OTC Grain Indexes and Assessment Methodology

September 2017

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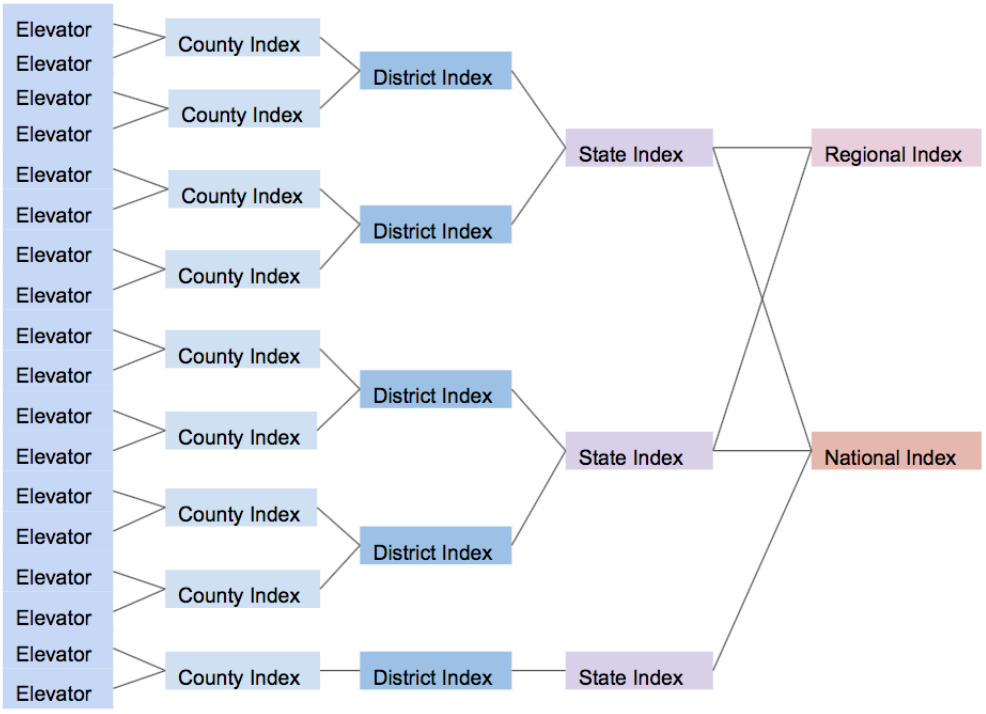
1 Introduction

1.1 cmdtyIndexes OTC Grain Index and Assessment Family

Figure 1: cmdty Agriculture Index Family Hierarchy



cmdtyIndexes OTC Grain Index and Assessment Family: The cmdtyIndexes OTC Grain Index and Assessment Family is a series of data driven volume weighted indexes and price assessments, representing continuous calculations of real time market values of physical grain within a proprietary series of rolling delivery periods. These market values are distributed in two distinct series - a Price series representing the market clearing cash price for physical grain transactions, and a Basis series representing the marketing clearing offset that grain buyers apply to futures related to the underlying commodity.

Within each series, values are calculated and distributed relative to the following delivery windows: Front, Next, and Harvest.

Consideration with regards to facility capacity, utilization, and throughput is given to more accurately provide a market clearing price for a given geographical region. For each commodity product within the cmdtyIndexes OTC Grain Index and Assessment Family there exists the following index groupings:

- cmdtyIndexes County OTC Grain Assessments
- cmdtyIndexes District OTC Grain Assessments
- cmdtyIndexes State OTC Grain Indexes
- cmdtyIndexes Regional OTC Grain Indexes
- cmdtyIndexes National OTC Grain Index

Within each of these index groupings two series values are distributed for both Price and Basis.

cmdtyIndexes County OTC Grain Assessments: Each cmdtyIndexes County OTC Grain Assessment is a price assessment of the real-time fair value price and basis for trading physical cash commodities within that geographic region. This value serves as a benchmark for products traded within a given delivery period and is used by both grain buyers and sellers as a reference to measure the competitiveness of their quotes and transactions.

cmdtyIndexes District OTC Grain Assessments: Each cmdtyIndexes District OTC Grain Assessment is representative of grain transactions within each specified crop reporting district and is used to identify trends relative to historical pricing behavior. This value can serve as a leading indicator of cmdtyIndexes State OTC Grain Index trends.

cmdtyIndexes State OTC Grain Indexes: Each cmdtyIndexes State OTC Grain Index is representative of state wide grain transactions and is used to identify trends relative to historical pricing behavior. This value can serve as a leading indicator of cmdtyIndexes Regional OTC Grain Index trends.

cmdtyIndexes Regional OTC Grain Indexes: Each cmdtyIndexes Regional OTC Grain Index is representative of grain transactions within established main growing regions and is used to identify trends relative to historical pricing behavior. This value can serve as a leading indicator of cmdtyIndexes National OTC Grain Index trends.

cmdtyIndexes National OTC Grain Index: cmdtyIndexes National OTC Grain Index is representative of grain transactions within the U.S and is used to identify trends relative to historical pricing behavior.

1.2 Naming Convention

The cmdtyIndexes OTC Grain Index and Assessment Family adheres to the following naming conventions specific to each delivery window

- Front Month (Default): cmdtyIndexes [region] [crop] [series] Index
  - i.e. cmdtyIndexes Iowa Corn Price Index
- Next Month: cmdtyIndexes [region] Next [crop] [series] Index
  - i.e. cmdtyIndexes National Next Soybean Basis Index
- Harvest Month: cmdtyIndexes [region] Harvest [crop] [series] Index
  - i.e. cmdtyIndexes Boone County (IA) Harvest Corn Price Index

1.3 Data Sourcing and Integrity

Market Data: The market cash bid data is provided by AgriCharts, the market leading provider of proprietary cash grain bid and transaction data. AgriCharts is trusted for its reliable, precise, and accurate data.

