

Insights into basis and movement of corn in NC

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WHAT IS “BASIS”?

“Basis is the difference between local cash prices and futures market prices at any point in time.”

$$BASIS_t = LOCAL\ CASH\ PRICE_t - FUTURES\ PRICE_t$$

AND, IT FOLLOWS THAT:

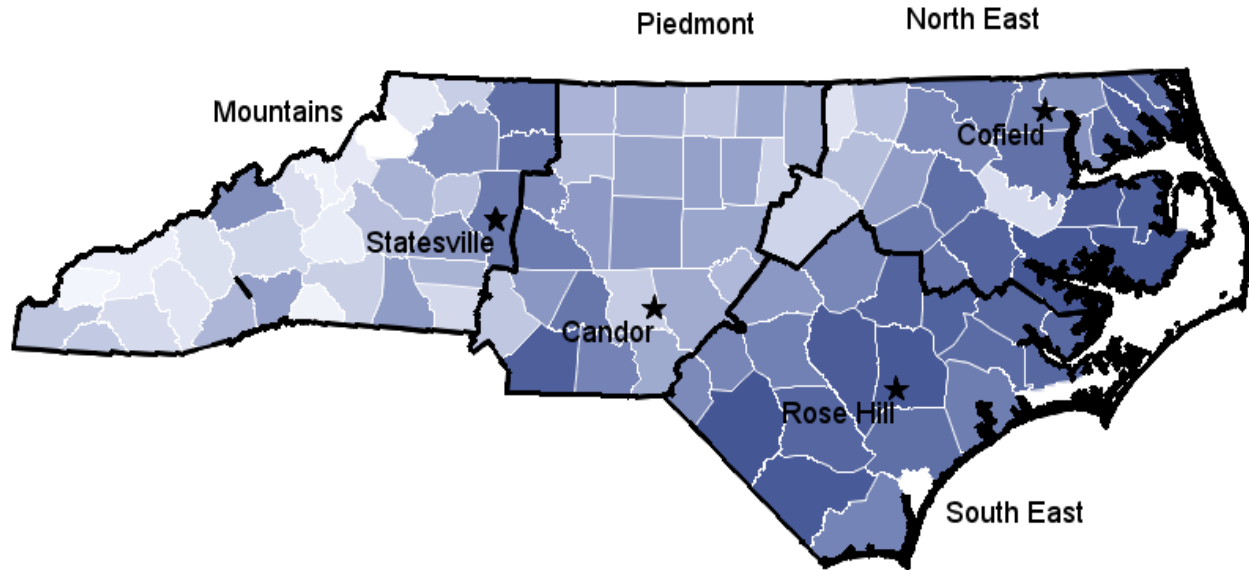
$$LOCAL\ CASH\ PRICE_t = FUTURES\ PRICE_t + BASIS_t$$

Important Details Regarding the Data

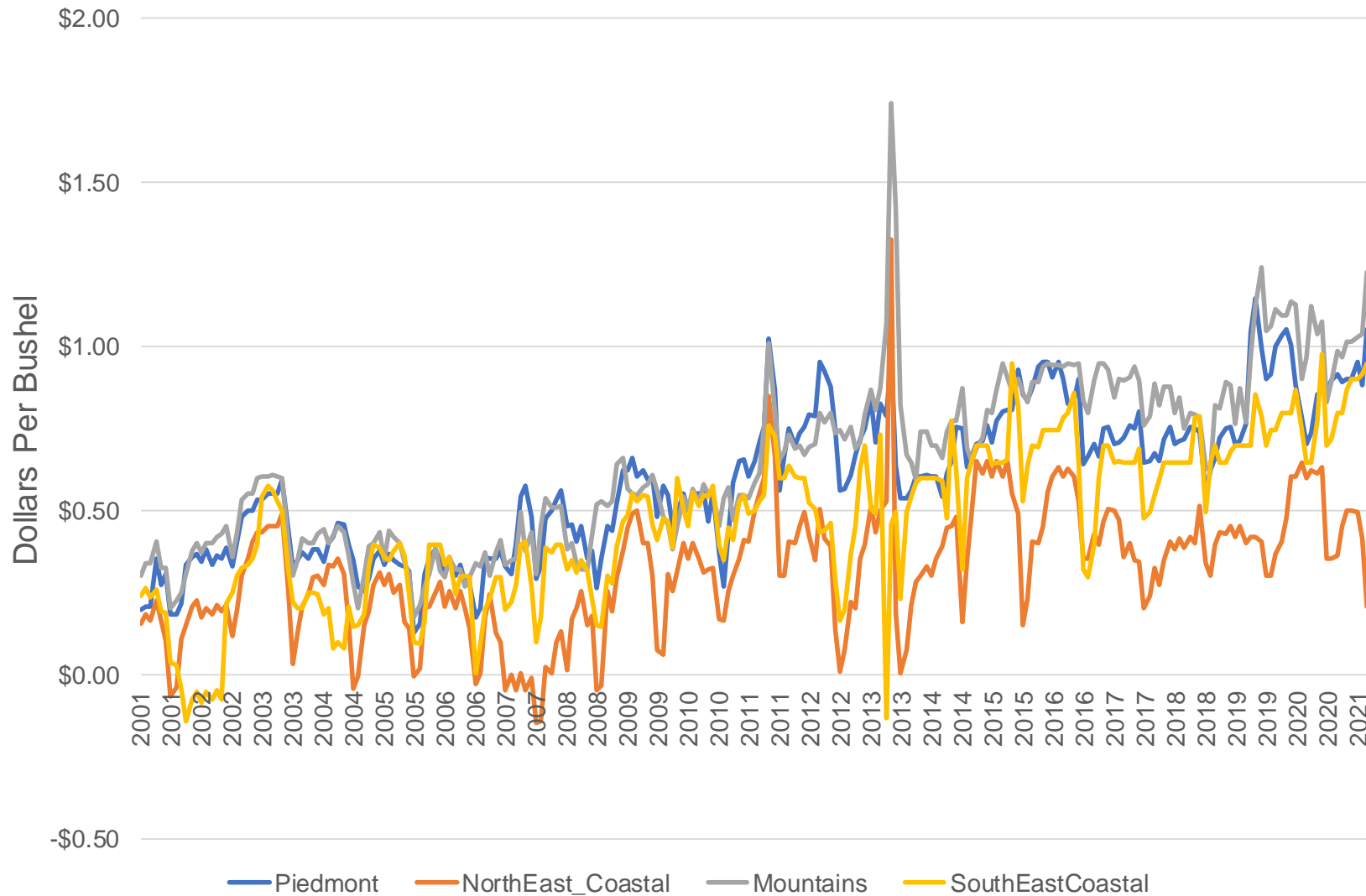
- A new database for corn price was established
 - Replaced the USDA RAGR110 report
- Utilized USDA reports from USDA RA_GR110 reports in .txt format and compiled them into new data base using SAS. Importantly includes cash and forward bids (new).
- August of 2020 the RA_GR115 report was discontinued in favor of the AMS 3156 report – which contains the same information in PDF format which is also accessible through an API provided by the USDA AMS.
- The new corn database consists of 89,730 data points
 - 36 unique locations
 - Delivery Point (Country Elevator, Mill and Processor)
 - 42 unique Location # Delivery Points
 - Bids (Immediate [spot], Delivery [new crop])
- Daily observations were aggregated to month averages over the period 2001(3)-2020(4) to create a workable database of monthly basis to engage in econometrics



Corn Production by Regions and Markets

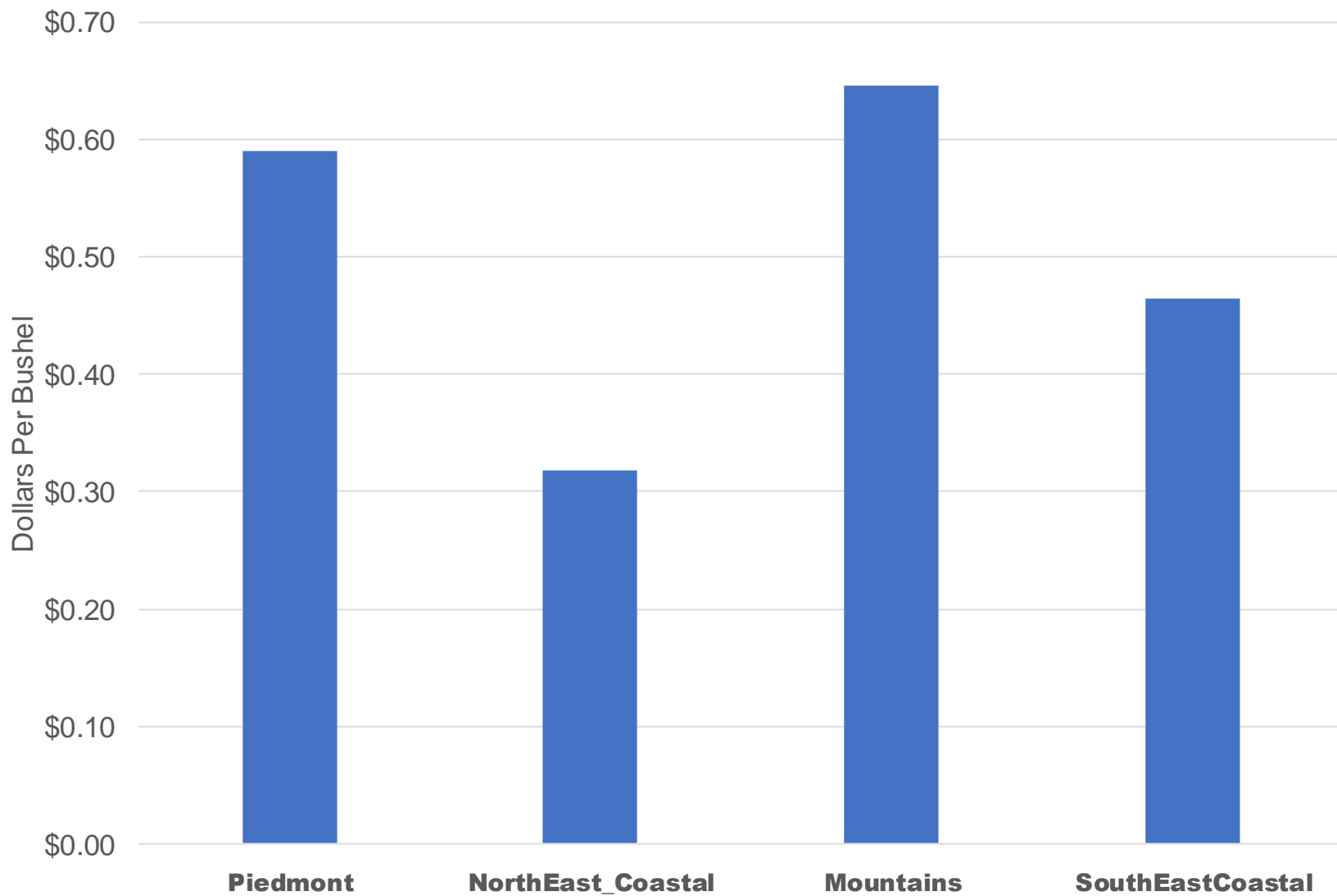


Monthly North Carolina Immediate Corn Basis by Regions 2001(3)-2021(4)

