BASIS TRENDS IN U.S. COTTON FUTURES

Stephen MacDonald
Leslie Meyer
Economic Research Service, USDA
Washington, DC

Abstract

Basis in U.S. futures for cotton and other commodities was volatile during 2008. At times, the basis in U.S. cotton futures was unusually high, affecting the role of the futures market in the U.S. cotton system. As a first step to establishing the causes of cotton basis behavior during 2008, trends in basis starting in 2001 were examined. Initial results indicate that the convergence of basis is a trend during the life of most contracts. However, after the first notice day, basis is volatile, and the May and July contracts show signs of poor convergence between that point and expiration. The trend over 2002–2007 for trading period between the last 200th trading day before expiration and first notice day was a falling basis for the May and July contracts, but a rising basis for the October and December contracts. The basis surge in 2008 was strong enough to reverse estimated trends for May and July at high levels of statistical significance. The estimated upward trend for October and December is nearly doubled when 2008 data is added to the sample.

Introduction

The world economy has been volatile in recent years, and commodity prices have been particularly volatile. One troubling aspect of commodity price volatility has been the periodic divergence of futures and cash markets from past relationships. As a result, the basis between futures and cash markets has been even more volatile than the underlying prices. Futures markets serve the public good in part through price discovery, with the ability to hedge on this market critical for cotton producers and textile producers around the world. The ability to predict basis is the key to effective hedging (Ferris 1998), but during 2008, the spread between futures prices and cash markets reached its widest span in a number of years, and this spread displayed unprecedented volatility. Similar concerns have been evident in other commodities (Irwin, Garcia, Good 2007), but developments in cotton markets have received more limited attention by the profession. As a first step to developing an understanding of the forces driving these changes in basis for U.S. cotton futures prices, this study will examine the trends that were evident before 2008, and compare recent developments with these underlying trends.

Data and Methods

The Intercontinental Exchange (ICE) No. 2 cotton futures contract has been the world's key price-setting instrument for cotton for many decades. While recent years have seen the appearance and increased use of futures markets in other countries—most notably, China's Zhengzhou Cotton Exchange (ZCE)—the ICE contract is still a crucial price discovery and hedging instrument for U.S. cotton.

The ICE contract has the following specifications:

--U.S. origin cotton only
--Delivery points: Galveston, TX; Houston, TX, New Orleans, LA; Memphis, TN, Greenville/Spartansburg, SC
--Base grade:
  Staple length 34 (1–1/16")
  Strict Low Middling (color grade 41, leaf grade 4)
--Delivery months:
  March, May, July, October, December

Under the U.S. Cotton Futures Act (7 U.S.C. 15b), USDA's Agricultural Marketing Service publishes daily spot quotations for cotton. In addition to reporting the price for the same base grade as ICE, AMS Cotton Division also reports premiums and discounts for additional grades. AMS reports an average spot price for the United States, and quotations for the following individual markets:

--Southeast, North Delta, South Delta, East Texas/Oklahoma, West Texas, Desert Southwest, and San Joaquin Valley.

For this analysis, only the U.S. average spot quotation for the base grade was used to measure basis. Given that certified stocks are not evenly distributed between delivery points, and that the grade of certified stocks may vary from the base grade, this assumption may be questionable when analyzing basis behavior close to contract expiration. The choice of spot quotation is a simplifying assumption that could be examined in future research, but the U.S. average provides a useful starting point.

Futures data was collected for the 5 delivery months closest to expiration between 2002 and 2007. The earliest contract examined was for expiration in March 2003 and the latest was the December 2008 contract. For each contract, data for the last 200 trading days before expiration was collected. The earliest data used in this study was from May 15, 2002 for the March 2002 contract, and the latest data was from December 5, 2008.