Capacity, Utilization, and Throughput Data: Facility capacity, utilization, and throughput data is gathered and estimated from internal processes. It is cross-referenced against third-party data sources, updated continuously, and reviewed for integrity on an ongoing basis.

Cash Bids: cmdtyIndexes passes the market data provided by AgriCharts through a custom cleaning and restructuring process that ensures data integrity as it is ingested by our Index calculation engine.

1.4 Data Processing

1.4.1 Data Restructuring

Data restructuring is required to properly filter and remove price outliers. This is accomplished by grouping inbound data by delivery month and State.

1. Sample input data point, process and output data points:
    - Input data point : Location ID-000001, Commodity - Soybean (Yellow, Number 2), Cash price: 8.64, Delivery start: 06/01/17, Delivery end: 07/31/17, State: IA, etc.
    - Processing:
        - State:IA
            * Delivery period by month:
                · 17Jun: 06/01/2017-06/30/2017
                · 17Jul: 07/01/2017-07/31/2017

- Output data point :
  - Location ID - 000001, Commodity - Soybean (Yellow, Number 2), Cash price: 8.64, Delivery month: 17Jun, Delivery start: 06/01/17, Delivery end: 06/30/17, State: IA, etc.
  - Location ID - 000001, Commodity - Soybean (Yellow, Number 2), Cash price: 8.64, Delivery month: 17Jul, Delivery start: 07/01/17, Delivery end: 07/31/17, State: IA, etc.

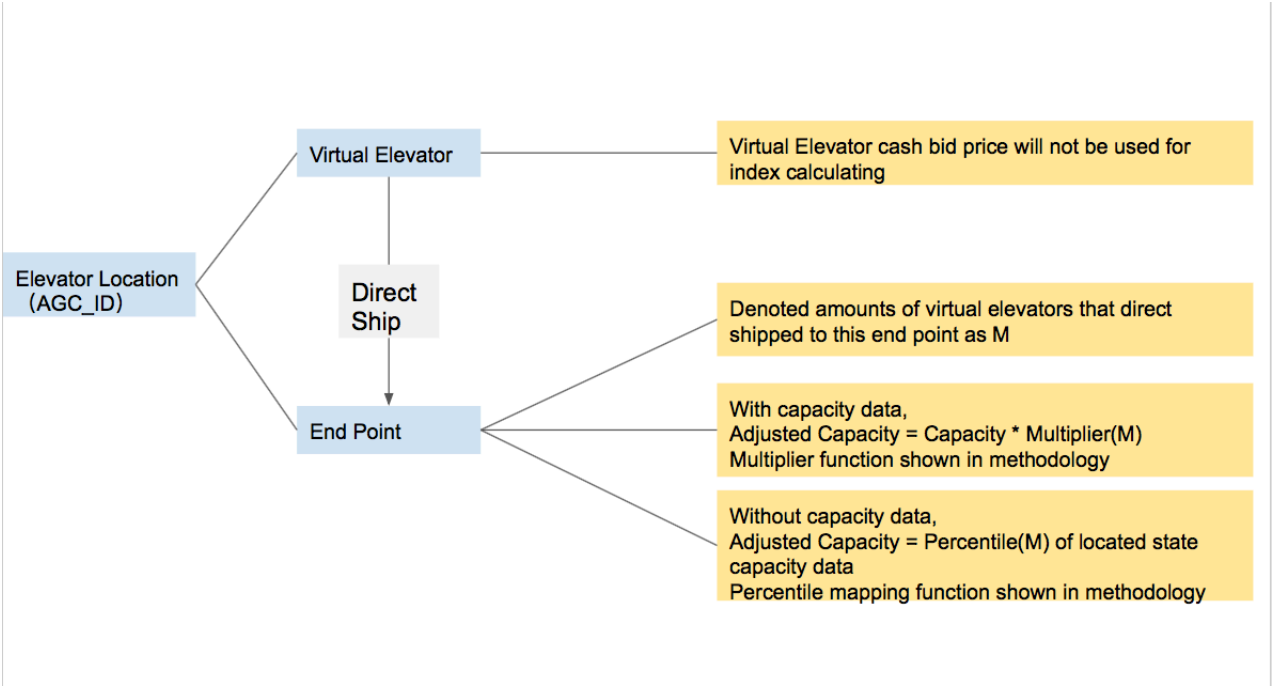
1.4.2 Cleaning Data

cmdtyIndexes generates a cash bid data filter to identify potential erroneous data points, and to ensure the highest quality data for index calculation. The filter is constructed through the following process:

1. Filter grouped data by cash bid price: Calculate the mean μ and standard deviation σ of cash bid price first, and then remove data points with cash bid price out of the range$[\mu - 4\sigma, \mu + 4\sigma]$.
2. Filter grouped data by delivery date: Remove data points with a delivery start date more than 4 months before delivery end date.
3. Filtering grouped data by location ID: If there is a duplicated location ID for different data points, keep one data point provided all associated reference data is the same. Otherwise, remove all those data points.