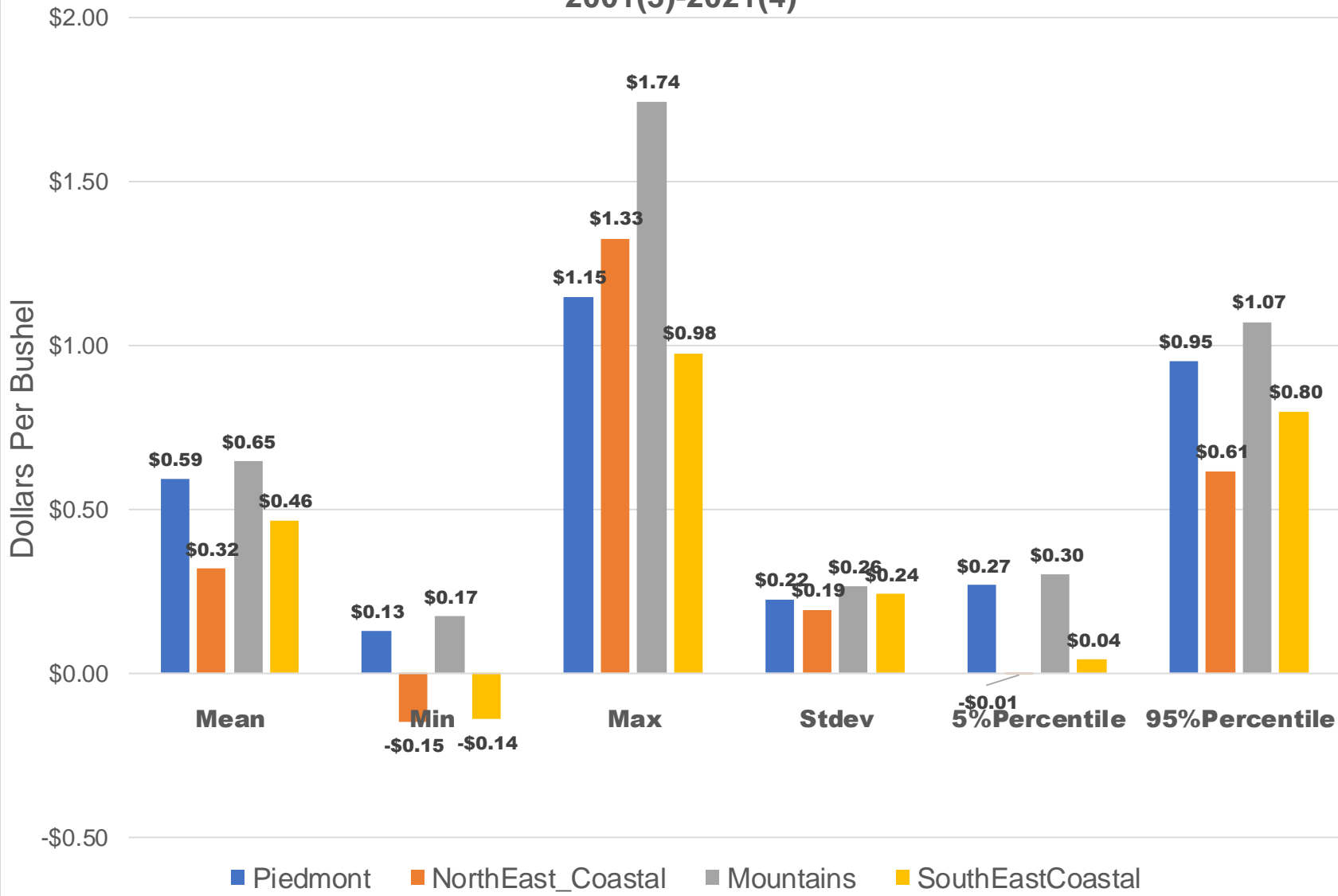


| Location | Country Elevators | Mills and Processors | Total |
|-----------------|--------------------------|-----------------------------|--------------|
| Barber | 1 | 1 | 2 |
| Bladenboro | 1 | 1 | 2 |
| Creswell | 1 | 1 | 2 |
| Pantego | 1 | 1 | 2 |
| Rose Hill | 1 | 1 | 2 |
| Warsaw | 1 | 1 | 2 |
| Candor | 0 | 1 | 1 |
| Cofield | 0 | 1 | 1 |
| Laurinburg | 0 | 1 | 1 |
| Monroe | 0 | 1 | 1 |
| Nashville | 0 | 1 | 1 |
| Roaring River | 0 | 1 | 1 |
| Selma | 0 | 1 | 1 |
| Statesville | 0 | 1 | 1 |
| Autryville | 1 | 0 | 1 |
| Calypso | 1 | 0 | 1 |
| Chadbourn | 1 | 0 | 1 |
| Clarkton | 1 | 0 | 1 |
| Clement | 1 | 0 | 1 |
| Cleveland | 1 | 0 | 1 |
| Clinton | 1 | 0 | 1 |
| Dunn | 1 | 0 | 1 |
| Elizabeth City | 1 | 0 | 1 |
| Greenville | 1 | 0 | 1 |
| La Grange | 1 | 0 | 1 |
| Lagrange | 1 | 0 | 1 |
| Lumberton | 1 | 0 | 1 |
| Mount Olive | 1 | 0 | 1 |
| Mount Ulla | 1 | 0 | 1 |
| New London | 1 | 0 | 1 |
| Newton | 1 | 0 | 1 |
| Norwood | 1 | 0 | 1 |
| Register | 1 | 0 | 1 |
| Shelby | 1 | 0 | 1 |
| Whiteville | 1 | 0 | 1 |
| Wilson | 1 | 0 | 1 |
| Totals | 28 | 14 | 42 |

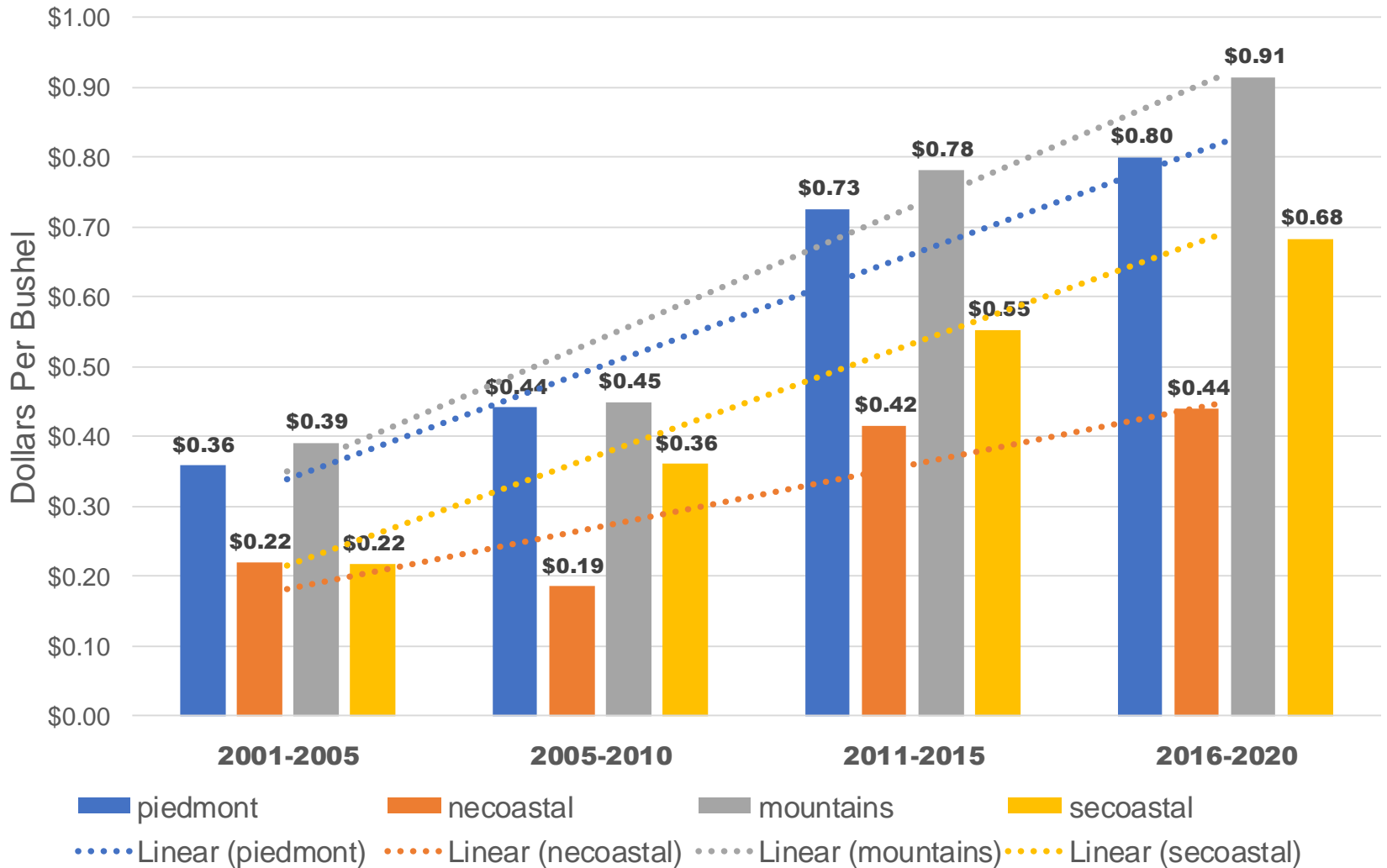
NC Monthly Immediate Corn Basis Means by Regions 2001(3)-2021(4)



