

# NC STATE ECONOMIST

COLLEGE OF AGRICULTURE AND LIFE SCIENCES

## Using Corn Basis to Calculate Changes in the Transportation Cost of Importing Corn into North Carolina

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**With a deficit of feed grain to nourish North Carolina's "tails and feathers" production – hogs, broiler chickens and turkeys – the profitability of our state's livestock industry hinges on adequate, reliable and low-cost out-of-state sources for corn.**

**As North Carolina agriculture competes in a global agricultural economy, says economics professor and NC State Extension specialist Nicholas Piggott, it may be prudent to invest in our infrastructure – depending on the numbers.**

### Corn Prices in North Carolina

The Southeast in general and North Carolina in particular are a region with a feed grain deficit: the significant number of hogs, broilers and turkeys produced consume more feed grains annually than what is produced in the state. The prominent components fed to hogs and poultry are corn, wheat, sorghum and soybean meal – and corn is an essential component. A corn deficit makes North Carolina an importer of corn, reliant upon out-of-state sources; this in turn has implications for how corn prices are determined in North Carolina.

**Arbitrage:** (*noun*) Used by economists to describe the actions of traders responding to a price difference for the same commodity in two or more markets in different locations, inclusive of the costs of transportation between locations.

Arbitrage dictates that the price of corn in North Carolina reflects the cost of buying the corn where it can be sourced out-of-state plus the cost of transporting it to North Carolina. If the price of corn in North Carolina is above the cost of buying corn plus transportation from out-of-state, it would be profitable for an arbitrageur to ship corn to North Carolina. Additional corn shipments into the state will increase the local (North Carolina) supply of corn, hence lowering the local price. This process would continue until the North Carolina corn price just equals the out-of-state location's price plus the cost of transportation, at which point it is no longer profitable for the arbitrageur to make additional shipments.

Historically, the North Carolina livestock industry has sourced corn imports from regions that have excess supplies of corn, such as the Midwestern Corn Belt, and transporting this corn to North Carolina by rail.

However, because North Carolina is a coastal state, accessing corn from international destinations like Brazil or Argentina is also possible. Corn from these locations can be transported via ship into the Port of Wilmington. Sourcing corn from alternative destinations, using different modes of transportation, gives end-users in North Carolina important alternatives – an insurance of sorts. The profitability of the North Carolina livestock industry hinges on having an adequate, reliable and low-cost supply of out-of-state corn to feed all the “tails and feathers” several times a day, year-round. With the possibility of alternative domestic and international sources comes some assurance that the North Carolina livestock industry should be able to import the lowest cost corn (inclusive of transportation costs) at any given point in time.

Corn is harvested annually, so a drought in the Midwest that drives up corn prices there might mean that corn sourced in Brazil or Argentina might become the lowest-cost supply of corn for a period of time. This, indeed, was the case when the drought of 2012 in the Midwest prompted livestock producers to begin importing corn through Wilmington from Brazil.

With alternative sources of supply destinations and differing modes of transportation, a number of factors are in play which ultimately impact the price of corn in North Carolina. Weather and crop production in source locations, changes in costs of transportations rates (rail, ocean and trucks) and exchange rate movements all factor in. At any given time, this multitude of factors combine to determine where end-users will source corn for future imports. Thus, for the North Carolina corn farmer, this means the prices they can expect to receive for their corn can potentially be impacted by numerous external factors. This serves as a reminder that North Carolina agriculture competes in a global agricultural economy.

## What is Basis?

Basis is defined as the difference between cash prices and futures prices for a commodity at a given point in time. “Nearby basis” is the difference between cash prices and the futures contract price closest to delivery on a given day. More concretely, the nearby corn basis in Rose Hill, North Carolina, in October would be calculated as the difference in the current cash corn price in Rose Hill and the December corn futures contract – i.e., the nearest futures contract to expiration – traded on the Chicago Board of Trade (CBOT) in Chicago.

Example: For a given day in October, if the cash price for corn at Rose Hill, North Carolina was \$4.50 per bushel and the December corn futures price the same day was trading at \$4.05 per bushel, the nearby basis would be \$0.45 per bushel ( $\$4.50 - \$4.05$ ). Many factors affect basis levels within a given region, including supply and demand within the market area; availability of storage, handling and processing facilities; the volume of imports; and the cost of transportation to the area.