1.4.3 Adjusted Capacity Methodology

Figure 2: Adjusted Capacity figure



$$Multiplier_i^{t_0} = \begin{cases} 1, & \text{if } M_i^{t_0} = 0 \\ 1.5, & \text{if } M_i^{t_0} = 1 \\ 1 + \log_2^{M_i^{t_0}}, & \text{if } M_i^{t_0} > 1 \end{cases}$$

$$Percentile_i^{t_0} = \begin{cases} 25, & \text{if } M_i^{t_0} = 0 \\ 75 + 7\log_2^{M_i^{t_0}}, & \text{if } 1 \leq M_i^{t_0} \leq 11 \\ 100, & \text{if } M_i^{t_0} > 11 \end{cases}$$

$$AC_i^{t_0} = \begin{cases} Multiplier_i^{t_0} * C_i^{t_0}, & \text{if capacity of elevator } i \text{ available} \\ Percentile_i^{t_0}(AC_{State}^{t_0}), & \text{otherwise} \end{cases}$$

where,

$M_i^{t_0}$ is the total amount of virtual elevators with a direct ship relationship to elevator i at the most recent annual index revision date t_0, it is a constant until the next index revision is implemented.

$C_i^{t_0}$ is the capacity of elevator i at the most recent annual index revising date t_0, it is a constant until the next index revision is implemented.

$AC_i^{t_0}$ is the adjusted capacity data of elevator i, it is a constant until the next index revision is implemented.

$AC_{State}^{t_0}$ is the array of adjusted capacity data of the state that elevator i located in.

$Multiplier_i^{t_0}$ is the multiplier of the elevator i at the most recent annual index revision date t_0, it is a constant until the next index revision is implemented.

$Percentile_i^{t_0}$ is the percentile of the ith elevator's adjusted capacity among its located state at the most recent annual index revise date t_0, it is a constant until the next index revision.

1.4.4 Rolling Methodology

Exclusive to the Front Month Basis series the corresponding futures contract will roll on the forth Friday the month before expiration - after market close. For example, the July futures expiry will roll on the fourth Friday in June.

2 cmdtyIndexes County OTC Grain Assessment Methodology

2.1 Calculation Guide

$$TC_j^t = \sum_{i=1}^{n_j^t} AC_{ij}^{t_0}$$
$$W_{ij}^t = \frac{AC_{ij}^{t_0}}{TC_j^t}$$
$$I_j^t = \sum_{i=1}^{n_j^t} W_{ij}^t P_{ij}^t$$
$$B_j^t = I_j^t - F^t$$

where,

t_0 is the most recent index revision date.

t is time index value is computed.

n_j^t is the total amount of elevators in the county j at time t, which provided cash bid quote on a specific physical commodity that delivery period included the index delivery month.

$AC_{ij}^{t_0}$ is the adjusted capacity of elevator i in county j that updated at the most recent annual index revision date t_0.

TC_j^t is total adjusted capacity of elevators in county j that quoted at time t.

W_{ij}^t is the weight of elevator i in county j at time t.

P_{ij}^t is the cash bid quote of elevator i in county j at time t.

I_j^t is the price index value of county j at time t.

B_j^t is the basis index value of county j at time t.

F^t is the price of corresponding futures contract at time t.

2.2 cmdtyIndexes County Price Assessment Derivation Guide

cmdtyIndexes derives assessments for certain data points where the underlying data isn't sufficient to apply standard pricing methodology for a particular calculation instance of our continuous price indexes. These scenarios are classified into the following categories and are processed in order as required:

1. Missing Delivery Window: For counties with at least one of three possible index values(Front, Next, Harvest), but without all of them, cmdtyIndexes applies a derivation process to simulate the missing delivery window associated with that county index. In the event that none of the three possible index values are available for a given calculation instance the following methodology will be applied.
2. Missing Time Series: For counties that are missing all three observed index values(Front, Next, Harvest), cmdtyIndexes will derive these values using observations of price from previous days - from that county - as well as historical price relationships with other pricing locations. Upon a calculation event, cmdtyIndexes generates a derivation candidate list, and if the county qualifies, applies our calculating process to simulate that county index.

More details on the exact assessment methodology are below.

2.2.1 Derivation Qualification Assessment

As a qualified county, once underlying bid data has been missing more than 30 days that county will no longer be eligible for a price assessment. This ensures that cmdtyIndexes does not continuously produce assessments for regions that no longer have a meaningful grain buying presence.

2.2.2 Derivation Methodology for Missing Delivery Window

Assume county j in district k only has Front month index at time t,

$$I^t_{jk_{Next}} = \overset{\smile t}{I}_{k_{Next}} + I^t_{jk_{Front}} - \overset{\smile t}{I}_{k_{Front}}$$
$$I^t_{jk_{Harvest}} = \overset{\smile t}{I}_{k_{Harvest}} + I^t_{jk_{Front}} - \overset{\smile t}{I}_{k_{Front}}$$

Assume county j in district k has Front index and Next Index at time t,

$$I^t_{jk_{Harvest}} = \overset{\smile t}{I}_{k_{Harvest}} + \frac{1}{2}(I^t_{jk_{Front}} - \overset{\smile t}{I}_{k_{Front}} + I^t_{jk_{Next}} - \overset{\smile t}{I}_{k_{Next}})$$

where,

$\overset{\smile t}{I}_{k_{Front}}, \overset{\smile t}{I}_{k_{Next}}, \overset{\smile t}{I}_{k_{Harvest}}$ are the cmdtyIndexes District Front/Next/Harvest Price Index of crop district k at time t.

$I^t_{jk_{Front}}, I^t_{jk_{Next}}, I^t_{jk_{Harvest}}$ are the cmdtyIndexes County Front/Next/Harvest Price Index of county j in district k at time t.