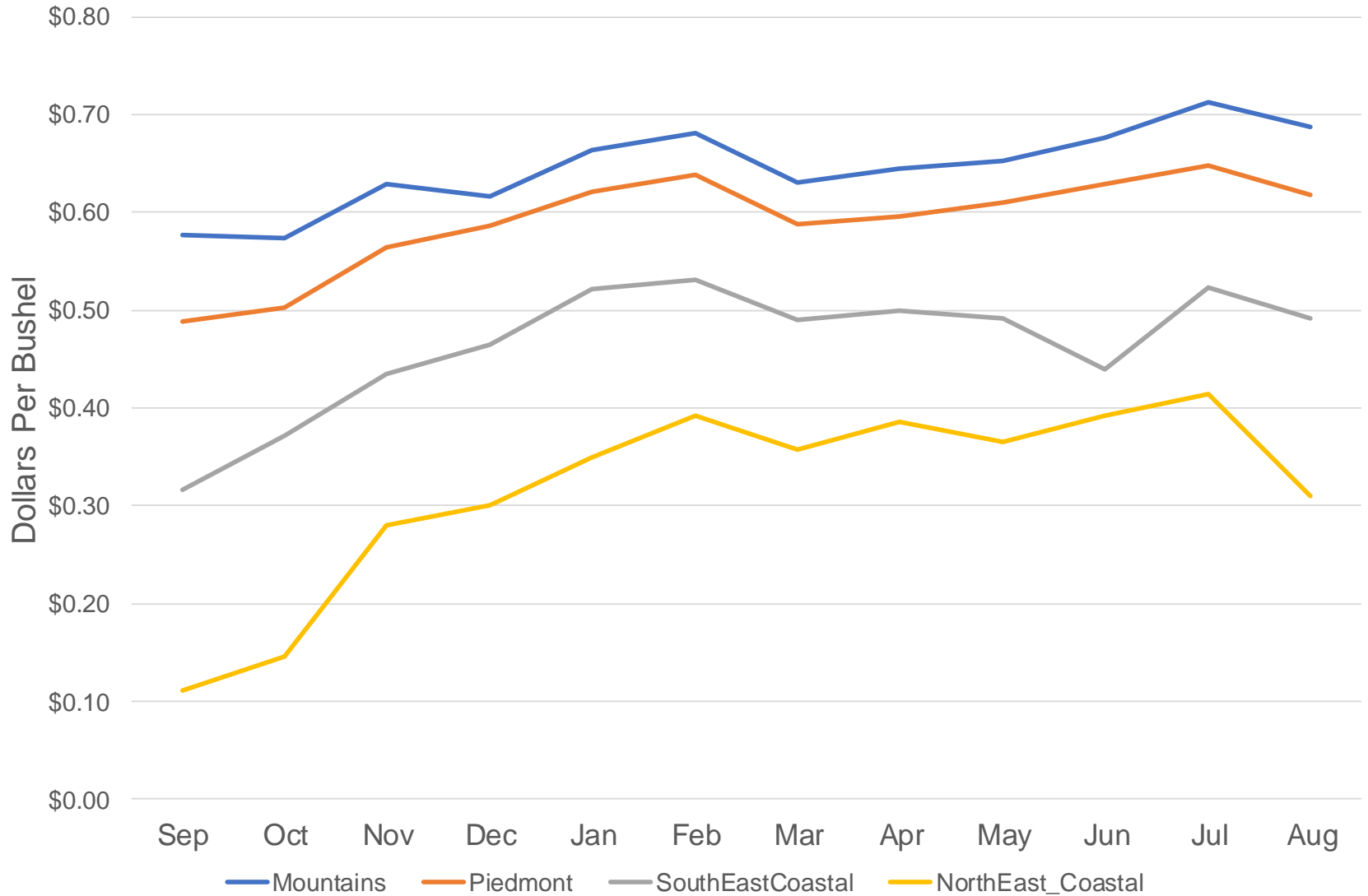
NC Monthly Immediate Corn Basis Summary Statistics by Regions 2001(3)-2021(4)



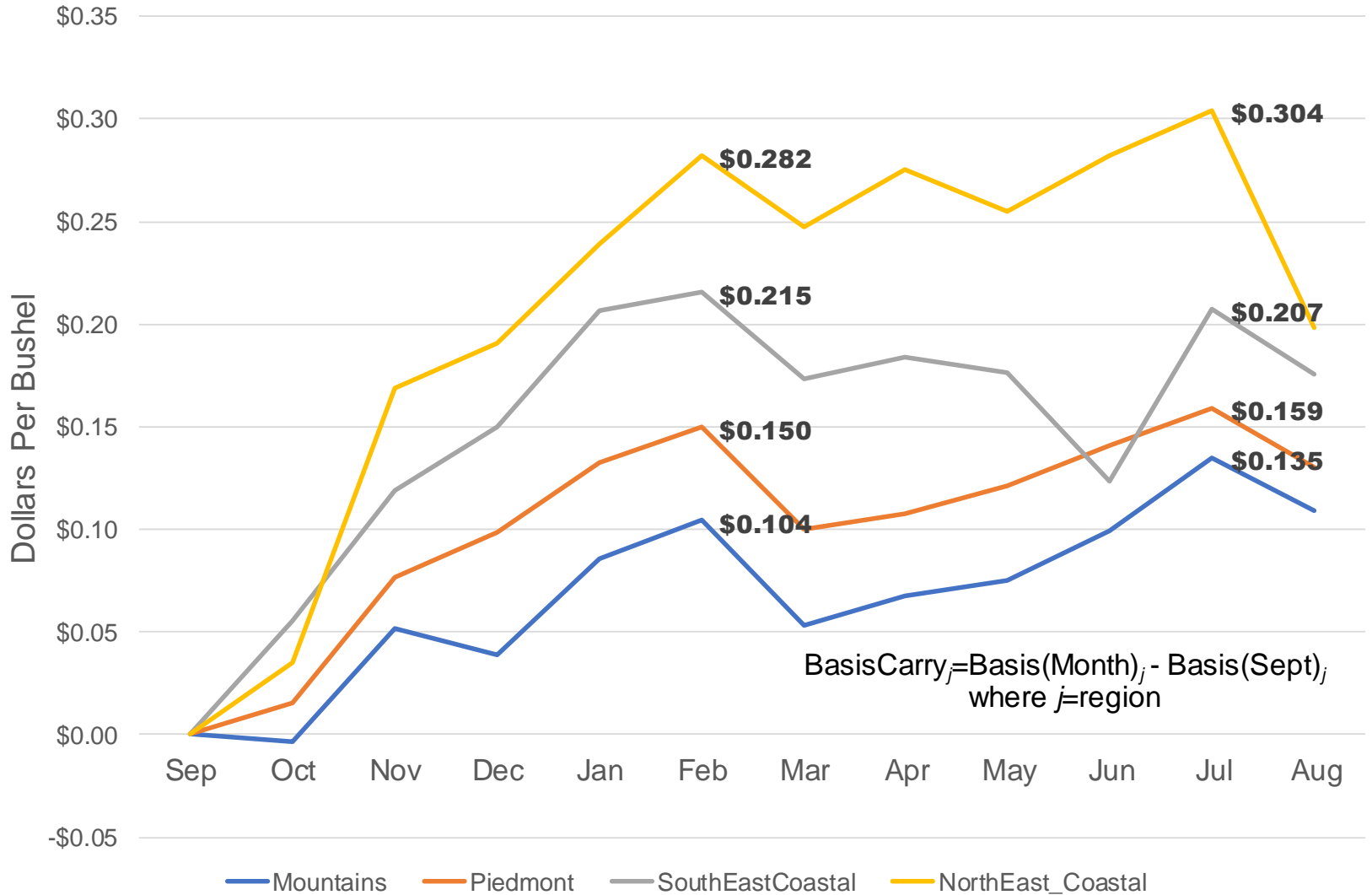
NC Monthly Immediate Corn 5-Year Averages by Regions 2001(3)-2020(12)



North Carolina Corn Basis by Regions and Month 2001(3)-2021(4)



North Carolina Average "Basis Carry" by Month and Regions for 2001(3) - 2021(4)



Basic Econometric Model

$$Basis_t^r = \alpha + \sum_{j=1}^{11} \beta_j Month_j + \tau T$$

where

- $Basis_t^{Region}$ = average monthly basis for r^{th} region 2001(3)-2021(8)
- $Month_j$ = monthly dummy variable for the j^{th} month
- τT = linear time trend
- $r = \{ \text{Mountains, Piedmont, SEcoastal, NEcoastal} \}$
- $j = \{ \text{Oct, Nov, Dec, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug} \}$
- α and β_j are parameters to estimate

Single Equation Regressions

| Single Equation Regressions | | | | | | | | |
|-----------------------------|-----------|---------|----------|---------|-----------|---------|-----------|---------|
| | Mountains | | Piedmont | | SEcoastal | | NEcoastal | |
| R-Square | 0.7456 | | 0.7547 | | 0.7547 | | 0.4916 | |
| Variable | Estimate | Pr > t | Estimate | Pr > t | Estimate | Pr > t | Estimate | Pr > t |
| Intercept | 0.18792 | <.0001 | 0.15988 | <.0001 | -0.02307 | 0.0992 | -0.05848 | 0.0992 |
| m_oct | -0.00661 | 0.8819 | 0.01254 | 0.7349 | 0.05289 | 0.4572 | 0.03346 | 0.4572 |
| m_nov | 0.04515 | 0.3103 | 0.07147 | 0.0546 | 0.11329 | 0.0003 | 0.16591 | 0.0003 |
| m_dec | 0.02948 | 0.5074 | 0.09022 | 0.0155 | 0.14128 | <.0001 | 0.18623 | <.0001 |
| m_jan | 0.07302 | 0.1014 | 0.12173 | 0.0012 | 0.19505 | <.0001 | 0.2338 | <.0001 |
| m_feb | 0.0882 | 0.0482 | 0.13627 | 0.0003 | 0.20138 | <.0001 | 0.27496 | <.0001 |
| m_mar | 0.05345 | 0.2243 | 0.0999 | 0.0068 | 0.17363 | <.0001 | 0.24724 | <.0001 |
| m_apr | 0.06456 | 0.1425 | 0.10458 | 0.0046 | 0.18129 | <.0001 | 0.27363 | <.0001 |
| m_may | 0.06946 | 0.1147 | 0.11862 | 0.0013 | 0.17051 | <.0001 | 0.25013 | <.0001 |
| m_jun | 0.11499 | 0.0093 | 0.14922 | <.0001 | 0.14022 | <.0001 | 0.26265 | <.0001 |
| m_jul | 0.16602 | 0.0002 | 0.1731 | <.0001 | 0.21674 | <.0001 | 0.3111 | <.0001 |
| m_aug | 0.10426 | 0.0183 | 0.14455 | 0.0001 | 0.17946 | <.0001 | 0.19697 | <.0001 |
| t | 0.00322 | <.0001 | 0.00271 | <.0001 | 0.0028 | <.0001 | 0.0014 | <.0001 |
| | | | | | | | | |
| Test | F-test | Pr > F | F-test | Pr > F | F-test | Pr > F | F-test | Pr > F |
| All Monthly = 0 | 2.46 | 0.0064 | 4.1 | <.0001 | 5.03 | <.0001 | 9.31 | <.0001 |
| All Monthly Equal | 2.2 | 0.0186 | 2.84 | 0.0024 | 2.65 | 0.0044 | 5.74 | <.0001 |

