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Solving the Basis Aggregation Problem

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Introduction

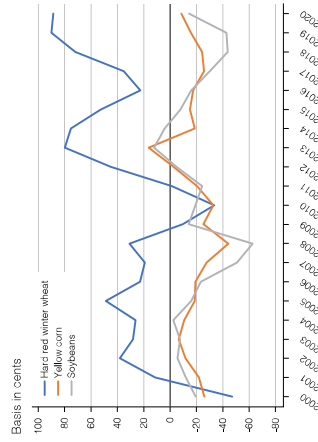
- Basis represents the difference between the commodity futures price and cash price at a specific date.
- Basis is often used in calculations related to prediction of season average price and formulas important to farmers and policymakers.
- Basis fluctuates regionally and over time, posing difficulties for creating an average basis.
- An aggregate basis has four main uses:
 1. Prediction of season average price
 2. Determination of boundaries of basis markets
 3. Comparison of local and regional bases to national basis
 4. Indication of basis for time series analysis
- The research helps show how basis has changed over a 20-year period and how some locations fare better when considering farm cash price.

Method

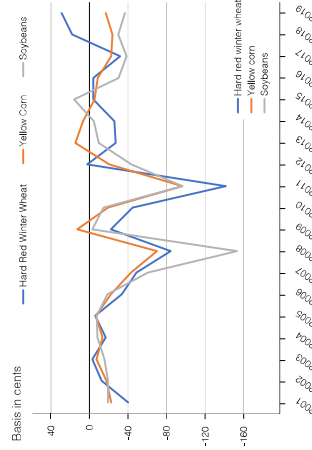
- Twenty years (2000-2020) of regional basis data from USDA Agricultural Marketing Service (AMS) for soybeans, corn, and wheat was combined with 20 years of USDA National Agricultural Statistics Service (NASS) price and Chicago Mercantile Exchange (CME) futures data.
- The data were used to create weighted averages of basis for comparison.
- Basis aggregations were considered based on two main criteria.
 1. NASS-provided season average price minus average futures price
 2. Quantity-weighted average of basis based on AMS basis data
- Basis was judged based on predictive validity to determine which aggregation better predicted average cash prices as determined by NASS from futures.



Average basis by year AMS



Average basis by year NASS



Results and Evaluation

- Basis aggregations were evaluated on two criteria:
 1. Usefulness in predicting season average price in a futures model annually as measured by mean average percent error and root mean squared error
 2. Usefulness in predicting monthly prices directly as measured by mean average percent error and root mean squared error
- The NASS 5-year average method of basis aggregation performed better at predicting monthly prices than the 1-year and 5-year AMS averages, but the AMS 1-year average performed significantly better than the NASS 1-year average to predict monthly prices.
- Based on all criteria, the NASS aggregation performed better on the criteria of evaluation when compared to the AMS data.

Yearly prediction errors

Crop	Year	NASS Basis		AMS Basis		AMS Basis	
		1-year RMSE	5-year RMSE	1-year RMSE	5-year RMSE	1-year RMSE	5-year RMSE
Corn	2018	0.04	2.36	0.04	3.59	0.03	1.98
	2017	0.06	7.24	0.06	8.66	0.06	6.76
Soybeans	2018	0.06	3.24	0.07	4.01	0.07	3.76
	2017	0.06	1.82	0.06	0.03	0.07	0.04
Wheat	2018	0.06	3.55	0.08	8.02	0.09	8.57

Monthly prediction errors

Crop	Year	AMS Basis												
		1-year RMSE	2-year RMSE	3-year RMSE	4-year RMSE	5-year RMSE	6-year RMSE	7-year RMSE	8-year RMSE	9-year RMSE	10-year RMSE	11-year RMSE	12-year RMSE	
Corn	2018	0.07	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
		0.71	0.49	0.48	0.44	0.45	0.61	0.64	0.50	0.64	0.91	0.77	0.80	0.80
		0.76	0.51	0.48	0.45	0.49	0.66	0.68	0.56	0.67	0.91	0.85	0.84	0.84
		0.89	0.64	0.57	0.60	0.66	0.76	0.81	0.82	0.83	1.06	0.99	0.90	0.90

Conclusion

- Based on the aggregations created, basis fluctuated over the 20-year time period as shown in the graph and appears to have increased in the past 5 years.
- The best method for basis aggregation based on methodology was the NASS methodology.
- This research contributes to the development of prediction of prices received by farmers and determining relative cash prices when comparing nationally.
- Further research should investigate how to better account for volatility of futures markets in basis and use volatility within the prediction of season average price.

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