2.2.3 Derivation Methodology for Missing Time Series

$$\Delta\overset{\smile t}{B}_k = \overset{\smile t}{B}_k - \overset{\smile t-1}{B}_k$$
$$\Delta F^t = F^t - F^{t-1}$$
$$I^t_{jk} = I^{t-1}_{jk} + \Delta F^t + \Delta\overset{\smile t}{B}_k$$
$$I^t_{jk} = I^{t-1}_{jk} + \Delta\overset{\smile t}{I}_k$$

where,

$\overset{\smile t}{B}_k, \overset{\smile t-1}{B}_k$ are the cmdtyIndexes District OTC Grain Basis of crop district k at time t and time $t-1$.

$\Delta\overset{\smile}{B}_k^t$ is the difference between the cmdtyIndexes District OTC Grain Basis of crop district k at time t and time $t-1$.

F^t, F^{t-1} are the last prices of associated futures contract at time t and time $t-1$.

ΔF^t is the difference between the last price of associated futures contract at time t and time $t-1$.

$\overset{\smile}{I}_k^t$ is the cmdtyIndexes District OTC Grain Price Assessment of crop district k at time t.

$\Delta\overset{\smile}{I}_k^t$ is the difference between the cmdtyIndexes District OTC Grain Price Assessment of crop district k at time t and time $t-1$.

I_{jk}^{t-1} is the cmdtyIndexes County OTC Grain Price Assessment of county j in crop district k at time $t-1$ if it exists. Otherwise, it would be replaced by the simulated cmdtyIndexes County OTC Grain Price Assessment of county j in crop district k at time $t-1$.

I_{jk}^t is the simulated cmdtyIndexes County OTC Grain Price Assessment of county j in crop district k at time t.

2.3 Index Maintenance

cmdtyIndexes performs ongoing review of the entire cmdtyIndexes OTC Grain Index and Assessment Family. The capacity and direct ship relationships between all index constituents are reviewed for accuracy on a regular basis, and new locations are onboarded daily.

3 cmdtyIndexes District OTC Grain Assessment Methodology

3.1 Crop District Definition

Agricultural Statistics Districts ("Crop Reporting Districts") are groupings of counties - defined by the USDA - in each State with similar climate and geographical attributes. The components used for grouping include mean temperature, annual precipitation and length of growing season.

Geographic boundaries for Crop Reporting Districts are available on the USDA NASS website:
Map Link - USDA Agricultural Districts boundaries map
Codes Link - USDA Agricultural Districts codes

3.2 Calculation Guide

$$\overset{\smile}{TC}_k^t = \sum_{j=1}^{N_k^t} TC_{jk}^t$$
$$\overset{\smile}{W}_{jk}^t = \frac{TC_{jk}^t}{\overset{\smile}{TC}_k^t}$$
$$\overset{\smile}{I}_k^t = \sum_{j=1}^{N_k^t} \overset{\smile}{W}_{jk}^t I_{jk}^t$$
$$\overset{\smile}{B}_k^t = \overset{\smile}{I}_k^t - F^t$$

where,

t is time index value is computed.

N_k^t is the total amount of counties in the crop district k at time t, which has a corresponding cmdtyIndexes County OTC Grain Assessment.

TC_{jk}^t is total adjusted capacity of elevators of county j in district k that quoted at time t.

$\breve{TC}_k^t$ is total adjusted capacity of elevators in the district k that quoted at time t.

$\breve{W}_{jk}^t$ is the weight of county j among the district k at time t.

I_{jk}^t is the county price index value of county j in the district k at time t corresponding to associated cmdtyIndexes County OTC Grain Assessment.

$\breve{I}_k^t$ is the district price index value of crop district k at time t.

$\breve{B}_k^t$ is the basis index value of district k at time t.

F^t is the price of corresponding futures contract at time t.

3.3 cmdtyIndexes District Price Assessment Derivation Guide

cmdtyIndexes derives assessments for certain data points where the underlying data isn't sufficient to apply standard pricing methodology for a particular calculation instance of our continuous price indexes. These scenarios are classified into the following categories and are processed in order as required:

1. Missing Delivery Window: For districts with at least one of three possible index values(Front, Next, Harvest), but without all of them, cmdtyIndexes applies a derivation process to simulate the missing delivery window associated with that district index. In the event that none of the three possible index values are available for a given calculation instance the following methodology will be applied.
2. Missing Time Series: For districts that are missing all three observed index values(Front, Next, Harvest), cmdtyIndexes will derive these values using

observations of price from previous days - from that district - as well as historical price relationships with other pricing locations. Upon a calculation event, cmdtyIndexes generates a derivation candidate list, and if the district qualifies, applies our calculating process to simulate that district index.

More details on the exact assessment methodology are below.

3.3.1 Derivation Qualification Assessment

As a qualified crop reporting district, once underlying bid data has been missing more than 30 days that district will no longer be eligible for a price assessment. This ensures that cmdtyIndexes does not continuously produce assessments for regions that no longer have a meaningful grain buying presence.

3.3.2 Derivation Methodology for Missing Delivery Window

Assume district k in state l only has Front month index value at time t,

$$\overset{\smile}{I}^{t}_{kl_{Next}} = \widehat{I}^{t}_{l_{Next}} + \overset{\smile}{I}^{t}_{kl_{Front}} - \widehat{I}^{t}_{l_{Front}}$$
$$\overset{\smile}{I}^{t}_{kl_{Harvest}} = \widehat{I}^{t}_{l_{Harvest}} + \overset{\smile}{I}^{t}_{kl_{Front}} - \widehat{I}^{t}_{l_{Front}}$$

Assume district k in state l has Front index value and Next Index value at time t,

$$\overset{\smile}{I}^{t}_{kl_{Harvest}} = \widehat{I}^{t}_{l_{Harvest}} + \frac{1}{2}(\overset{\smile}{I}^{t}_{kl_{Front}} - \widehat{I}^{t}_{l_{Front}} + \overset{\smile}{I}^{t}_{kl_{Next}} - \widehat{I}^{t}_{l_{Next}})$$

where,

$\widehat{I}^{t}_{l_{Front}}, \widehat{I}^{t}_{l_{Next}}, \widehat{I}^{t}_{l_{Harvest}}$ are the cmdtyIndexes State Front/Next/Harvest Price Index of state l at time t.

