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Seasonal Market Hog Price Patterns in the Western Corn Belt Region by Weight, Type, and Location

Daniel Gertner, *Graduate Student, Department of Agricultural Economics, University of Nebraska–Lincoln*

Elliott J. Dennis, *Assistant Professor of Livestock Marketing and Risk Management, Department of Agricultural Economics, University of Nebraska–Lincoln*

Each year, hog prices fluctuate based on changes in supply and demand in the pork complex. Regional, national, and international changes in slaughter rates, supplies of substitute meat products, and consumer pork preferences all influence hog prices. Often, these factors form repeated annual patterns. Identified seasonal price patterns can aid in making more informed production, pricing, and marketing decisions. Over time, these seasonal patterns can change with production technology advancements, altered industry structures, and other factors, all of which ultimately affect supply and demand.

The purpose of this NebGuide is to demonstrate seasonal price patterns for various types of hogs raised and marketed across the United States. Specifically, we focus on barrows and gilts and sows across different pricing mechanisms, location, and weight. The pricing mechanisms of interest for barrows and gilts are (1) negotiated carcass price; (2) other market formula carcass price; (3) swine/pork market formula carcass price; and (4) other purchase arrangement carcass price. Negotiated carcass prices are spot market prices that reflect immediate supply and demand conditions. Market formula carcass prices reflect longer-term arrangements between individual producers and packers. Other purchase arrangement carcass prices typically earn a premium to the other pricing mechanisms for certain production methods and characteristics (Meyer, 2018). Prices are examined nationally and across regions, including the Western Corn Belt, Eastern Corn Belt, and Iowa/Minnesota.1 Using a national price, we examine how sow prices change seasonally. We then show how these seasonal price patterns can be used for better informed decision-making by hog producers in Nebraska and around the United States. All indices are calculated using aggregate barrows and gilts and sows data from January 2010 to December 2019.

Seasonal Price Patterns

Average Price Index

A yearly seasonal index is calculated by dividing each category's monthly price by the average annual price. Averaging each month (January–December) between 2010 and 2019 gives an average seasonal index. Average seasonal price indices are most useful in making pricing decisions, specifically forecasting prices and evaluating pricing alternatives—both discussed in detail at the end of this NebGuide. Weekly data were obtained from the U.S. Department of Agriculture (USDA) Agricultural Marketing Service (Agricultural Marketing Service staff, 2020) and then aggregated within each month.

Price Variability Range

The price variability range within a month for a given hog type and location indicates how historically (in)consistent the price index is for a given month. Price variability may be higher during certain times of the year than others.

This is often conditional on how certain the market is about supply and demand conditions at a given point in time. The standard deviation is one way to quantify this variation in price. The standard deviation is calculated from the average price indices for each month (January–December) between 2010 and 2019.

A range of expected prices can then be obtained by adding or subtracting one standard deviation from the average seasonal price index. This represents, in part, a historically reliable range of prices around the average price index in each month. The wider the price variability range, the more sporadically historical prices follow established seasonal price patterns. In the figures below, "sd.pos" represents one standard deviation above the average index, whereas "sd.neg" represents one standard deviation below the average index.2

Drivers of Seasonal Hog Patterns

Seasonal patterns occur as the result of repeated changes in supply and demand. With increased commercial, contract, and confinement production of hogs, farrowings and slaughter are distributed more evenly throughout the year. Seasonal fluctuations in sow farrowings and hog slaughter, too, are minor compared to earlier years (Lawrence & Dittmer, 2006). More precisely, the movement away from primarily farrowing sows on pasture in warmer months has muted the seasonal variation in farrowings. There are still variations in farrowing rates and the number of pigs per litter (especially with sows bred in times of high heat stress, as these affect both sow and boar fertility). Yet, compared to the cattle production cycle, hog production is less heavily impacted by seasonal variations due to the existence of confined, climate-controlled production facilities. In other words, despite new production practices limiting changes in supply and demand factors, month-to-month production variations still result in seasonal price fluctuations (Schulz, 2020).

The continued existence of seasonal trends can be largely attributed to nature. Despite the prevalence of climate-controlled hog barns, seasonal variations are unavoidable: in the summer, barrow and gilt barns get warmer and days get longer, which allows for the influence of biological rhythms. Additionally, temperatures also impact production in grow-finish barns, where most hogs live for roughly 175 days after their 21-day nursing period (Economic Research Service staff, 2019).3 Higher temperatures reduce feed intake and slow down the growth rates of hogs (Plain, 2003). As a result, some finishings are delayed until fall. Conversely, cooler temperatures increase feed intake and growth rates, and result in earlier-than-expected finishings. Finally, feed palatability has a similar effect as temperature on intake and growth rates: as summer progresses, old-crop corn's palatability decreases, and feed intakes and growth rates lag, which delays some finishings. New-crop corn does just the opposite, pulling some finishings forward as corn is harvested in early fall (Meyer, 2019).

