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Cotton Market Integration across Countries, among Qualities, and through Time

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Cotton Market Integration across Countries, among Qualities, and through Time

Abstract: Cotton is among the most internationally traded agricultural commodities. As a result, cotton prices are often described in terms of a world price. This world price, called the A Index, has been published by the trade group Cotlook since the mid-1960's and is generally accepted as representative of a global price for cotton. As a world price, the A Index is derived as an average of export offers from cotton merchants for fiber delivered to Far Eastern ports, where most of the world's cotton is spun into yarn. In addition to the average that is the A Index, Cotlook also publishes merchant offers for specific qualities of cotton from specific countries. Given that cotton prices were the most volatile of all agricultural commodity prices during the 2010/11 crop year, it could be expected that historic relationships among prices for different qualities and growths may have changed. This research is designed to identify and describe these changes. Cointegration analysis examines relationships between prices according to quality and country of origin and description of how were affected by recent volatility with the objective of informing discussion of potential implications for global cotton trade.

Cotton is among the most internationally traded agricultural commodities.¹ Considering the degree of globalization in cotton markets, prices for cotton from around the world could be expected to be integrated. However, the record volatility in cotton prices during the 2010/11 crop year and recent policy actions by several countries, such as India's intermittent export bans and Chinese reserve purchases, could have altered the strength and nature of existing co-integrative relationships.

To investigate potential changes in relationships among cotton prices over time, this article examines a range of cotton prices. In particular, it focuses on cotton prices collected by Cotlook Ltd. (Cotlook), a cotton trade group and publisher of the A Index. The A Index is widely regarded as representative of a world price for cotton.² Cotlook derives the A Index from cotton merchant offers for fiber delivered to the Far East, where most of the world's cotton is spun into yarn. To represent world prices, the A Index is derived as an average of the cheapest five of a collection of sixteen cottons (at present) from around the world that are specified as being "medium grade" (Cotlook's designation for middling cotton with 1-3/32" staple).

Ideally, the merchant price offers would be accompanied by transaction volume data to create a world price based on weighted averages. However, transactional volume figures are not available. The issue of the lack of transactional data is likely partially offset by the way Cotlook derives the A Index from merchant quote data. The A Index is derived as the average of the five cheapest quotes among the set of medium grade cottons. Since all of eligible varieties are of a standard quality, it could be assumed that the cheapest varieties of a standard grade of cotton would be those more actively traded and, therefore, be the more representative of world prices.

¹ Between the 2004/05 and 2011/12 crop years, an average of 32% of annual cotton production has been exported. Parallel figures for other crops are the following: soybeans 33%, wheat 19%, corn 12%, rice 7% (USDA World Agricultural Outlook Board).

² The A Index is the price cited by the United Nations, the International Monetary Fund, and the International Cotton Advisory Committee. Elements of the A Index are used by the USDA for the derivation of the Average World Price used in payment programs.

Although ineligible for inclusion in the A Index, Cotlook also publishes price data for high and low grades of upland cotton as well as prices for premium grade pima varieties. Each quality of cotton may be subject to unique supply and demand considerations, and therefore may or may not share a consistent integrative relationship with the A Index. The purpose of this article is to identify and discuss any co-integrative relationships that might exist among different cotton qualities offered for export from different cotton-producing countries. Given recent volatility in world cotton prices, a specific focus of analysis is if the relationships among prices may have changed over time.

Only limited existing research is known to address questions related market integration in the global cotton market, with the sole identified article on the subject being that from Baffes and Ajwad (2001). These authors examined a subset of merchant offers from Cotlook and presented pairwise comparisons across different countries. Since the previous article was published, there have been significant changes in the global cotton market. One major change was China's accession to the World Trade Organization (WTO) in 2001 and emergence as the world's largest cotton consumer and importer. Another major event occurred in cotton prices. Following the tightening of supplies in 2009/10 and 2010/11, cotton prices reached record levels and experienced unprecedented volatility during the 2010/11 crop year (Plastina, 2011).