$\overset{\smile}{I}^{t}_{kl_{Front}}, \overset{\smile}{I}^{t}_{kl_{Next}}, \overset{\smile}{I}^{t}_{kl_{Harvest}}$ are the cmdtyIndexes District Front/Next/Harvest Price Index of crop district k in state l at time t.

3.3.3 Derivation Methodology for Missing Time Series

$$
\begin{aligned}
\Delta \widehat{B}_l^t &= \widehat{B}_l^t - \widehat{B}_l^{t-1} \\
\Delta F^t &= F^t - F^{t-1} \\
\overset{\smile t}{I}_{kl} &= \overset{\smile t-1}{I}_{kl} + \Delta F^t + \Delta \widehat{B}_l^t \\
\overset{\smile t}{I}_{kl} &= \overset{\smile t-1}{I}_{kl} + \Delta \widehat{I}_l^t
\end{aligned}
$$

where,

$\widehat{B}_l^t, \widehat{B}_l^{t-1}$ are the cmdtyIndexes State OTC Grain Index of state l at time t and time $t-1$.

$\Delta \widehat{B}_l^t$ is the difference between the cmdtyIndexes State OTC Grain Basis Index of state l at time t and time $t-1$.

F^t, F^{t-1} are the last prices of associated futures contract at time t and time $t-1$.

ΔF^t is the difference between the last price of associated futures contract at time t and time $t-1$.

$\widehat{I}_l^t$ is the cmdtyIndexes State OTC Grain Price Index of state l at time t.

$\Delta \widehat{I}_l^t$ is the difference between the cmdtyIndexes State OTC Grain Price Index of state l at time t and time $t-1$.

$\overset{\smile t-1}{I}_{kl}$ is the cmdtyIndexes District OTC Grain Price Assessment of district k in state l at time $t-1$ if it exist. Otherwise, it would be replaced by the simulated cmdtyIndexes District OTC Grain Price Assessment of district k in state l at time $t-1$.

$\overset{\smile t}{I}_{kl}$ is the simulated cmdtyIndexes District OTC Grain Price Assessment of district k in state l at time t.

3.4 Index Maintenance

cmdtyIndexes performs ongoing review of the entire cmdtyIndexes OTC Grain Index and Assessment Family. The capacity and direct ship relationships between all index constituents are reviewed for accuracy on a regular basis, and new locations are onboarded daily.

4 cmdtyIndexes State OTC Grain Index Methodology

4.1 Calculation Guide

$$\widehat{TC}_l^t = \sum_{k=1}^{\widehat{N}_l^t} \breve{TC}_{kl}^{\,t}$$

$$\widehat{W}_{kl}^t = \frac{\breve{TC}_{kl}^{\,t}}{\widehat{TC}_l^t}$$

$$\widehat{I}_l^t = \sum_{k=1}^{\widehat{N}_l^t} \widehat{W}_{kl}^t \breve{I}_{kl}^{\,t}$$

$$\widehat{B}_l^t = \widehat{I}_l^t - F^t$$

where,

t is time index value is computed.

$\widehat{N}_k^t$ is the total amount of districts in the state l at time t, which has a corresponding cmdtyIndexes District OTC Grain Assessment.

$\breve{TC}_{kl}^{\,t}$ is total adjusted capacity of elevators of district k in state l that quoted at time t.

$\widehat{TC}_l^t$ is total adjusted capacity of elevators in the state l that quoted at time t.

$\widehat{W}_{kl}^t$ is the weight of district k among the state l at time t.

$\breve{I}_{kl}^{\,t}$ is the district price index value of district k in the state l at time t corresponding to associated cmdtyIndexes District OTC Grain Assessment.

$\widehat{I}_l^t$ is the state price index value of state l at time t.

$\widehat{B}_l^t$ is the basis index value of state l at time t.

F^t is the price of corresponding futures contract at time t.

4.2 cmdtyIndexes State Price Assessment Derivation Guide

cmdtyIndexes derives assessments for certain data points where the underlying data isn't sufficient to apply standard pricing methodology for a particular calculation instance of our continuous price indexes. These scenarios are classified into the following categories and are processed in order as required:

1. Missing Delivery Window: For states with at least one of three possible index values(Front, Next, Harvest), but without all of them, cmdtyIndexes applies a derivation process to simulate the missing delivery window associated with that state index. In the event that none of the three possible index values are available for a given calculation instance the following methodology will be applied.
2. Missing Time Series: For states that are missing all three observed index values(Front, Next, Harvest), cmdtyIndexes will derive these values using observations of price from previous days - from that state - as well as historical price relationships with other pricing locations. Upon a calculation event, cmdtyIndexes generates a derivation candidate list, and if the state qualifies, applies our calculating process to simulate that state index.

More details on the exact assessment methodology are below.