On the demand side, domestic consumer preferences for pork and substitute meat products also vacillate throughout the year, which adds to the seasonal variation in prices. For example, pork demand may increase during certain holiday seasons, like Easter and Christmas, where pork is a common centerpiece. Additionally, warmer weather during the summer months leads to more grilling and higher pork demand (Pork Checkoff staff, 2017). The international market is perhaps the most significant driver of domestic pork prices. Since 2000, the United States has been one of the top five annual pork exporters, shipping an average of over five billion pounds of fresh and frozen pork cuts to foreign markets since 2010 (Economic Research Service staff, 2019). In recent years, five countries accounted for more than 75% of the pork leaving the United States—Mexico, Japan, Canada, China, and South Korea (Economic Research Service staff, 2019). When trade relations with those countries are positive, more domestic pork supplies are diverted abroad, pushing domestic prices upward.

Seasonal Patterns in Hog Markets

Seasonal Patterns by Pricing Mechanism

Barrows and Gilts—All Locations

Figure 1 plots the seasonal price patterns for barrows and gilts across all locations, with a separate plot for each pricing mechanism. The general directional seasonal patterns were nearly identical across location and pricing mechanism. On average during the 2010–2019 period, price indices gradually trended upward seasonally from January to March, moved sharply upward from April to July, and declined from August to December. The highest average barrow and gilt price index occurred in July, whereas the lowest average price index occurred in November and December. The seasonal indices for "negotiated prices" displayed the highest magnitude, charting both the highest maximum and lowest minimum of all four pricing mechanisms. The indices for the "other market formula prices" formed the flattest seasonal trends, with the least extreme maximum and minimum of the four pricing mechanisms. In summary, the pricing mechanisms listed in descending order of magnitude are: (1) "negotiated;" (2) "swine/pork market formula;" (3) "other purchase arrangement;" and (4) "other market formula."