This article seeks to further this existing research on cotton market integration by examining a more recent set of price data (from the onset of the 2004/05 crop year to the present) that captures some of the important recent changes in the cotton market. In addition, this article looks to supplement previous analysis by investigating price relationships across cotton qualities. For example, it could be expected that prices for high quality upland cottons would behave in a manner similar to those for medium grade upland cottons. However, it may be less clear how premium (pima) cotton prices may fluctuate relative to upland prices. Given the volatility experienced in world cotton markets during the 2010/11 crop year, existing relationships between cotton prices from different countries and among different qualities of

cotton may have changed. Correspondingly, a second goal of this research is to examine evidence of structural change that might have occurred among price relationships over the past several crop years.

Established time series methods are applied in order to describe relationships among cotton prices. The general approach is the same as that outlined by Balcome & Morrison (2002), and Rapsomanikis et al. (2003), and Conforti (2003), and involving the application of error-correction models and Granger causality tests. To investigate the possibility of structural change given recent volatility, two approaches are taken. The first involves comparison of coefficient values describing long-term relationships to determine consistency, adopting techniques used in by Goodwin & Holt (1999), Abdulai (2000), Kuiper et al. (2003), and Rapsomanikis et al. (2003). A second approach involves the application of dummy variables, as proposed by Prakash et al. (2001).

The content of this article begins with an overview of existing research regarding co-integration in cotton markets and a summary of the evolution of the time series methods used to estimate price relationships. This discussion is followed by a more thorough description of the price data used in this analysis. A formal econometric structure is presented and results are discussed. Conclusions indicate that global cotton prices are co-integrated, although the strength of the relationships among varieties from different countries has evolved over time.

Conceptual Framework

A volume of research has been conducted regarding the degree of integration. The general objective of much of this analysis could be characterized as the determination of the extent to which price shocks are transmitted across spatially separated markets (Goodwin & Piggott, 2001). Early efforts involving the examination of price linkages were motivated by the Law of One Price. Implications related to

Empirical Framework

This article is designed to represent an update and supplement existing integration research on cotton prices. As a result, a portion of the econometric analysis presented in this article is replication of the same set of econometric techniques applied by Baffes and Ishad (2001). Their analysis examined cotton prices under two different time samples (August 1985-December 1987 and August 1995-December 1997) and could be considered to have been divided into two. To determine the presence of any changes in the integrative relationships among cotton prices between these two time periods, a series of tests were applied.

The first of these tests applied by Baffes and Ishad (2001) was based on an examination of stationarity. Following the determination of the order of integration, stationarity tests were conducted pairs of international cotton price differentials.

Data

The principal source of data for the analysis presented in this article is Cotlook. Cotlook has been publishing export offers from international cotton merchants, along with the A Index, since the 1966. Quotes for individual qualities sourced from a range cotton producing countries are published daily on Cotlook's website. These figures are also included in the trade group's weekly publication, Cotton Outlook. The prices used in the analysis are monthly averages of the prices published Cotton Outlook.

The individual quotes for specific cotton qualities sourced from specific cotton producing countries are supplemented by several other cotton prices. The other cotton prices included in the analysis are New York Nearby futures, the China Cotton Index, and the A Index (i.e., the average of the lowest five eligible Cotlook quotes for medium grade cotton). In terms of derivation, the China Cotton (CC) Index is somewhat analogous to the A Index in that it is derived as an average of quoted prices. However, a

difference is that the CC Index is derived as an average of prices for domestically grown Chinese cotton quoted to a network of Chinese mills (China Cotton Association). As with the quotes published by Cotlook, prices are quoted for several qualities. The quality used in this analysis 328, which represents cotton with 28mm staple length (1-3/32”). Values used in the derivation of the CC Index are those for domestically grown Chinese cotton and include delivery to the mills.

Over its nearly 50-year history, there have been several important changes in the A Index. The most significant recent revision occurred in August 2004 (the onset of the 2004/05 northern hemisphere crop year), when the geographical basis for all of quotes published by Cotlook shifted from Northern Europe to the Far East. Given this important change in prices, the time period considered for this analysis is from August 2004 through May 2012 (when this draft of the research was completed).