This initial examination of trends is confined to some descriptive statistics for these contracts and estimation of a simple relationship between basis levels and time. While a number of factors might be expected to determine basis, including the cost of storage, interest rates, and delivery options (Hranaiova and Tomek 2002; Williams 2001), these can be simplified into an expectation of convergence. If:

Basis: $B_{it} = Futures_{it} - Cash_t$ (Equation 1)

(where $Futures_{it}$ is the closing price on day t of the ICE contract expiring in month i)

Then,

$$B_{it} = \alpha + \beta_1 Exp_{it} + \varepsilon_{it} \quad \text{(Equation 2)}$$

Where Exp_{it} is the number of days remaining until contract expiration. The impact of storage costs and interest rates is in large part a function of time until expiration, so this parsimonious specification is useful, with the expectation is that $\beta_1 > 0$. If convergence were perfect, then $E(\alpha) = 0$, but delivery options and the cost of arbitrage mean a nonzero α is still consistent with basis convergence.

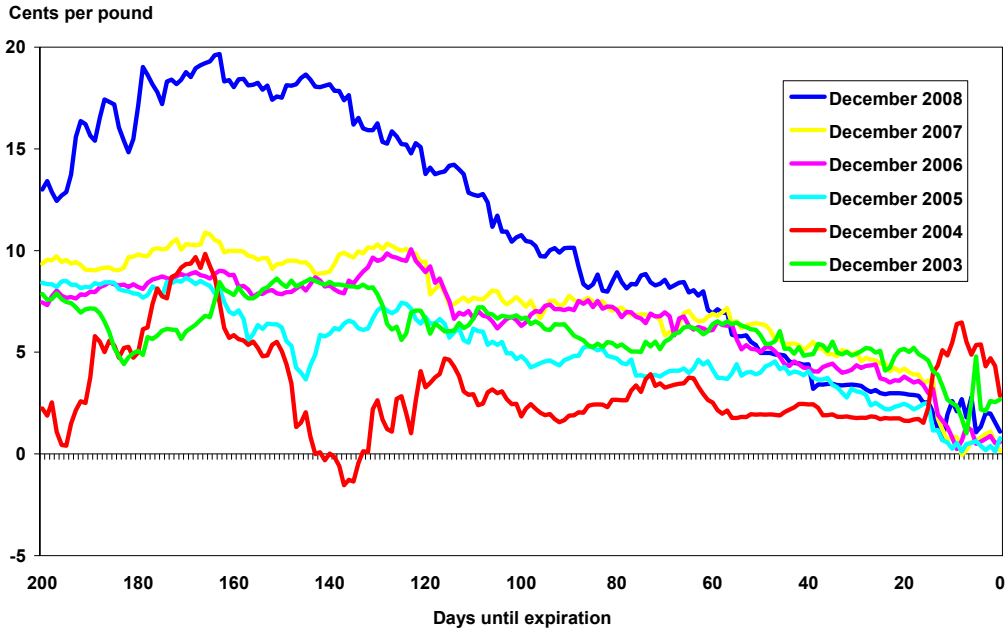
In order to determine if basis can be described as rising or falling during the 2001-2008 period, a slightly modified version of Equation 2 was estimated:

$$B_{it} = \alpha + \beta_1 Exp_{it} + \beta_2 Year_{it} + \varepsilon_{it} \quad \text{(Equation 3)}$$

Where $Year_{it}$ is the year of contract expiration. Specifying the passage of time in this manner avoids the collinearity between the days to expiration and the trend variable that would arise if the trend variable also represented the discrete passage of time from one trading day to the next within a given contract. Thus, for a given contract i (e.g. March), if the estimated value of $\beta_2 > 0$, then between 2002 and 2008 the average basis on any given trading day has tended to rise from one year to the next. If $\beta_1 > 0$, then the contract for month i has tended towards convergence during 2002 through 2008.

This study undertakes one further adjustment, separately analyzing the behavior of basis before and after the first notice period. Figure 1, showing the basis of the December contract between 2003 and 2008 during the last 200 trading days up to expiration, illustrates why this was undertaken. Shortly after the 20th day before expiration, the basis enters a period of behavior distinctly different from the preceding days. A sharp decline is evident for most years, although 2004 stands out in realizing a sharp increase right about the same point in the contract's life. The impending prospect of delivery alters the behavior of the basis trends significantly, adding volatility. While this study does not attempt to determine the causes of the trends in basis, clearly different factors are at work before and after first notice day, so the two periods were studied separately.

