasts can be used to forecast end-use consumption.

Prices for apparel and other goods are included in the model to control for influences related to changing apparel prices and prices for other goods that compete for spending ability on apparel which might affect the relationship between income and apparel spending. For example, if apparel prices increase, it could be expected that spending on apparel might be affected. The same is also true for prices of other goods. In emerging market economies, a large proportion of consumer budgets are commonly devoted to food. In China, the NBS estimates that 40% of consumer budgets are devoted to food. In India, it is estimated that as much as 50% of consumer spending is devoted to food (Chari & Raghavan, 2011). As a result, changes in food prices could be expected to have an impact on clothing expenditures in both China and India.

<u>Data</u>

As explained in the introduction, the objective of this analysis is not to develop precise point estimates for elasticities relating income growth to growth in end-use cotton consumption. Rather, the purpose of this research is

to inform discussion of potential growth trajectories using available data. Given this objective, models were estimated using a range of different data sources.

For China, data were available at the national level from the NBS. These data are published for both urban and rural Chinese. In China, the designation of urban or rural does not refer to the location of where a certain citizen may live. Rather, it refers to where their family originates. These designations were used as a means of restricting rural inhabitants from immigrating to cities following the revolution. While enforcement has declined somewhat in recent decades, an urban designation means easier access to schools and jobs and urban centers, and often implies significantly higher incomes (The Economist, 2010).

A problem with these national-level data for China is the limited number of observations. Figures for apparel expenditures began being published in 1996, implying that only 15 observations are available for regression analysis. One way to compensate for a lack of depth in the time series is to look for a broader collection of data. In China, a broader dataset is available in the form of city-level data. China publishes data on income and prices for 36 cities. By examining the data for each of these cities over the 15 years that these data are available in a panel framework, more observations are available to describe how apparel spending may be related to changes in income.

In addition to these macroeconomic data, microeconomic data were also available. Cotton Council International (CCI) and Cotton Incorporated have been conducting consumer surveys in China since 2009. This survey data can be examined as a cross section, comparing income levels across individual respondents in order to derive estimates for elasticity.

For India, key macroeconomic data were provided by Euromonitor International, a private firm specializing in consumer market research. These data included real GDP, real consumer expenditures for clothing, the CPI for clothing, and the general CPI. Data covered the 1990-2010, allowing for 21 observations used in the analysis.

To supplement the macroeconomic variables and also serve as an additional dependent variable in the analysis, NCC economists calculated estimates for the apparent consumption of cotton textile and apparel products by India's consumers. Apparent consumption is derived by determining the cotton fiber content of imports and exports of textile and apparel products. Net imports are added to the reported cotton mill use to determine apparent cotton consumption.

As a cross-check of the macro-level analysis, data from consumer surveys were also used. Since 2003, Cotton Council International has been conducting consumer surveys of textile and apparel purchases in India. Due to changes in survey procedures over time, results from surveys conducted since 2008 were primarily used in this project.

While it has been explained that major developed countries underwent periods of rapid economic growth in the past, there are recent examples of smaller developed countries which experienced rapid rates of economic growth only within the past few decades. Examples of such countries are Taiwan and South Korea. Given that these countries are both neighbors to China, they likely share some cultural characteristics and, by investigating how economic growth in these countries translated into apparel spending growth could also inform discussion of growth potential in China and India.

Figures 3 and 4 depict growth in GDP and apparel spending that occurred in Taiwan and South Korea since 1970. For comparison, the GDP growth in Taiwan and South Korea are contrasted with current GDP levels in China (Figure 5). From these charts, it is evident that apparel spending started to increase at an increasing rate in Taiwan and South Korea once GDP per capita approached levels of \$5,000 in real terms or \$7,000 per capita in terms of PPP (constant 2005 USD and constant 2005 \$Int).

Descriptive statistics outlining the data used to estimate the models for Taiwan, South Korea, China (national-level only), and India (national-level only) appear in Table 1.



Figure 3. Taiwanese GDP and Clothing Expenditure Growth. Source: Taiwan Directorate-General of Budget, Accounting, & Statistics.



Figure 4. South Korean GDP and Clothing Expenditure Growth. Source: Bank of Korea.



Figure 5. Chinese GDP and Clothing Expenditure Growth Relative to Taiwanese and South Korean GDP Growth. Chinese per capita GDP is nearing the level where apparel spending accelerated in Taiwan and South Korea. Sources: China NBA, Taiwan Directorate-General of Budget, Accounting, & Statistics, Bank of Korea.