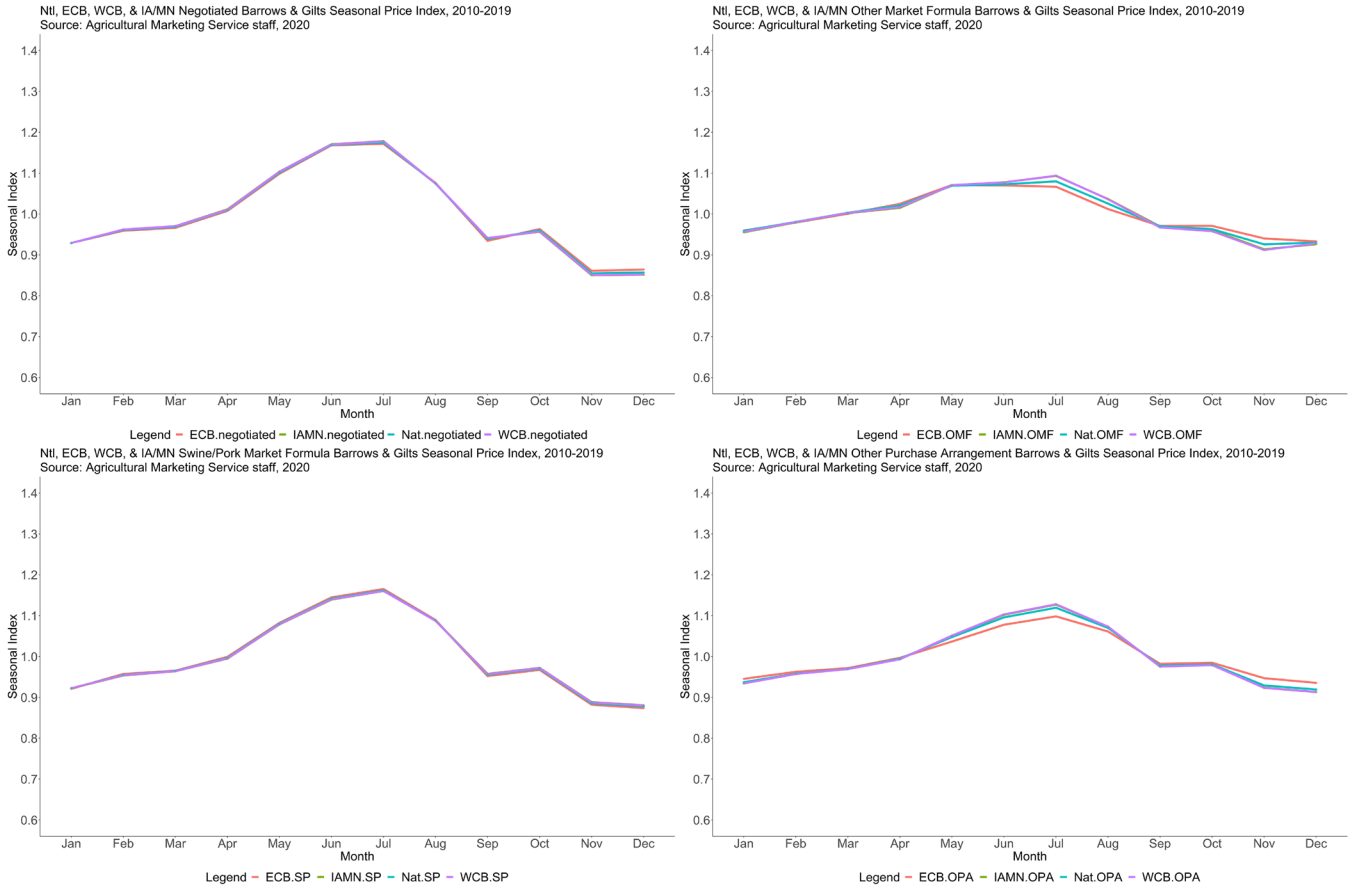

Fig.1

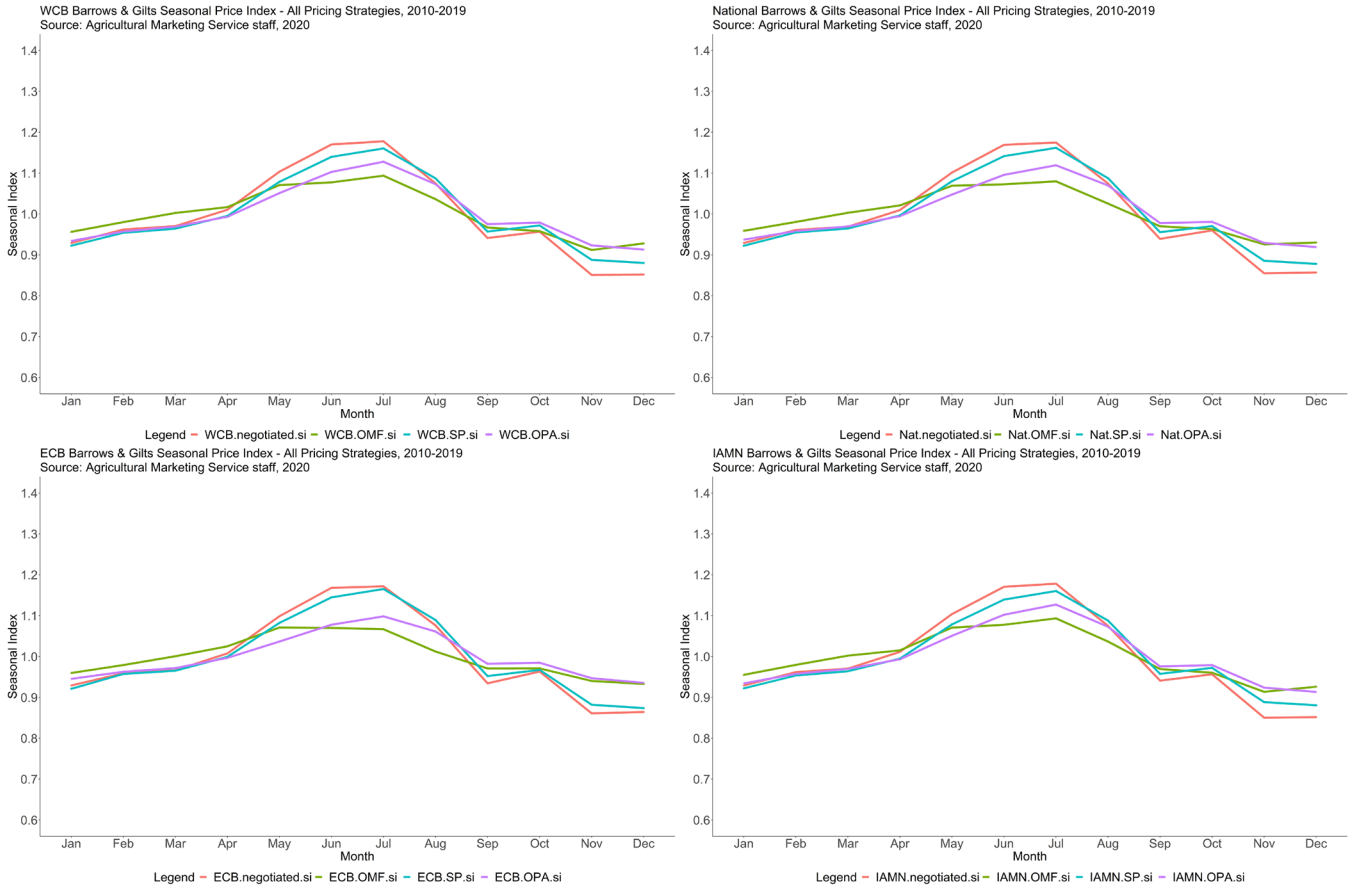

Fig.2

Seasonal Patterns by Pricing Mechanism and Location

Barrows and Gilts—Individual Locations

Figure 2 plots the seasonal patterns of all pricing mechanisms confined to each region. Although there was little variation between regions for each pricing mechanism, there is significant variation between pricing mechanisms within a given region. The general seasonal variations among pricing mechanisms are similar across regions. In general, the average seasonal indices displayed limited variability between pricing mechanisms from January to April. During that period, the seasonal indices for the "other market formula prices" remained higher, on average, than the other three pricing mechanisms. From May to August, variability between the four pricing mechanisms increased, with "negotiated" prices charting the highest average seasonal indices and the "other market formula prices" averaging the lowest seasonal indices. Both the "swine/pork market formula" and "other purchase arrangement" indices remained between "negotiated" and "other market formula" indices in terms of maximums and minimums. Overall, "other purchase agreement" and "other market formula" seasonal price indices followed similar patterns in terms of direction and magnitude, as did the seasonal indices for "negotiated" and "swine/pork market formula" prices.

Seasonal Patterns in the Western Corn Belt by Pricing Mechanism

Barrows and Gilts—Western Corn Belt

Figure 3 plots the seasonal price patterns for barrows and gilts in the Western Corn Belt by pricing mechanism. Plots display the average range of price variability for a given month, as represented by one standard deviation above and one standard deviation below the average price index. Total price variability, as measured by standard deviations away from the average seasonal price index, remained constant throughout the year. Patterns of variability were similar across all four plots in Figure 3. The widest variability occurred from January to April, and the narrowest variability occurred from June to August. Periods with the widest seasonal variability for individual pricing mechanisms were the