Shaded estimates and test statistics are significant at the 5% level

Single Equation Results and Test Reveal

- For each region we can reject:
 - Dummy Variables for Months are ALL equal to 0.
 - Dummy Variable are equal
- These test confirm that season components as measured by monthly dummies are not equal to 0 and are different from one another
 - charts reveal basis strengthens after harvest in September up until February then it levels off or declines
 - return to storage according to the “basis carry” component does not pay after February

Seeming Unrelated Regression Test Results

| Seemingly Unrelated Regression | | |
|--------------------------------|--------|--------|
| Test | F-test | Pr > F |
| M_OCT Across Region Equal | 0.44 | 0.7262 |
| M_NOV Across Region Equal | 2.38 | 0.0679 |
| M_DEC Across Region Equal | 3.89 | 0.0089 |
| M_JAN Across Region Equal | 4.21 | 0.0057 |
| M_FEB Across Region Equal | 5.6 | 0.0008 |
| M_MAR Across Region Equal | 6.25 | 0.0003 |
| M_APR Across Region Equal | 7.44 | 0.0001 |
| M_MAY Across Region Equal | 5.34 | 0.0012 |
| M_JUN Across Region Equal | 4.28 | 0.0052 |
| M_JUL Across Region Equal | 4.08 | 0.0069 |
| M_AUG Across Region Equal | 1.43 | 0.2338 |

Shaded estimates and test statistics are significant at the 5% level

Seeming Unrelated Regression Test Results

- For the months of Aug, Oct, and Nov the monthly dummy variables are not statistically different from each other
- For all of the other months Dec, Jan, Feb, Mar, Apr, May, Jun, and Jul we reject that the monthly dummy variables are the same
 - This confirms important difference in basis levels by regions

NC grain and oilseed imports

Shipments from international locations OR other U.S. states terminating in NC

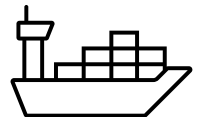
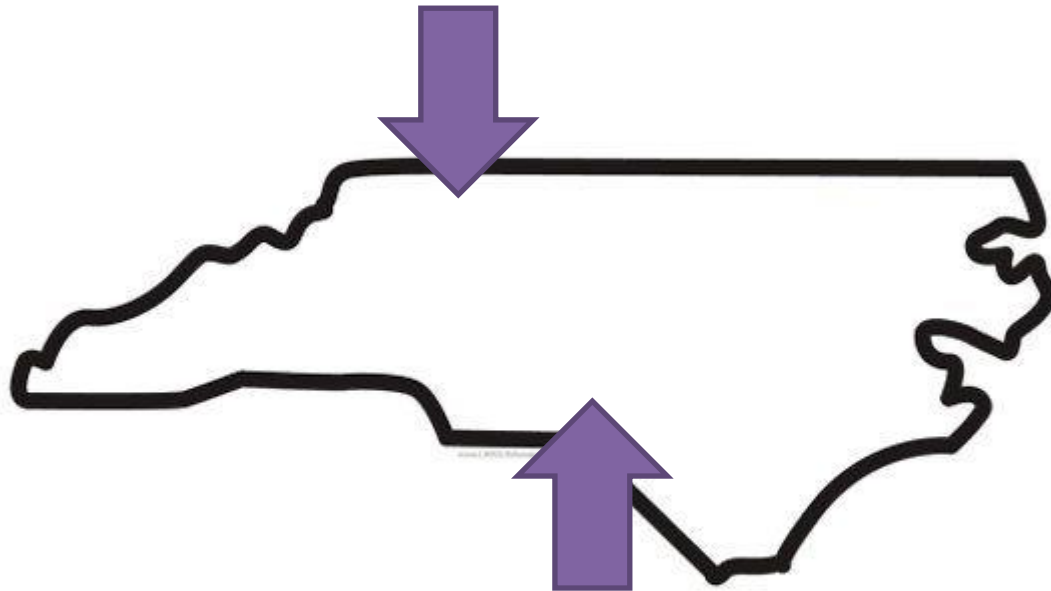
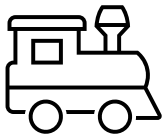


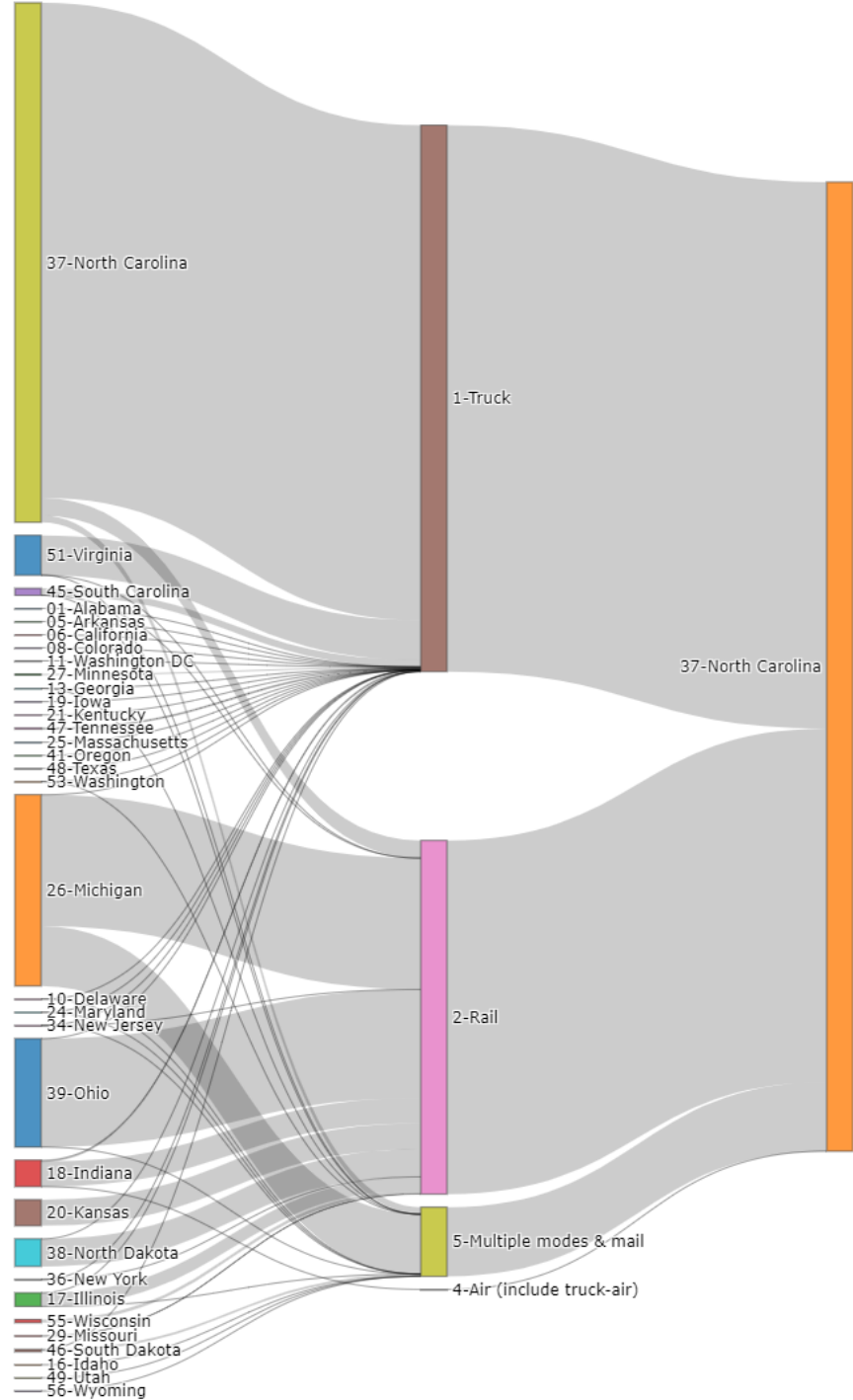
Photo source is NC State Packpix portal: [link](#)