A list of price data available during this time period appears in Table 1. Descriptive statistics appear in Table 2. Given variation in availability that can occur due to changes in acreage and weather conditions, prices for specific qualities from specific countries are not always available. Since certain varieties had less data available, only those with at least 85% coverage between August 2004 and the present were considered for this analysis. Given that certain prices were not available for certain months, two alternate methods were examined.³ One involved simple linear interpolation for the time periods with missing data. Another involved the use of New York futures. Relying on the degree of co-integration among world prices which is outlined in the results section, this approach used the average difference between the New York futures and the variety with missing data to develop hypothetical values that could replace missing values.⁴

³ For comparison of results according to the two different approaches, please contact the authors.

⁴ To illustrate this approach, consider the example of the A Index. Due to the lack available quotes in July 2010, the A Index was not published at this time. The average difference between the most active New York futures contract was #.## cents/lb in the two months before and after the month with missing data. This difference was added to the average price for the most active New York futures contract in July 2010 to develop a value to replace the missing one.

Table 1. Prices Considered for Analysis

Data Source	Cotton Variety	Percent Coverage (Aug. 2004-May 2012)
Cotlook: Long Staple (Pima)	US Pima	90.4%
	Egyptian Giza 86	87.2%
Cotlook: High Grade	Australian SM	91.5%
	Benin Kaba/	93.6%
	Burkina Faso BOLA	96.8%
	California Acala SJV	85.1%
	Cameroon PLEBE	92.6%
	Ivory Coast MANBO	96.8%
	Mali JULI/	96.8%
	Uzbekistan SM	98.9%
	Cotlook: Medium Grade	Benin BELA
Brazilian Midd		87.2%
Burkina Faso RUDY		96.8%
California/Arizona Midd		89.4%
Iv. Coast BEMA		96.8%
Mali ROKY/KATI		96.8%
Memphis/Eastern Midd		96.8%
Orleans/Texas Midd		97.9%
Uzbekistan Midd		98.9%
Cotlook: Lower Grade	Memphis/Eastern SLM	85.1%
	Orleans/Texas SLM	86.2%
Cotlook	A Index (average of medium grades)	97.9%
Intercontinental Exchange	New York Nearby	100.0%
China Cotton Association	CC Index 328	100.0%

Note: Between August 2004 and May 2012, there were a total of 94 months. The number of months with price data is divided by 94 to derive the figures shown in percent coverage column.

Table 2. Descriptive Statistics

Data Source	Cotton Variety	Min	Max	Avg.	Coeff. of Variation
Cotlook: Long Staple (Pima)	US Pima	83.0	296.0	138.2	30.8%
	Egyptian Giza 86	78.1	270.0	128.3	38.5%
Cotlook: High Grades	Australian SM	57.1	233.9	89.5	43.0%
	Benin Kaba/	48.6	239.1	81.9	50.1%
	Burkina Faso BOLA	49.3	231.8	81.6	46.0%
	California Acala	60.2	176.6	84.0	29.6%
	Cameroon PLEBE	52.9	234.9	83.9	45.7%
	Ivory Coast MANBO	50.1	218.3	79.8	41.6%
	Mali JULI/	48.3	230.8	80.7	46.6%
	Uzbekistan SM	50.9	242.8	86.1	48.4%
Cotlook: Medium Grades	Benin BELA	47.1	230.8	79.7	47.6%
	Brazilian Midd	51.8	165.0	74.6	32.8%
	Burkina Faso RUDY	47.8	230.1	80.1	46.6%
	California/Arizona Midd	55.2	216.9	80.2	37.9%
	Iv. Coast BEMA	48.6	215.5	78.4	42.0%
	Mali ROKY/KATI	46.8	229.1	80.8	48.2%
	Memphis/Eastern Midd	51.4	225.6	82.3	46.7%
	Orleans/Texas Midd	49.9	222.8	82.4	47.6%
	Uzbekistan Midd	48.7	240.3	83.6	49.8%
Cotlook: Lower Grades	Memphis/Eastern SLM	47.9	119.2	67.1	25.6%
	Orleans/Texas SLM	46.6	120.2	65.7	26.9%
Cotlook	A Index	47.5	229.7	79.6	48.2%
Intercontinental Exchange	New York Nearby	42.2	201.3	72.6	46.6%
China Cotton Association	CC Index 328	62.1	212.8	100.4	36.8%

Empirical Model**Results****Conclusions**

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