same across pricing mechanisms. This may indicate that, realized prices in a given year tend to vary widely from the relatively stable average price index trends in January to April The periods of the narrowest variability in Figure 3 (June–August and October–December) coincided with the periods of the widest differences between pricing mechanisms in Figure 2. Consequently, realized prices during the periods of narrow variability in Figure 3 may more closely reflect the trends of the average seasonal price indices in Figure 2 than the periods of wide variability in Figure 3.

Seasonal Patterns by Weight Class

Sows—All Locations

Figure 4 plots the seasonal price patterns for sows by weight class across all four locations. The general seasonal patterns across weight class and location were nearly identical: prices tend to increase seasonally from January to the early summer months, and decrease from the mid-summer months to the end of the year. The highest average price indices for sows occurred in August, whereas the lowest were in January. Unlike the differences in the magnitudes of seasonal patterns for barrows and gilts between pricing mechanisms as seen in Figure 1, there were limited variations in the magnitude of seasonal patterns for sows between weight classes.

Seasonal Patterns by Location

Sows—Individual Locations

Figure 5 plots the seasonal patterns by location across all weight classes. The general patterns discussed for Figure 4 hold for Figure 5, as well. Differences in the magnitude of indices between weight classes was highest from January to March and June to August. Seasonal price indices for 300–399 lb. and 400–449 lb. sows were lowest, on average, from January to March and highest, on average, from June to August. Average indices across weight classes showed the greatest variability in the Eastern Corn Belt. In the Eastern Corn Belt, variation between weight classes was evident from January to March, June to August, and November to December. Three-hundred to 399 lb. sows in the Eastern Corn Belt displayed higher average price indices than the other weight classes in May to June, and lower average price indices than the other weight classes in January to March and November to December.