4.2.1 Derivation Methodology for Missing Delivery Window

Assume state l only has Front month index value at time t,

$$\widehat{I}_{l_{Next}}^t = \widehat{UI}_{l_{Next}}^t + \widehat{I}_{l_{Front}}^t - \widehat{UI}_{l_{Front}}^t$$
$$\widehat{I}_{l_{Harvest}}^t = \widehat{UI}_{l_{Harvest}}^t + \widehat{I}_{l_{Front}}^t - \widehat{UI}_{l_{Front}}^t$$

Assume state l has Front index value and Next Index value at time t,

$$\widehat{I}_{l_{Harvest}}^t = \widehat{UI}_{l_{Harvest}}^t + \frac{1}{2}(\widehat{I}_{l_{Front}}^t - \widehat{UI}_{l_{Front}}^t + \widehat{I}_{l_{Next}}^t - \widehat{UI}_{l_{Next}}^t)$$

where,

$\widehat{I}^t_{l_{Front}}, \widehat{I}^t_{l_{Next}}, \widehat{I}^t_{l_{Harvest}}$ are the cmdtyIndexes State Front/Next/Harvest Index of state l at time t.

$\widehat{UI}^t_{l_{Front}}, \widehat{UI}^t_{l_{Next}}, \widehat{UI}^t_{l_{Harvest}}$ are the upper state level cmdtyIndexes Front/Next/Harvest Price Index of state l at time t, which could be cmdtyIndexes Regional Front/Next/-Harvest Price Index or cmdtyIndexes National Front/Next/Harvest Price Index depends on the location of state l.

4.2.2 Derivation Methodology for Missing Time Series

$$\widehat{UI}^t_l = \begin{cases} \widetilde{I}^t, & \text{if state } l \text{ is located in any major growing region} \\ \overline{I}^t, & \text{otherwise} \end{cases}$$

$$\widehat{UB}^t_l = \begin{cases} \widetilde{B}^t, & \text{if state } l \text{ is located in any major growing region} \\ \overline{B}^t, & \text{otherwise} \end{cases}$$

$$\begin{aligned} \Delta\widehat{UB}^t_l &= \widehat{UB}^t_l - \widehat{UB}^{t-1}_l \\ \Delta F^t &= F^t - F^{t-1} \\ \widehat{I}^t_l &= \widehat{I}^{t-1}_l + \Delta F^t + \Delta\widehat{UB}^t_l \\ \widehat{I}^t_l &= \widehat{I}^{t-1}_l + \Delta\widehat{UI}^t_l \end{aligned}$$

where,

$\widetilde{B}^t, \widetilde{I}^t$ are the cmdtyIndexes Regional OTC Grain Basis and Price Index values of the major growing region that state l located in at time t.

$\overline{B}^t, \overline{I}^t$ are the cmdtyIndexes National OTC Grain Basis and Price Index values at time t.

$\widehat{UI}^t_l, \widehat{UI}^{t-1}_l$ are the upper level cmdtyIndexes State OTC Grain Price Index of state l at time t and $t-1$, which could be cmdtyIndexes Regional OTC Grain Price Index or cmdtyIndexes National OTC Grain Price Index depending on the location

of state l.

$\Delta\widehat{UI}_l^t$ is the difference between the upper level cmdtyIndexes OTC Grain Price Index of state l at time t and $t-1$.

$\widehat{UB}_l^t, \widehat{UB}_l^{t-1}$ are the upper state level cmdtyIndexes OTC Grain Basis Index of state l at time t and $t-1$, which could be cmdtyIndexes Regional OTC Grain Basis Index or cmdtyIndexes National OTC Grain Basis Index depends on the location of state l.

$\Delta\widehat{UB}_l^t$ is the difference between the upper level cmdtyIndexes OTC Grain Basis Index of state l at time t and $t-1$.

F^t, F^{t-1} are the last prices of associated futures contract at time t and time $t-1$.

ΔF^t is the difference between the last price of associated futures contract at time t and time $t-1$.

$\widehat{I}_l^{t-1}$ is the cmdtyIndexes State OTC Grain Price Index of state l at time $t-1$ if it exists. Otherwise, it would be replaced by the simulated cmdtyIndexes State OTC Grain Index of state l at time $t-1$.

$\widehat{I}_l^t$ is the simulated cmdtyIndexes State OTC Grain Price Index of state l at time t.

4.3 Index Maintenance

cmdtyIndexes performs ongoing review of the entire cmdtyIndexes OTC Grain Index and Assessment Family. The capacity and direct ship relationships between all index constituents are reviewed for accuracy on a regular basis, and new locations are onboarded daily.

5 cmdtyIndexes Regional OTC Grain Index Methodology

5.1 Region Definitions

Major growing zones are divided into three regions:

- Eastern - Illinois, Indiana, Kentucky, Michigan, Ohio and Wisconsin
- Western - Iowa, Kansas, Minnesota, Nebraska, North Dakota and South Dakota
- Delta - Arkansas, Louisiana, Mississippi, Missouri and Tennessee

5.2 Calculation Methodology

$$\widetilde{TC}^t = \sum_{l=1}^{m^t} \widehat{TC}_l^t$$
$$\widetilde{W}_l^t = \frac{\widehat{TC}_l^t}{\widetilde{TC}^t}$$
$$\widetilde{I}^t = \sum_{l=1}^{m^t} \widetilde{W}_l^t \widehat{I}_l^t$$
$$\widetilde{B}^t = \widetilde{I}^t - F^t$$

where,

t is time index value is computed.

m^t is the total amount of states in this region at time t, which has a corresponding cmdtyIndexes State OTC Grain Index value.

$\widehat{TC}_l^t$ is total adjusted capacity of elevators in state l that quoted at time t.

$\widetilde{TC}^t$ is total adjusted capacity of elevators in this region quoted at time t.

$\widetilde{W}_l^t$ is the weight of state l among this region at time t.