Country	Variable	Mean	Std.	Min	Max
•			Deviation		
Taiwan	Per capita clothing PCE	299	136	95	456
	GDP per capita	10,688	4,179	4,565	17,434
	CPI clothing	101.95	2.48	97.52	106.32
	CPI food	80.66	16.93	58.10	111.65
South Korea	Per capita clothing PCE	396	108	189	523
	GDP per capita	12,702	4,513	5,395	19,719
	CPI clothing	83.74	19.25	47.29	114.13
	CPI food	69.70	25.41	32.95	115.63
China	Per capita clothing PCE (urban)	82	26	56	143
	Per capita clothing PCE (rural)	15	5	10	26
	GDP per capita	1,337	740	523	3177
	CPI clothing (national)	148.10	10.91	129.32	164.83
	CPI food (national)	202.85	33.90	151.18	276.34
India	Per capita apparent cotton consumption	4.54	0.56	3.83	5.67
	Per capita clothing PCE	1,421	339	1,045	2,059
	GDP per capita	38,448	11,437	25,204	62,594
	CPI clothing (national)	109.96	28.83	54.50	170.70
	CPI all items (national)	144.36	56.04	60.80	266.03

Table 1. Descriptive Statistics of Variables Relating Economic Growth to Consumer Apparel Spending

Notes: All data are annual figures from the national statistical agencies for the respective countries (Statistics Korea, Taiwanese Directorate General of Budget and Statistics, China National Bureau of Statistics) with the exception of Chinese GDP figures, which are from the World Bank, and India's data, which is provided by Euromonitor International. World Bank data were used for Chinese GDP per capita figures because data from China's National Bureau of Statistics were available only in indexed terms. All monetary data are expressed in constant US dollars (2005). Values in current monetary terms (China) were converted in constant terms using the appropriate CPI deflator (all CPIs in real terms). Apparel spending figures were deflated with the apparel CPI and GDP figures were deflated with the overall CPI. Taiwanese data were converted from constant 2006 figures into constant 2005 figures in a similar manner. Values in local currency terms were translated into US dollars using conversion rates from oanda.com. Each of the above statistics was derived from the most complete datasets available for regression. For Taiwan the data are from 1981 to 2009 (n=29). For South Korea the data are from 1985-2009 (n=25). For China the data are from 1994 to 2008 (n=15). For India, the data are from 1990 to 2010 (n=21).

Empirical Models & Results

In addition to the variation in elasticity estimates resulting from the choice of dataset, elasticities from a series of different functional forms for the general theoretical model described in the previous section are estimated. The reason that different functional forms were estimated is that the selection of a given functional form implies certain assumptions regarding elasticity. For example, use of a double-log functional form implies a constant elasticity. Specifically, the functional forms explored include linear, semi-log, and double-log for each dataset. The purpose of estimating a range of equations involving a range of assumptions regarding elasticity is to further develop the range of elasticity estimates the are possible from the range of data being examined. Some of the limitations and issues related to potential growth trajectories facilitated by the modeling process are discussed in this section.

Table 2 shows the ranges of elasticity estimates resulting from the regression analysis. All of the elasticity figures relate changes in per capita apparel spending to changes in real GDP. Values for China and India are expressed in terms of ranges. With the exception of certain outliers from models for Taiwan, India, China, there tends to be some

consistency among the estimates. National and city-level data, data for South Korea, China, and India tend to fall within a range between 0.5 and 0.8.

Table 2. Ranges for Elasticity Estimates				
Country	Estimated Elasticity			
Taiwan	1.5			
South Korea	0.5			
China				
National-level	0.7-1.1			
City-level	0.7-0.8			
Survey data	0.2			
USDA & Texas Tech	0.6			
India				
National-level	0.4-0.7,1.3			
Survey data	0.1-0.5			

The estimates derived from survey data were lower than those from national-level data sources. The lower relative values for these models may be a reflection of the data used in these estimates. While the data used in the national and city-level models were collected over time, the models using survey data were treated as cross-sections. Although this cross-sectional approach allows for comparison across individuals, it does not allow for comparison across time, and this may impact elasticity estimates. However, the precise nature of any associated bias is unknown. In this analysis, it appears to have had a dampening influence.

There are several other important issues to these data that deserve attention. One is that all of the models examine cotton consumption in terms of apparel expenditure. While the majority of end-use consumption around the world occurs in apparel form, implying that cotton apparel consumption may be a good representation of total cotton end-use consumption, it is not necessarily the case that total apparel consumption is an unbiased representation of total cotton end-use consumption. For total apparel expenditures to be an accurate representation of total cotton end-use consumption, cotton's share of apparel will need to remain consistent through time. Given recent price increases and volatility, this may not be a valid assumption.

Perhaps the most important limitation related to the data and to the models is that all of the models represent single equations. By being estimated in single equation form, these models implicitly ignore spill-over effects onto the world market. Such an assumption may be valid for smaller countries like Taiwan and South Korea, but are likely inappropriate for China and India which are home to nearly 40% of the world's population. Given the size of both of these markets, it may not be realistic to assume that there would not be significant effects on world cotton prices if the growth suggested by the elasticities shown in Table 2 is realized.



Figure 6. End-Use Estimates Derived from Different Elasticity Estimates for China. The high estimate is derived from elasticity estimates. The middle estimate is from MacDonald, et al. (2011). The low elasticity is derived from the South Korean model.