RAIL IMPORTS

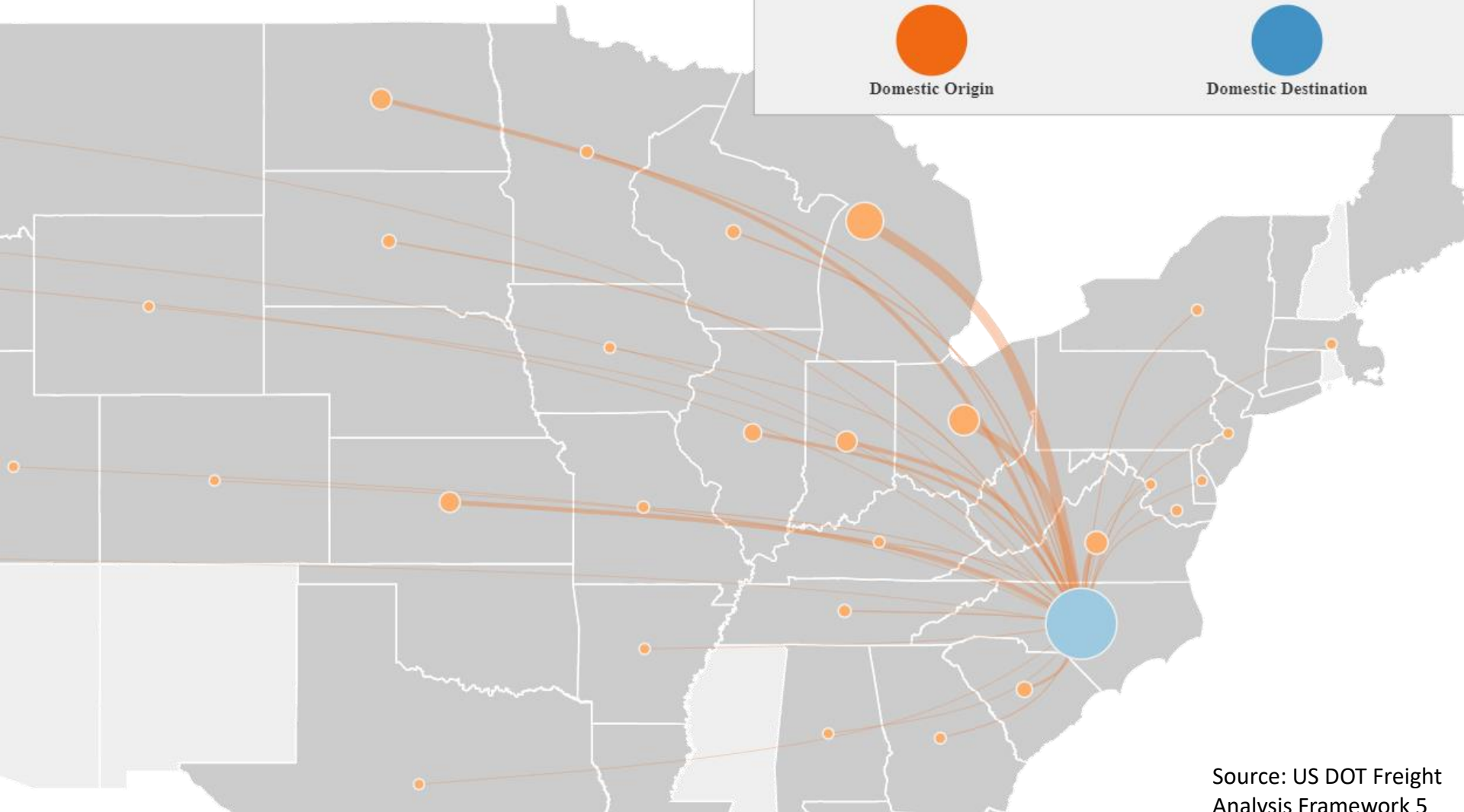
2017 cereal flows to NC

Domestic origin state → Transportation mode → Destination (NC)

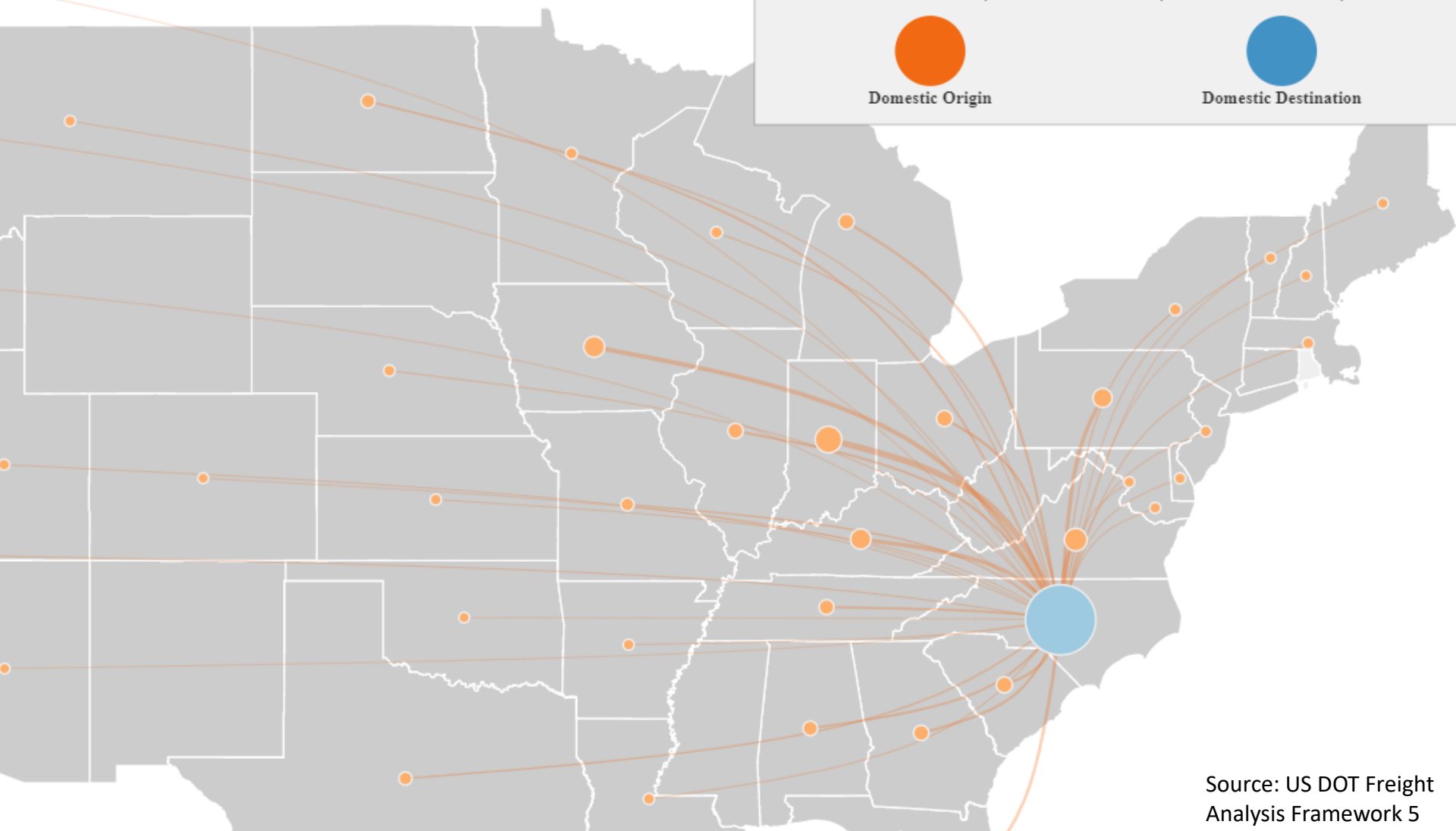


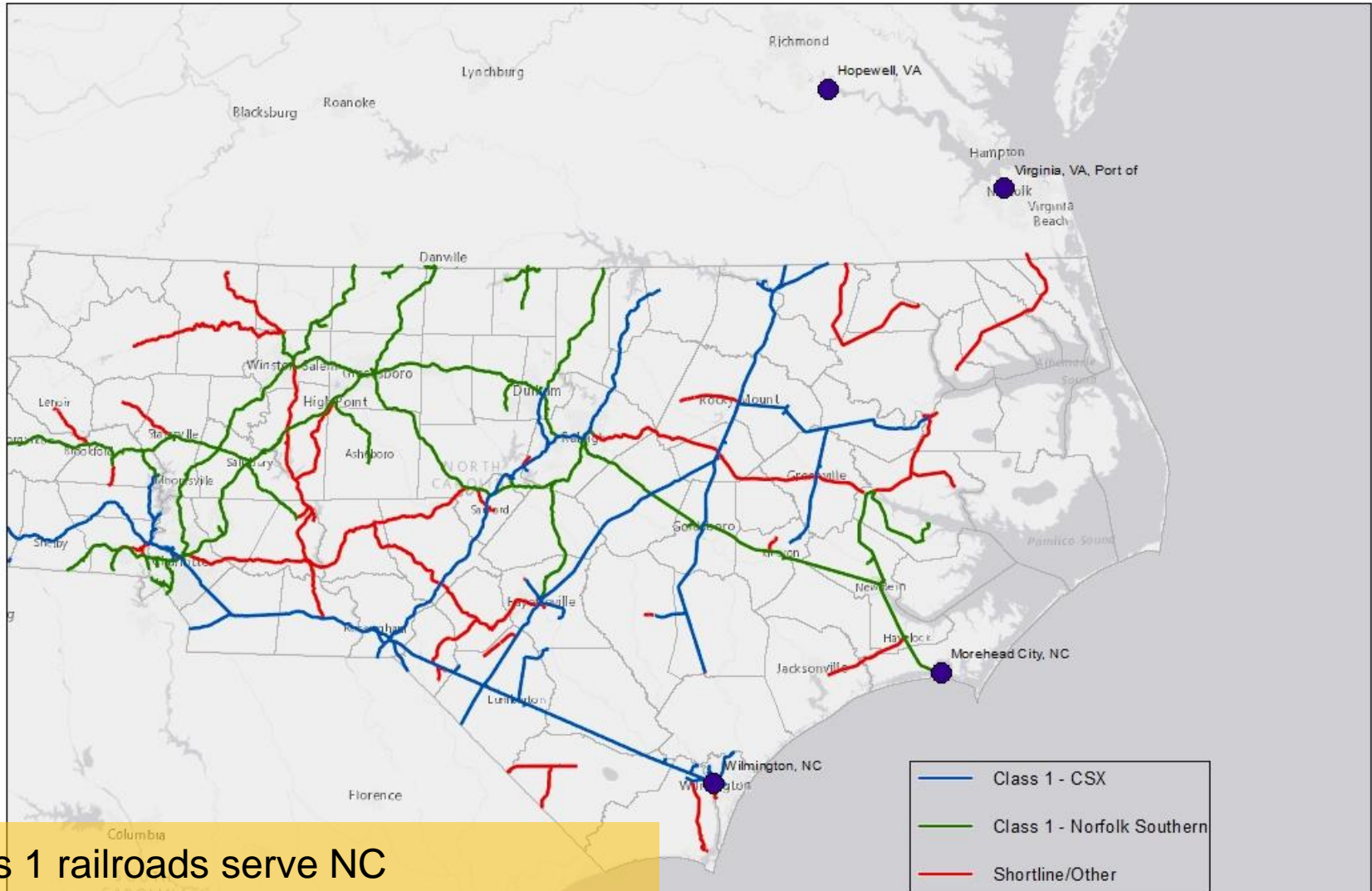
Source: US DOT Freight Analysis Framework 5