$\widehat{I}_l^t$ is the state price index value of state l at time t corresponding to associated cmdtyIndexes State OTC Grain Price Index.

$\widetilde{I}^t$ is the region price index value of this region at time t.

$\widetilde{B}^t$ is the region basis index value of this region at time t.

5.3 Front Month Weighting Method

cmdtyIndexes uses a Front Month weighting method for calculating cmdtyIndexes Next Month and Harvest Month regional indexes.

Front Month delivery data typically has superior market coverage and capacity information that is more representative of underlying market behavior. The methodology assumes all facilities quoted on Front Month delivery for physical grain additionally quote Next Month Harvest Month delivery.

Implementation:
Indexes calculated for Next Month and Harvest Month inherit the capacity weightings of Front Month index calculations.

5.4 Front Month Weighting Example

Assume cmdtyIndexes Regional OTC Grain Front Month Price Index is 2017 Jun region Index:

$$\widetilde{I}_{JUN}^t = \sum_{l=1}^{m_{Jun}^t} \widetilde{W}_{l_{JUN}}^t \widehat{I}_{l_{JUN}}^t$$

Delivery month 2017 Jul (Next Month) region Index will be calculated by using adjusted 2017 Jun weights $adj\widetilde{W}_{l_{JUN}}^t$, amount of state with cmdtyIndexes State

OTC Grain Index m^t_{Jun} and 2017 July state index value $\widehat{I}^t_{l_{JUL}}$:

$$\widetilde{I}^t_{JUL} = \sum_{l=1}^{m^t_{Jun}} adj\widetilde{W}^t_{l_{JUN}} \widehat{I}^t_{l_{JUL}}$$

If there are n^t states do not have their cmdtyIndexes State Next Month/Harvest Month OTC Grain Price Index in m^t_{Jun} states, cmdtyIndexes will set their weights to be zero and amplify the weights of other states proportional to its weights for calculating cmdtyIndexes Regional Next Month/Harvest Month OTC Grain Price Index:

$$adj\widetilde{W}^t_{l_{JUN}} = \begin{cases} \frac{\widetilde{W}^t_{l_{JUN}}}{1-\sum_{i=1}^{n^t} \widetilde{W}^t_{i_{JUN}}}, & \text{if state } l \notin n^t \text{ states} \\ 0, & \text{otherwise} \end{cases}$$

5.5 Index Maintenance

cmdtyIndexes performs ongoing review of the entire cmdtyIndexes OTC Grain Index and Assessment Family. The capacity and direct ship relationships between all index constituents are reviewed for accuracy on a regular basis, and new locations are onboarded daily.

6 cmdtyIndexes National OTC Grain Index Methodology

6.1 Calculation Methodology

$$\overline{TC}^t = \sum_{l=1}^{M^t} \widehat{TC}_l^t$$
$$\overline{W}_l^t = \frac{\widehat{TC}_l^t}{\overline{TC}^t}$$
$$\overline{I}^t = \sum_{l=1}^{M^t} \overline{W}_l^t \widehat{I}_l^t$$
$$\overline{B}^t = \overline{I}^t - F^t$$

where,

M^t is the total amount of states in United States at time t, which has its corresponding cmdtyIndexes State OTC Grain Index value.

$\widehat{TC}_l^t$ is total adjusted capacity of elevators in state l that quoted at time t.

$\overline{TC}^t$ is total adjusted capacity of elevators in the United States quoted at time t.

$\overline{W}_l^t$ is the weight of state l among the United States at time t.

$\widehat{I}_l^t$ is the state price index value of state l at time t corresponding to associated cmdtyIndexes State OTC Grain Price Index.

$\overline{I}^t$ is the national price index value of the United States at time t.

$\overline{B}^t$ is the national basis index value of the United States at time t.

6.2 Front Month Weighting Method

cmdtyIndexes uses a Front Month weighting method for calculating cmdtyIndexes Next Month and Harvest Month national indexes.

Front Month delivery data typically has superior market coverage and capacity information that is more representative of underlying market behavior. The methodology assumes all facilities quoted on Front Month delivery for physical grain additionally quote Next Month and Harvest Month delivery.

Implementation:
Indexes calculated for Next Month and Harvest Month inherit the capacity weightings of Front Month index calculations.

6.3 Front Month Weighting Example

Assume cmdtyIndexes National OTC Grain Front Month Price Index is 2017 Jun national Index:

$$\overline{I}^t_{JUN} = \sum_{l=1}^{M^t_{Jun}} \overline{W}^t_{l_{JUN}} \widehat{I}^t_{l_{JUN}}$$

Next Month 2017 July National Index will be calculated by using adjusted 2017 June weights $adj\overline{W}^t_{l_{JUN}}$, amount of states with cmdtyIndexes State OTC Grain Index M^t_{Jun}, and 2017 July state index value $\widehat{I}^t_{l_{JUL}}$:

$$\overline{I}^t_{JUL} = \sum_{l=1}^{M^t_{Jun}} adj\overline{W}^t_{l_{JUN}} \widehat{I}^t_{l_{JUL}}$$

If there are N^t states do not have their cmdtyIndexes State Next Month/Harvest Month OTC Grain Price Index in M^t_{Jun} states, cmdtyIndexes will set their weights to be zero and amplify the weights of other states proportional to its weights for calculating cmdtyIndexes National Next Month/Harvest Month OTC Grain Price Index:

$$adj\overline{W}^t_{l_{JUN}} = \begin{cases} \frac{\overline{W}^t_{l_{JUN}}}{1-\sum_{i=1}^{N^t} \overline{W}^t_{i_{JUN}}}, & \text{if state } l \notin N^t states \\ 0, & \text{otherwise} \end{cases}$$

6.4 Index Maintenance

cmdtyIndexes performs ongoing review of the entire cmdtyIndexes OTC Grain Index and Assessment Family. The capacity and direct ship relationships between all index constituents are reviewed for accuracy on a regular basis, and new locations are onboarded daily.