The basis can be positive or negative. A positive basis is referred to as being “over” since the cash price is higher than the futures price. Correspondingly, a negative basis is referred to as being “under.” An increase in basis is typically referred to as a “strengthening,” since the cash price has become higher relative to the futures market price; and a decrease in basis is typically referred to as a “weakening,” since the cash price has become lower relative to the futures market price. Corn basis in North Carolina is typically “over,” meaning that cash prices are higher than futures prices. The “over” North Carolina corn basis with respect to CBOT nearby corn futures stems from the deliverability of a corn futures contract in Chicago and that transportation costs are involved in shipping corn between Chicago and North Carolina. That is, for a given out-of-state location where North Carolina sources corn (generally the Midwest), the costs of transporting corn to North Carolina is greater than the costs of transporting corn to the delivery points of the futures contract in Chicago; hence the “over” basis reflects the higher transportation cost.

## Cash Corn Prices Broken Out

A fundamental relationship in cash corn prices (commonly termed “spot” prices) is that the current cash corn price should equal the sum of the nearby futures corn contract price plus local corn basis. Future markets play a critical role in price discovery, since futures market prices reflect expected levels of supply and demand for a product at different times in the future. The different periods in the future are reflected by different contracts being traded for different months. For example, the new-crop December corn futures price reflects expected levels of supply and demand for corn in December; but in particular, its price reflects expectations of the size of new-crop corn harvest in the United States. The nearby futures contract can be thought of as a measure of the current demand and supply situation in U.S. and world markets.

Similarly, the current local basis serves that same function for cash markets. When current basis is relatively strong, it implies that current local demand is high relative to supply. Likewise, when current basis is weak, it implies local demand is low compared to supply. Hence, adding the local basis to the nearby futures price “localizes” the U.S. and world market price to form the cash price in the local market.

Because nearby basis is the difference between two prices levels – the local cash price level and the nearby futures level – basis levels are significantly lower in value. This construct translates into basis risk (variations in basis size expressed in percentage terms) being much less than futures price risk (variations in futures price, also expressed in percentage terms) and is fundamental to why price risk is hedged using futures contracts.

The most significant component of cash price risk can be hedged using futures contracts. Corn growers can sell futures and buy them back at a later date to protect against price declines, and corn buyers can buy futures and sell them back at a later date to protect against price increases. Hedging eliminates the futures price risk component, but does not protect against the basis risk component of price risk. In the absence of any significant local demand and supply shocks or changes in transportation rates, we expect nearby basis to be similar from year-to-year at any given point in time.

## Nearby Corn Basis Broken Out

Nearby basis can be thought of as being comprised of two components, a relatively constant component reflecting transportation costs and a seasonal component reflecting fluctuations in local demand and supply throughout the year. The similarity of nearby basis levels and of seasonal trends from year to year is fundamental to making more informed risk management decisions. Calculating historical nearby basis data and understanding its typical patterns throughout the marketing year can help producers determine when to sell their crops and to evaluate alternative marketing strategies such as forward contracts, basis contracts, cash contracts and storage decisions.

As will be shown below, examining changes in local basis over extended periods of time allows for a determination of whether there have been changes in the cost of transportation over time. If changes in transportation costs are found, this has important implications with respect to prices North Carolina corn producers receive and the costs the producers of the “tails and feathers” must pay.

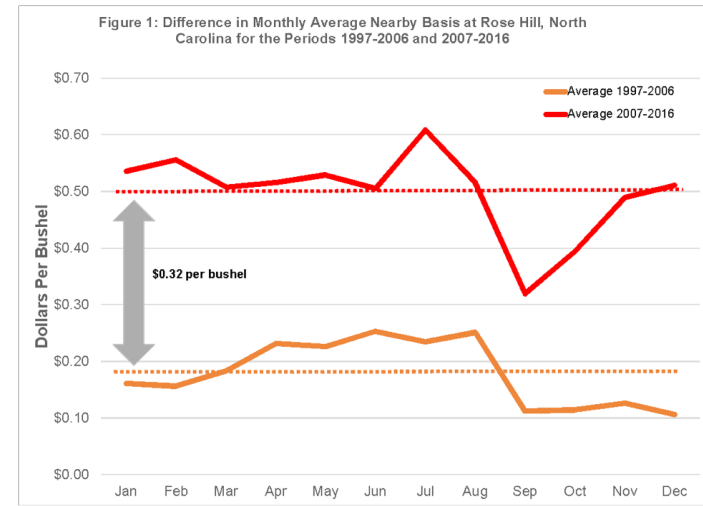


Figure 1: Difference in Monthly Average Nearby Basis at Rose Hill, North Carolina for the Periods 1997 - 2018 and 2007 - 2016

## Historical Nearby Corn Basis in Rose Hill, North Carolina

The Town of Rose Hill, North Carolina, is located in Duplin County and can be reasonably considered to be located in the proximity of the center of livestock production in North Carolina. Table 1 shows the monthly and annual average nearby basis at Rose Hill for two ten-year periods: 1997-2006 and 2007-2016. Figure 1 plots the monthly average nearby basis at Rose Hill for the same two ten-year periods. Surveying the variation in monthly average nearby basis across months in Table 1 reveals the seasonal trends within the year which are illustrated in Figure 1.