2017 cereal grain origins



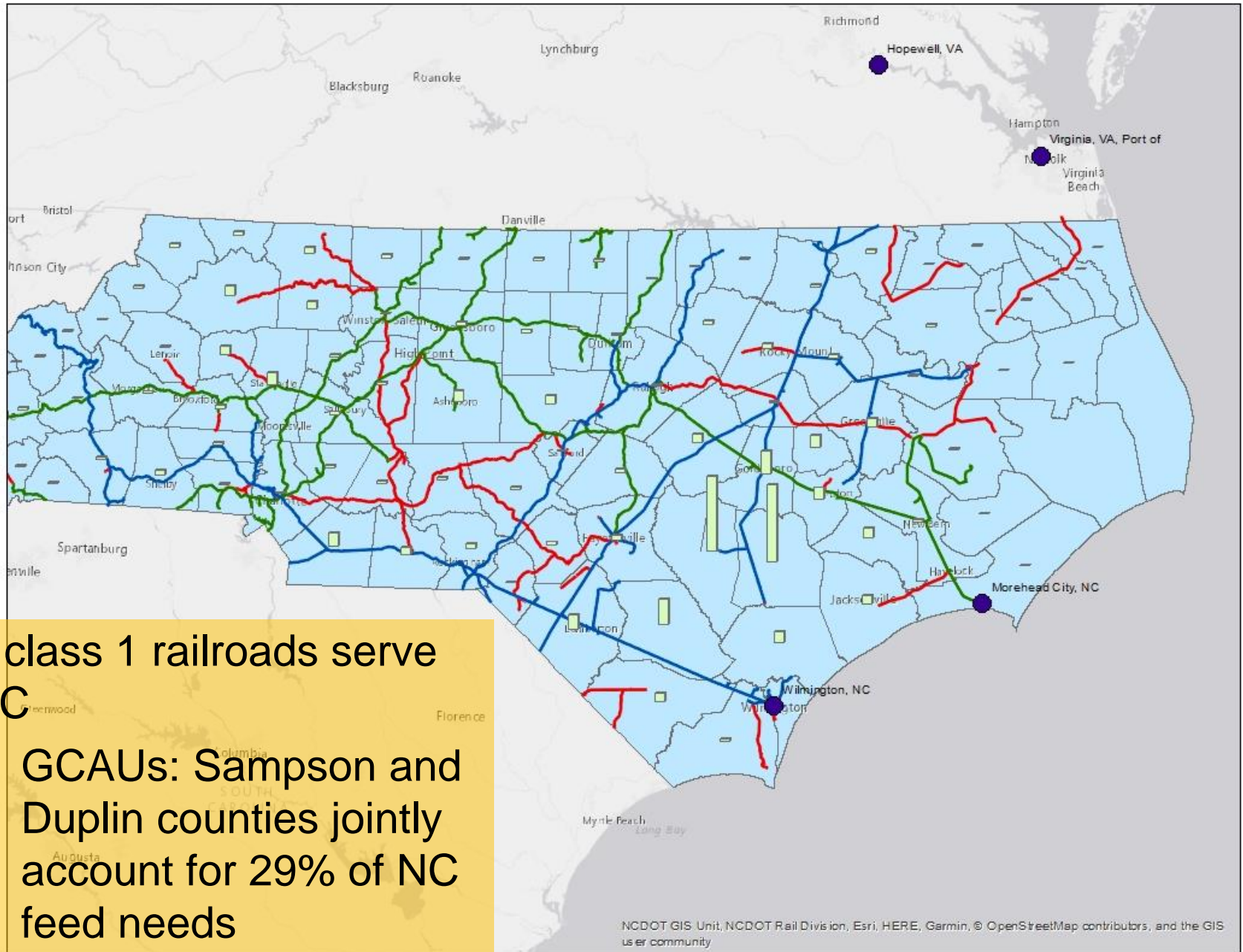
2017 animal feed origins





2 class 1 railroads serve NC

- Each port only has 1 rail carrier
- Goldsboro has access to 2 carriers
- Rose Hill has access to 1 carrier

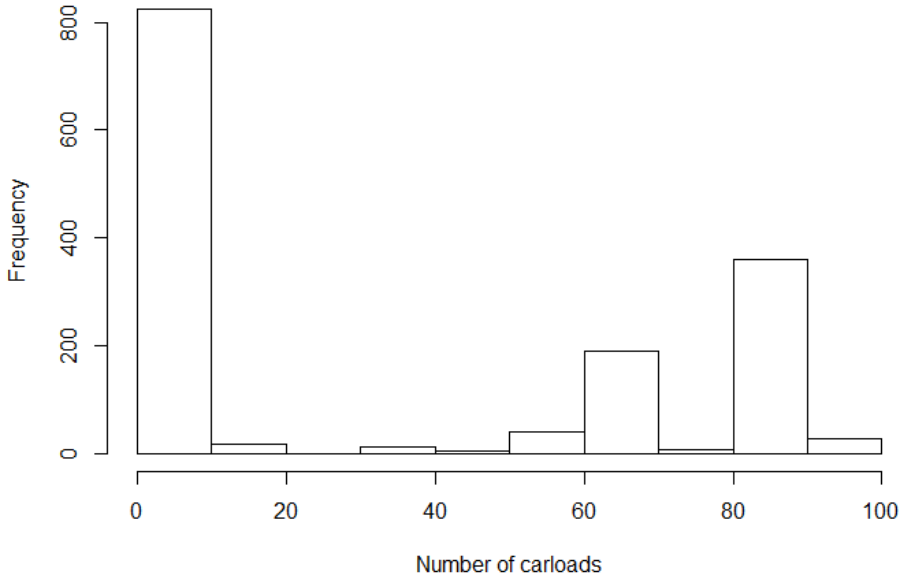


2 class 1 railroads serve NC

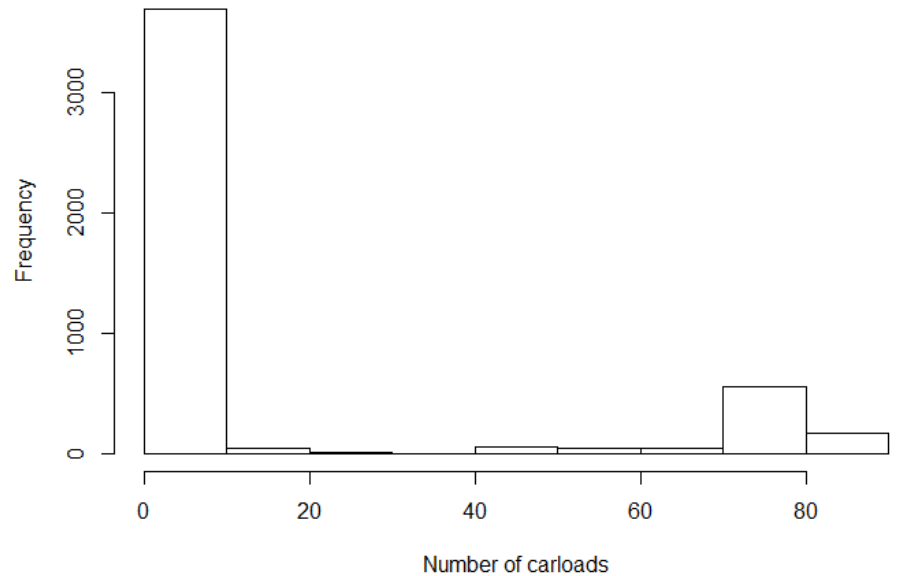
- GCAUs: Sampson and Duplin counties jointly account for 29% of NC feed needs

Corn shipments to NC: train type

CSX (survey weighted)



NS (survey weighted)



Data are from the waybill sample years 2000 to 2018

Shipment characteristics affecting import costs

Decreases in cost per ton-mi

- More carloads
- More miles

Increases in cost per ton-mi

- Fourth quarter is the most expensive time to import corn
- Using railroad-owned cars increases costs
- Purchasing from an origin that requires switching to NS or CSX increases costs

1 ton-mile = 1 ton of freight moved 1 mile



100 ton-miles = **100 tons of freight** moved 1 mile

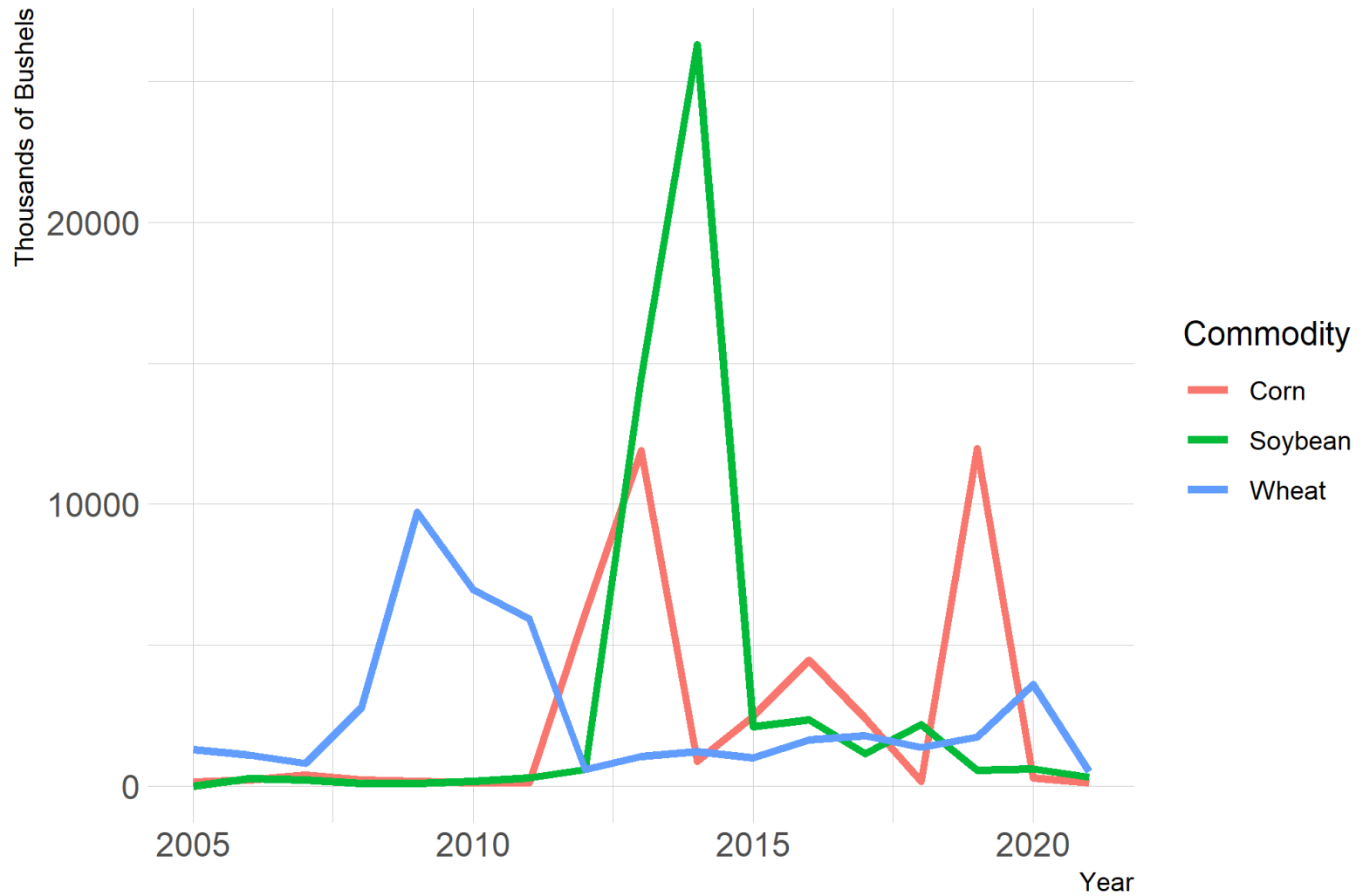
100 ton-miles = 1 ton of freight **moved 100 miles**