Figure 1--December cotton contracts' basis, 2003-2008



Results and Discussion

Figure 2 illustrates the basis calculated for these contracts, plus some additional contracts expiring in 2001, 2002, and 2009 in order to add one additional year and to show 5 contracts at any point in time. The inclusion of the 2009 contracts trading during 2008 emphasizes the impact of that year's events on basis. While the basis on the December 2008 contract was higher than any previous basis since 2001, the March 2009 and May 2009 contracts were even higher.

Figure 2--Basis: ICE futures – AMS U.S. average spot (250 days until expiration)

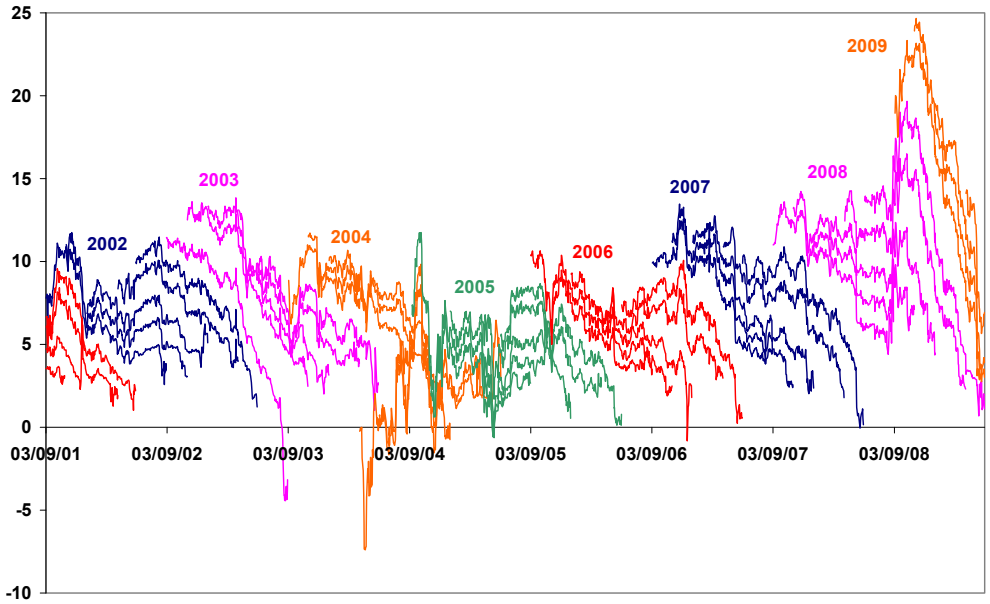


Table 1 summarizes the trends evident within the lifetime of each contract. Consistently across the expiration months, the basis declines about 0.02 cents per day up until first notice day (once any trends have been accounted for). October is an exception, declining half as much, but the October contract has by far the lowest average open interest among the 5 contracts. The value of β_1 is the same, regardless of whether the sample is estimated through 2007 or 2008.

Table 1. Estimated daily convergence (β_1)

Contract month	Before or after first notice	Year sample ends: 2007	2008
March	Before	0.02	0.02
	After	0.08	**0.04**
May	Before	0.02	0.02
	After	**0.00**	**0.00**
July	Before	0.02	0.02
	After	**0.04**	**0.04**
October	Before	0.01	0.01
	After	0.04	0.04
December	Before	0.02	0.02
	After	0.05	0.05

All estimates of β_1 were significant at the 1 percent level, except for the five figures in bold. The July contracts after first notice day's estimate were significant at the 10 percent level.