Although the seasonal trends are not the same over the two ten-year periods, there are some noteworthy similarities. Firstly, as expected, nearby basis for each period is weakest during harvest time in the months of September and October when locally grown corn around Duplin and surrounding counties bolsters local supply. After the local harvest, nearby basis then begins to strengthen in subsequent months as the new (local) corn crop is utilized, local supplies begin to diminish. Livestock producers increasingly rely upon corn imports from out-of-state to meet demand.

It is interesting to note that the strengthening in basis after harvest is much more pronounced in the period 2007-2016 versus 1997-2006. This suggests that between the two periods there have been some important changes in the cost of corn imports, in local demand and supply conditions, or some combination thereof. Secondly, in both ten-year periods the nearby basis is highest in both periods in the summer months, when local corn supplies are depleted; and decline significantly to their lowest levels as a new corn crop is harvested in September and October.

## Estimated Change in Transportation Costs

The annual averages over the two periods calculated in Table 1 reveal that nearby basis has increased from \$0.18 per bushel in 1997-2006 to \$0.50 per bushel in 2007-2016, an increase of \$0.32 per bushel. These annual averages represent the transportation costs of importing corn from out-of-state. In other words, it is estimated that the average cost of transporting corn from out-of-state via the various modes has increased by \$0.32 per bushel in the last decade as compared to the previous decade.

Table 1: Monthly Average Nearby Basis at Rose Hill, NC (\$/bu)

Month	Average, 1997-2006	Average, 2007-2016	Difference
	[a]	[b]	[b] - [a]
Jan	\$0.16	\$0.54	\$0.38
Feb	\$0.16	\$0.56	\$0.40
Mar	\$0.18	\$0.51	\$0.33
Apr	\$0.23	\$0.52	\$0.28
May	\$0.23	\$0.53	\$0.30
Jun	\$0.25	\$0.51	\$0.25
Jul	\$0.23	\$0.61	\$0.37
Aug	\$0.25	\$0.52	\$0.26
Sep	\$0.11	\$0.32	\$0.21
Oct	\$0.11	\$0.39	\$0.28
Nov	\$0.13	\$0.49	\$0.36
Dec	\$0.11	\$0.51	\$0.41
Annual	\$0.18	\$0.50	\$0.32

This increase in transportation costs has important implications both for end-users of corn in North Carolina and for North Carolina corn farmers. For the end-users of the imported corn – the livestock industry – it means feeding corn to the “tails and feathers” has increased by \$0.32 per bushel over the previous decade. Based on the five-year average North Carolina corn price of \$4.35 per bushel, a \$0.32 per bushel increase represents an increase of 7.4%.

For the North Carolina corn farmer this increase in transportation costs of \$0.32 per bushel represents the increase in price they are receiving as a result of the increase in transportation costs of importing corn into North Carolina. Based on the five-year annual average North Carolina corn production of 110 million bushels, this \$0.32 per bushel represents an increase in annual corn cash receipts in North Carolina of \$35 million.

## Summary of Importance

Looking forward, if the costs of transporting corn from out-of-state sources continues to rise, it will further increase the costs of corn – one of the most important inputs to the livestock industry. To preserve the vitality of North Carolina’s largest agricultural industry and the North Carolina agricultural economy, it may be prudent to consider further investments into the logistical infrastructure to address current inefficiencies and potentially lower the costs of importing corn from out-of-state.

In addition to being beneficial to the North Carolina livestock industry, investing in improved railways and ports might also generate significant positive spillovers to other industries that are dependent on transportation into and out of North Carolina; this in turn should help to improve the overall economy in North Carolina. At the same time, the significant costs of improving railways and ports, combined with many potential beneficiaries of this investment, begs the question who should pay for it? Furthermore, these investment costs and who bears them should be factored into determining whether the net result actually lowers in the price paid for corn imports by the livestock industry.

In the interim we can expect continued strength – and even further increasing in corn basis which will be benefit North Carolina feed grain producers. A continuing strong basis may well encourage greater corn production in North Carolina, which in turn could temper local corn deficits in the future. These critical issues will require further review and analysis going forward.