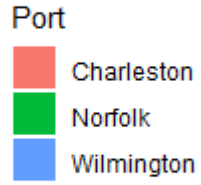


Photo source is @NCPorts twitter, posted 12 Jan 2021: [link](#)

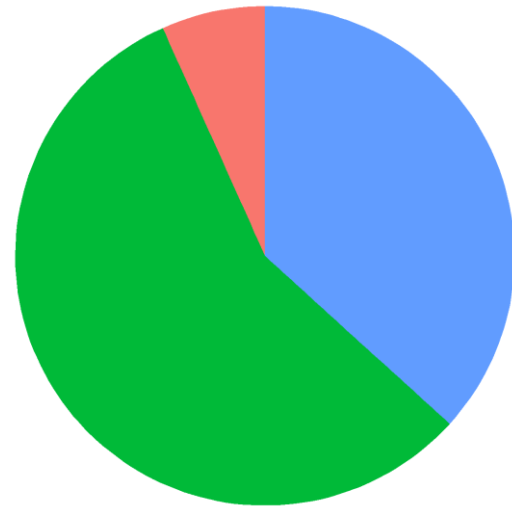
MARITIME IMPORTS

Imports to Norfolk, Wilmington & Charleston

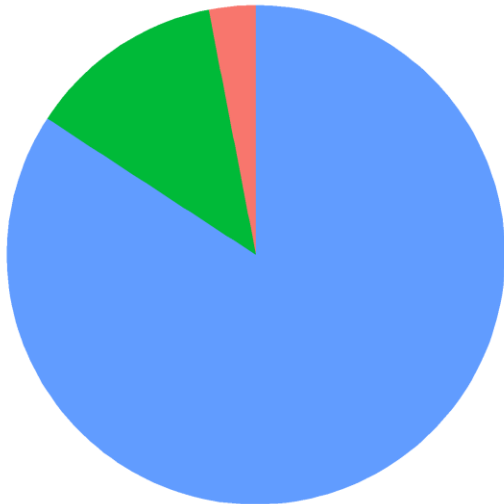




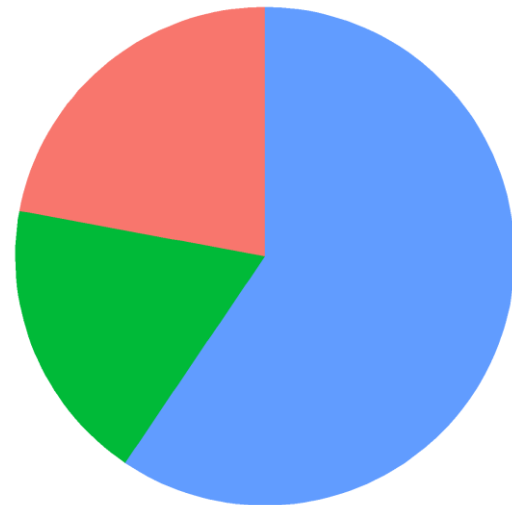
Soybean



Corn

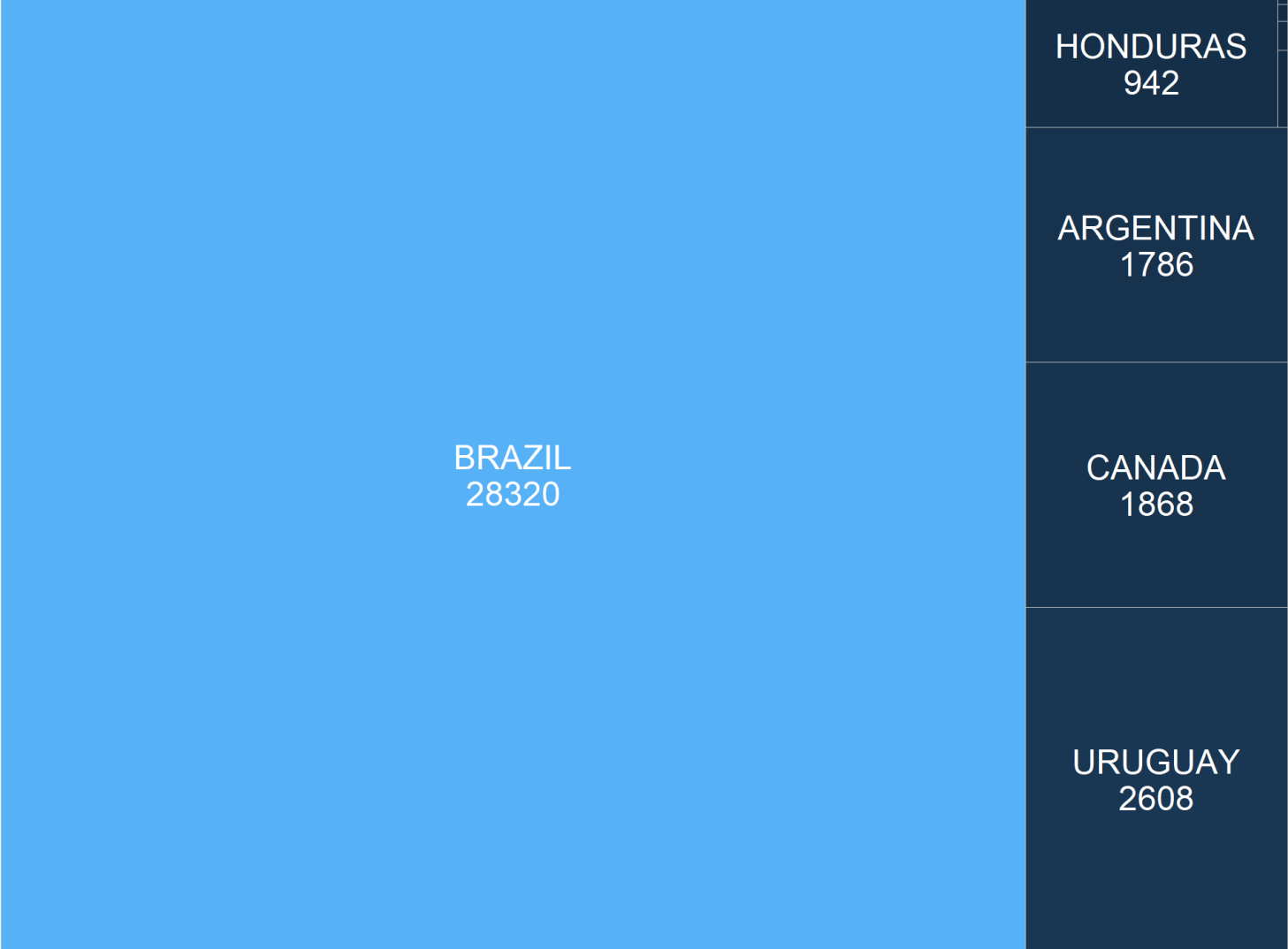


Wheat



Imported Corn at the Port of Wilmington, 2005 to 2021

By country of origin (total 35560 thousand bushels)



Data source: PIERS

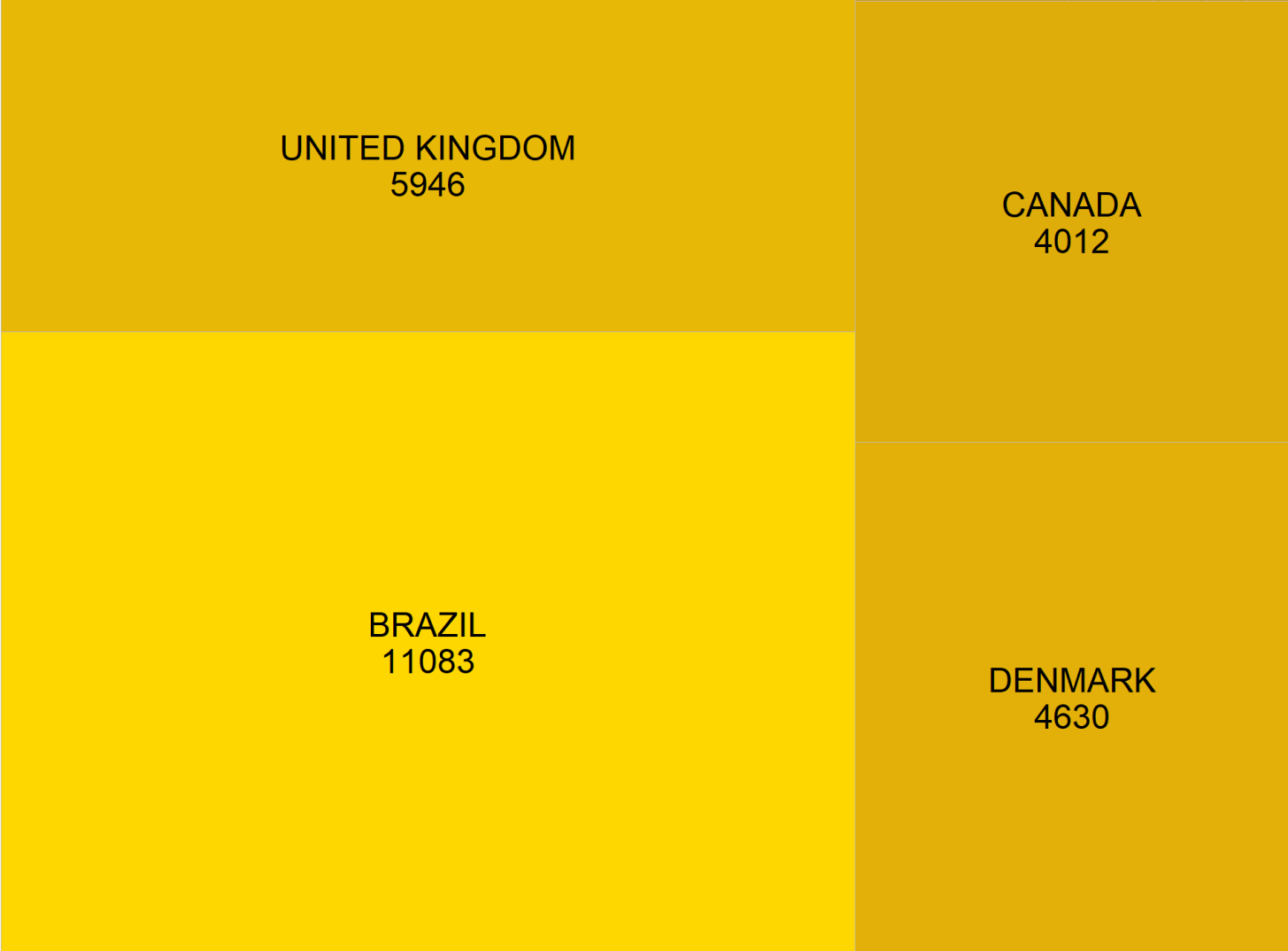
Imported Soybeans at the Port of Wilmington, 2005 to 2021
By country of origin (total 19034 thousand bushels)