Appendices

Included in the appendix are samples of historical price performance of certain cmdtyIndexes OTC Grain Indexes and Assessment Family series relative to a rolling front-month futures contract.

An overview of cmdtyIndexes data coverage by geographic region is included.

I Historical cmdtyIndexes OTC Grain Indexes and Assessment Samples

Figure 3: Sample cmdtyIndexes OTC Regional Soybean Price Indexes

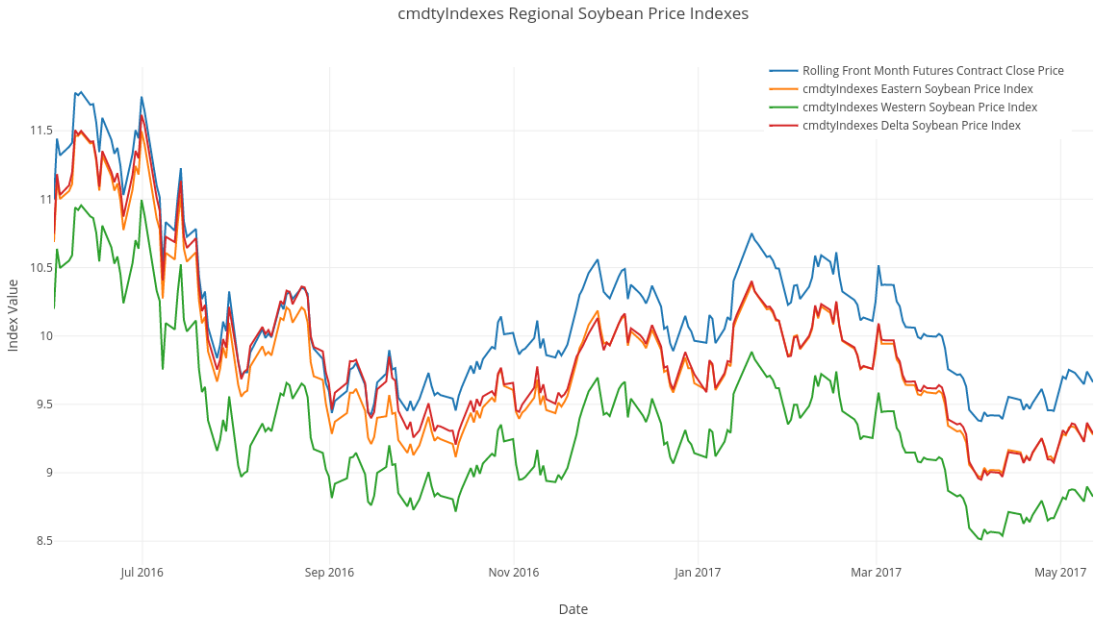
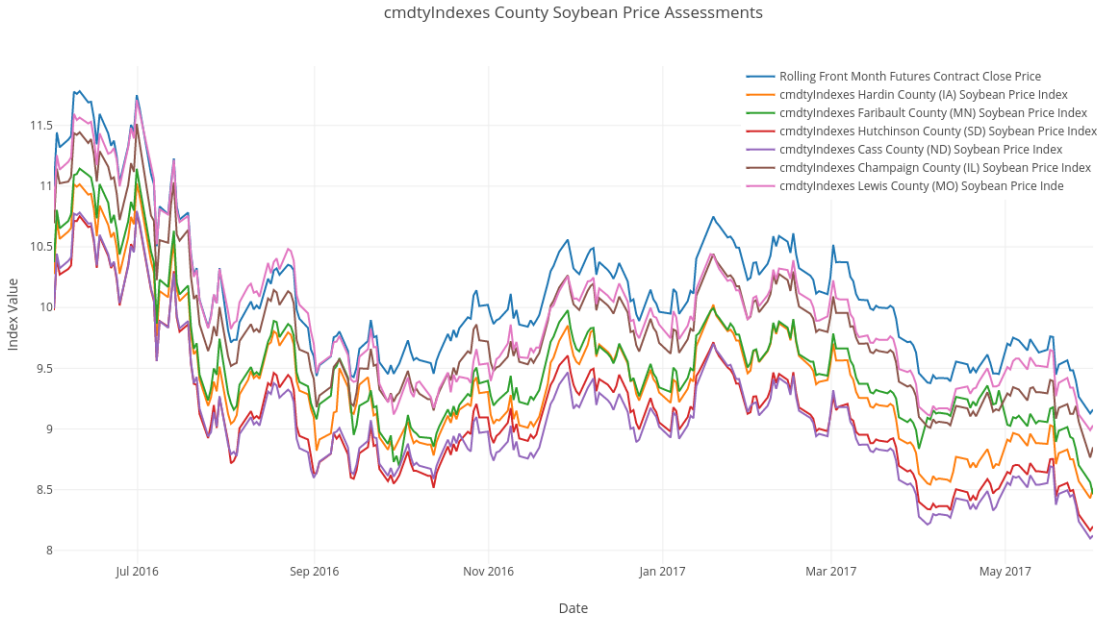


Figure 4: Sample cmdtyIndexes County Soybean Price Index History



About cmdty

cmdty delivers the data, solutions, and insights that commodity professionals need to drive their business. Our offerings are built for the most demanding of users - and are designed to be Smart, Transparent, and easily integrated into any client solution.

Contact Information

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