Figure 7. End-Use Estimates Derived from Different Elasticity Estimates for India. All elasticities are derived from the models described in this research.

Related to the problems associated with the lack of feedback from increased end-use demand to increased fiber prices, strong rates of future economic growth in emerging markets should also increase demand for other commodities. With food one of the first product categories in which emerging market consumers increase spending, and with food representing such a large proportion of household budget share in both China and India, economic growth in those countries could be expected to impact world food commodity prices. As food prices increase, the ability of Chinese and Indian consumers to increase spending on apparel may be mitigated. Similarly, increased demand could be expected to increase apparel prices. Future increases in apparel prices could dampen growth in apparel demand.

Researchers from USDA ERS and Texas Tech adopted a system of equations approach to the problem of estimating demand growth given certain assumptions related to income growth in China (MacDonald, Pan, Hudson, & Tuan, 2011). As would be expected, when accounting for the feedback in the form of higher world cotton prices in reaction to increased Chinese end-use demand, elasticity estimates from their model were lower than those from the Chinese models that did not allow for feedback. Nonetheless, the estimate of 0.6 remains within the general ranges of elasticity estimates from single equation models.

The results presented in Figures 5 and 6 demonstrate growth potential for China and India using these elasticities. In each case, a variety of elasticity estimates were selected in order to highlight the impact of selecting a particular value when formulating forecasts. The trend lines are projected from assumed bale equivalence of end-use consumption in 2009 (China) and 2010 (India). Values forming the trend lines result from the combination of GDP growth forecasts from the International Monetary Fund and the Long-Term Projections report from the USDA with elasticities estimated in the regression analysis. GDP forecasts for China average near 9.0% over the next ten years. GDP forecasts for India averaged just below 8.0%. Results suggest enormous growth potential for each country. Depending on the elasticity selected, ten-year growth projections for China range from 12 to 20 million bales. For India ten-year growth projections range from 7 to 20 million bales.

Using the values derived from the low end of both ranges, the total projected growth in world end-use demand resulting from economic growth in China and India is suggested as being as large as 19 million bales. Nineteen million bales represent more than 15% of 2011/12 production. Given the size of the potential increase, combined with factors that could limit increases in future cotton production, such as limits to the amount of additional land globally that can be brought into agriculture, competing crop prices that might restrict cotton's ability to secure additional acreage, and slowing growth in cotton yields, there may be reason to believe that these increases in demand will not be met by increases in production.

The combination of rising demand and limited ability to meet rising demand through production implies that the demand growth described by these elasticities may not be possible in reality. However, this is not considered to be problematic given the objective of this research. As stated in the introduction, the purpose of this work is to inform discussion regarding potential demand growth for cotton. Results suggest that the potential for growth in end-use demand is large. If it is the case that potential demand growth is in excess of potential production growth, the implication is that demand will have to be rationed by higher prices. If technological advances allow for significant production growth through improved yields, this analysis suggests that additional production would likely be able to be consumed in end-use form in emerging markets and likely would not weigh on prices due to this additional demand.

Conclusions & Limitations

As with many forecasts, the purpose of this research was to develop projections of potential future growth trajectories in order to facilitate discussion, rather than develop estimates meant to actually predict eventual outcomes. To inform discussion of potential growth in China and India over the next ten years, a series of elasticity estimates, relating apparel consumption growth to GDP growth, were derived from multiple datasets under assumptions associated with multiple functional forms. In turn, the resulting ranges of elasticity estimates were paired with forecasts for GDP growth for the next ten years to produce forecasts for potential end-use demand growth. Results generated from the lower bound of elasticity estimates suggest potential end-use demand growth from China and India alone could increase by nearly 20 million bales over the next 10 years.

However, it is important to emphasize that these results are intended to be interpreted as reflecting potential demand growth, and are not to be interpreted as point estimates for elasticity growth. There are important limitations related

to the data and to the modeling process that prevent results from being interpreted as point estimate forecasts. Among the limitations are that the models are based on apparel consumption, which does not directly describe enduse consumption of cotton. As a result, changes in non-apparel consumption and changes in market share of cotton in apparel expenditures are not controlled for. A limitation related to the modeling process is that elasticities were derived from single equation models. In single equation models, feedback from changes in demand on prices is not possible. Given that the lower-bound range of elasticity estimates projected potential demand growth of 20 million bales, it could be expected that there would be a price response.

Despite these limitations, the results presented in this research do allow for some insight regarding potential demand for China and India. Specifically, what these results communicate is that if Chinese and Indian economies grow as forecast, there is a large potential increase in end-use consumption of cotton in both countries. It could be expected that production may face some challenges in meeting this potential demand, and, as a result, cotton prices could be supported by fundamental tightness resulting from increased end-use demand. A key factor in determining whether these increases in demand will be realized may be related to cotton's market share. Observations currently being collected regarding the response of market share to record price levels and volatility during the 2010/11 crop year likely will be informative to the eventual trajectory of cotton end-use consumption growth in coming years.

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