The behavior of the contracts for different expiration months diverges significantly in the period after first notice day. The May contract does not appear to converge, with β_1 estimated as zero. The July contract also may not converge. While the July contract's estimated parameter for β_1 is not particularly different from the estimates for the October or December contracts, it is not significantly different from zero at the 5 percent level (it is significantly different at the 10 percent level). The December contract's basis declines 0.05 cents per day after first notice, and October declines by 0.04 cents. The March contract's estimated β_1 through 2007 is 0.08, but is not significantly different from zero when 2008 is included in the sample.

Table 2 summarizes the trends in these contracts' basis over time during 2002-2008. These results vary more from contract to contract and sample to sample than do the estimated degrees of convergence. In the period before first notice day, and using data through 2007, basis has tended to fall for the May and July contracts and rise for the October and December contracts. However, after first notice basis has tended to fall for the May, October, and December contracts, but rise significantly for the March contract. While the December basis has tended to rise 0.7 cents per year before first notice and fall 0.7 cents per year after first notice, the March contract after first notice has tended to rise 1.7 cents per year.

Table 2--Estimated annual change in basis starting in 2002 (β_2)

Contract month	Before or after first notice	Year sample ends: 2007	2008
March	Before	**0.00**	0.38
	After	1.70	1.47
May	Before	-0.39	0.17
	After	-0.35	0.26
July	Before	-0.25	0.42
	After	**0.17**	0.60
October	Before	0.55	1.13
	After	-0.27	-0.21
December	Before	0.69	1.21
	After	-0.70	-0.43

All estimates of β_2 were significant at the 1 percent level, except for the two figures in bold. The July contract after first notice day's estimate with data through 2007 was significant at the 10 percent level.

However, extending the sample into 2008 alters many of the results. Every contract exhibits a significant tendency to rise with the full sample during the period before first notice day. The March, May, and July contracts also have a significant tendency to rise in the period after first notice day. In contrast, October and December still show rising basis before first notice and falling basis after first notice. December differs in that both periods have higher estimates of basis change over time, about 0.5 cents before and 0.3 cents higher after first notice day. October is notably higher only before first notice day.

Conclusions

A simple model suggests that the U.S. cotton futures contract for most expiration months tend to converge. It also suggests that for the most important contract, December, the trend has been towards higher basis during much of the last year of the contract. The increase in basis before first notice day combined with the tendency to decline in the period after first notice suggests that convergence has become more pronounced late in the life of the contract in recent years. Including 2008 in this analysis tends to raise estimated basis trends. In some cases (May and July), the increase is sufficient to turn a declining trend into a positive trend.

This analysis makes no attempt to discern the causes of these trends. During the time in question, markets saw the appearance of "long only" index funds that altered the role of U.S. commodity markets, integrating them into markets for other financial instruments. This, and possibly greater interest by traditional market participants, contributed to a significant rise in open interest as time went on. The 2003-2008 period also saw a tendency for interest rates to rise. Additional research will be necessary to ascertain the relationship between cotton futures basis trends and these or other factors.

Acknowledgements

The authors received extensive and timely data and insight from a number of people. Carol Skelly and David Stallings of USDA's World Agricultural Outlook Board provided numerous insights into the operations of futures markets and assisted with access to data through Thomson/Reuters Datastream. Barbara Meredith of USDA's Agricultural Marketing Service provided conceptual assistance and generous access to data on U.S. spot prices. Rich Cantor, First Vice-president of Wachovia Securities, provided useful background on the operation of futures markets.

References

Ferris, John N. (1998), Agricultural Prices and Commodity Market Analysis, Boston: McGraw-Hill.

Hrannaiova, J., and Tomek, W. (2001), "Role of Delivery Options in Basis Convergence," The Journal of Futures Markets, 22(8): 783-809.

Irwin, S., Garcia, P., and Good, D. (2007), The Performance of Chicago Board of Trade Corn, Soybean, and Wheat Futures Contracts After Recent Changes in Speculative Limits.

Williams, J. (2001), "Commodity Futures and Options." In B.L. Gardner and G.C. Rausser (Eds.) Handbook of Agricultural Economics, Volume 1b: Marketing, Distribution, and Consumers (pp. 745-816). Amsterdam: Elsevier Science B.V.