Data source: PIERS

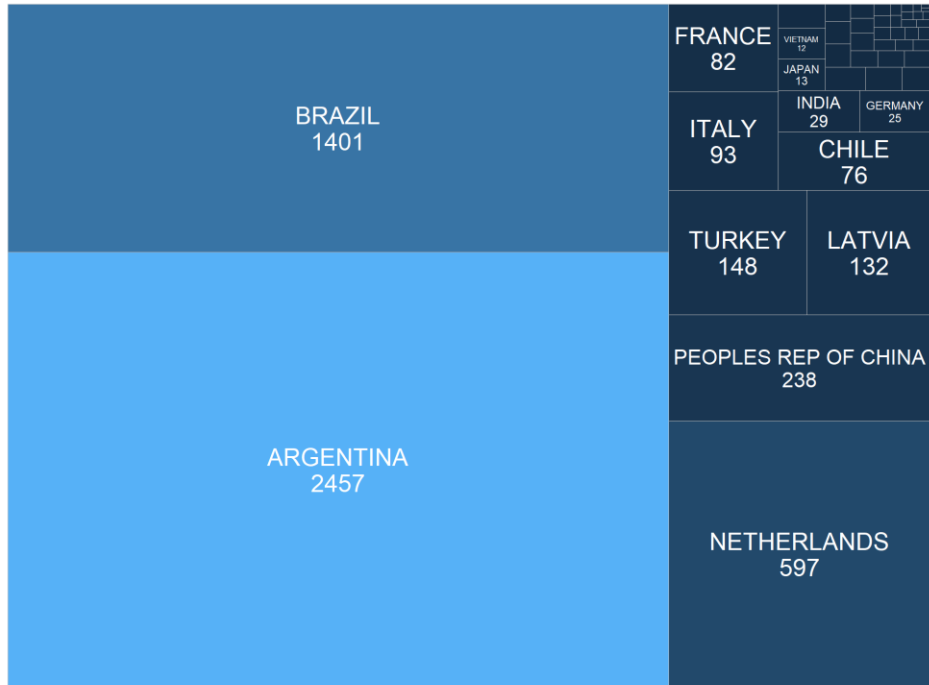
Imported Wheat at the Port of Wilmington, 2005 to 2021

By country of origin (total 25687 thousand bushels)



Data source: PIERS

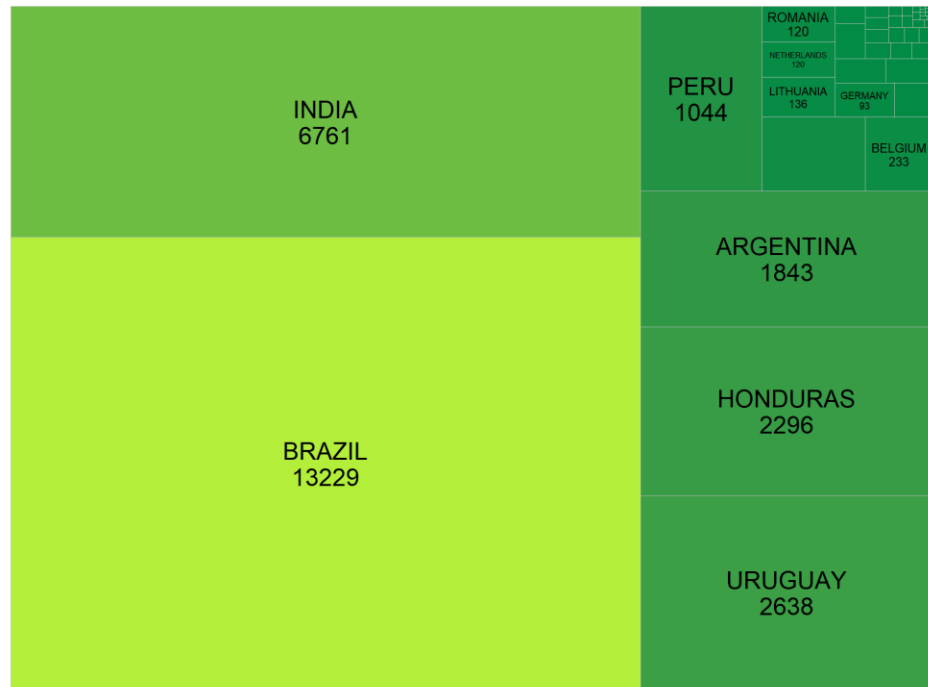
Imported Corn at the Port of Norfolk, 2005 to 2021
By country of origin (total 5390 thousand bushels)



Data source: PIERS

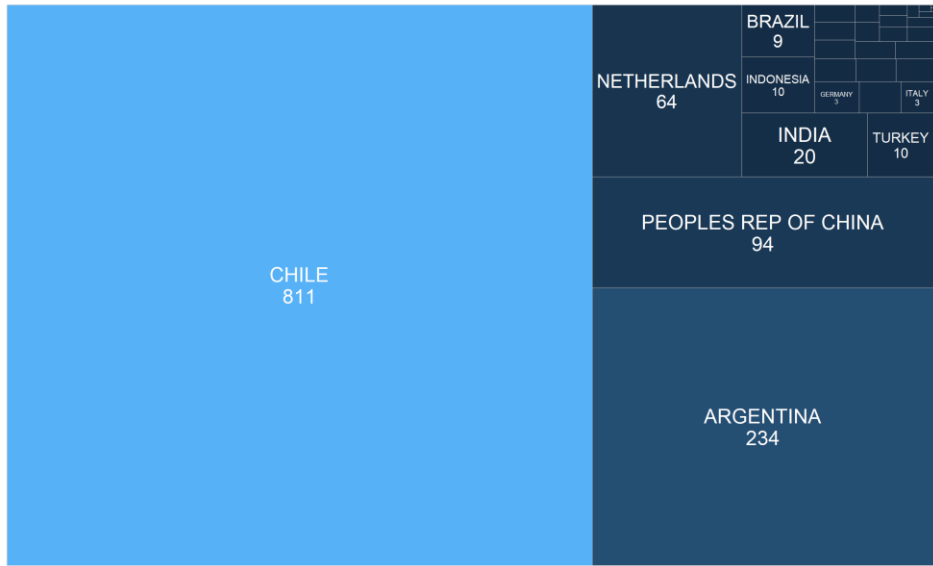
Norfolk

Imported Soybeans at the Port of Norfolk, 2005 to 2021
By country of origin (total 29280 thousand bushels)



Data source: PIERS

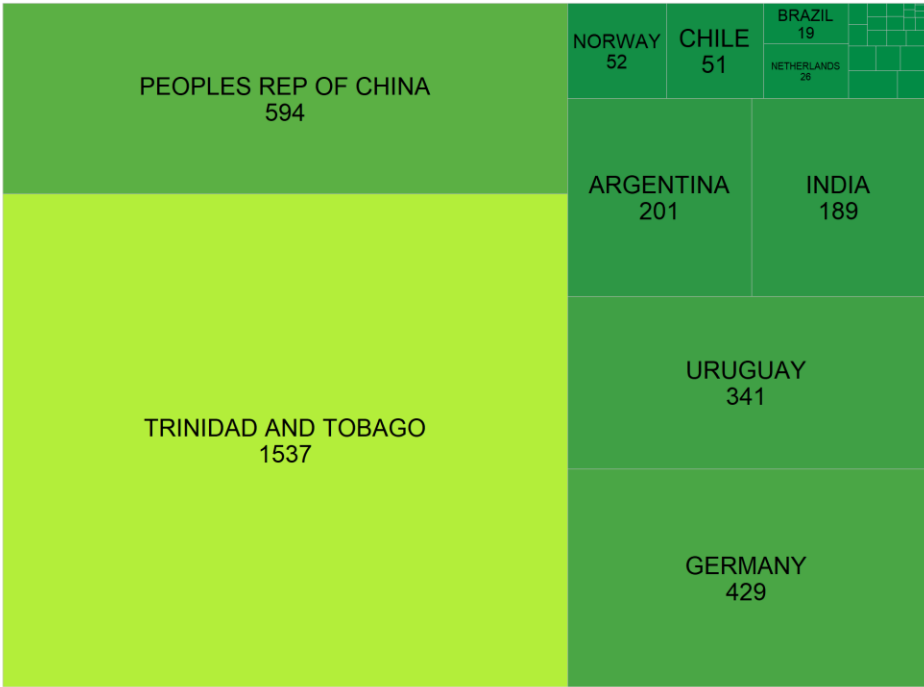
Imported Corn at the Port of Charleston, 2005 to 2021
By country of origin (total 1284 thousand bushels)



Data source: PIERs

Charleston

Imported Soybeans at the Port of Charleston, 2005 to 2021
By country of origin (total 3478 thousand bushels)



Data source: PIERs

What we know about maritime corn imports

- Infrequent and relatively small quantities
 - Still a “credible threat”
- Likelihood of international imports will be increased by
 - Weak BR or strong USD
 - Low ocean freight costs

Live tool demonstration

The price and basis tool can be accessed here:

<https://agecon.ces.ncsu.edu/>