Seasonal Patterns in the Western Corn Belt by Weight Class

Sows—Western Corn Belt

Figure 6 plots the seasonal price patterns for sows in the Western Corn Belt by weight class. Plots display the average range of price variability for a given month, as represented by one standard deviation above and one standard deviation below the average price index. Patterns of variability were similar across all five plots in Figure 6. Average price variability for sows in the Western Corn Belt spiked noticeably for specific months (February, May, and August) but remained constant during the rest of the year. The periods of the widest variability in Figure 6 coincided with the periods of the most noticeable differences in magnitude between weight classes in Figure 5. Consequently, realized prices during the periods of wide vari-

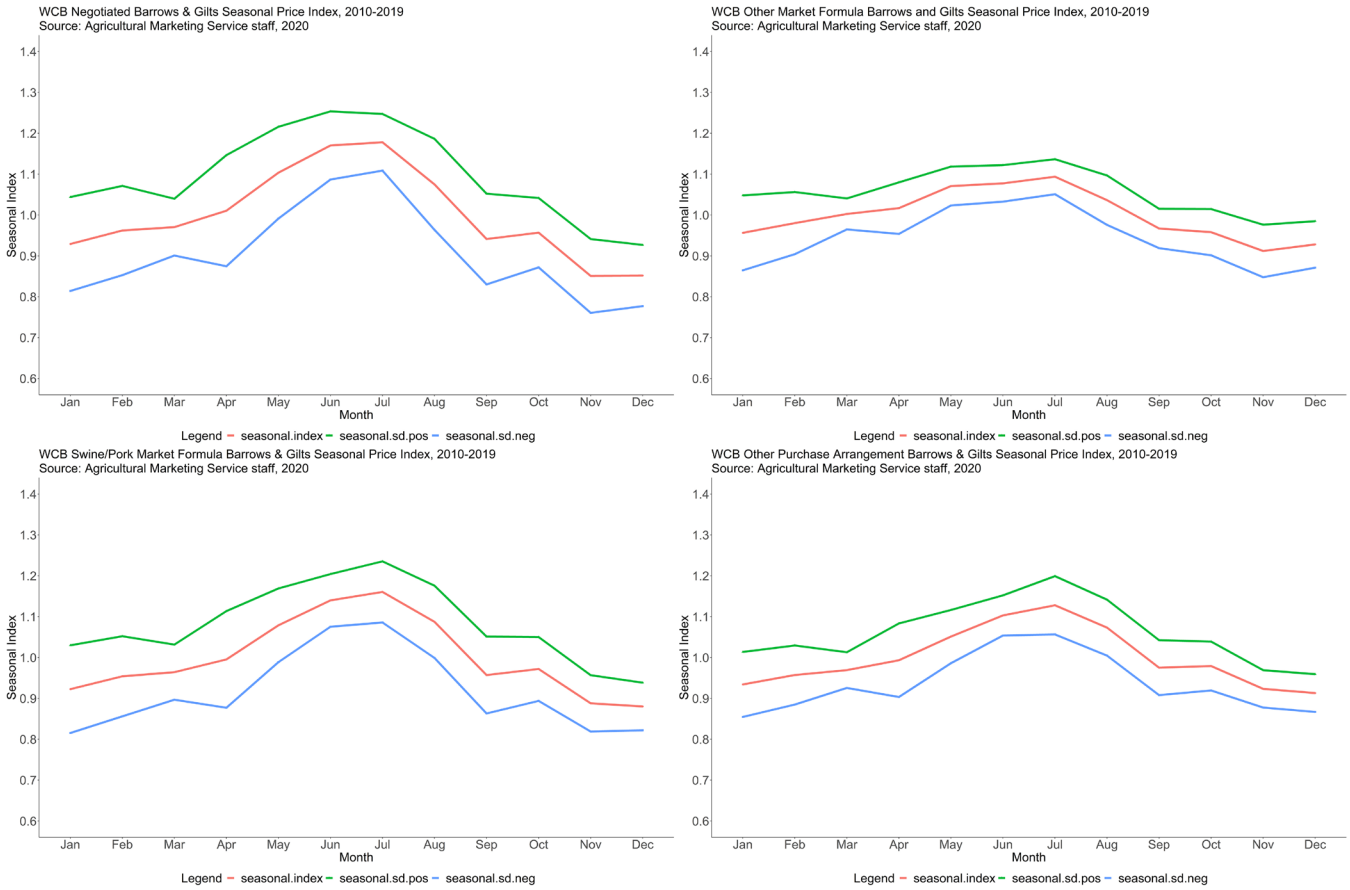

Fig.3

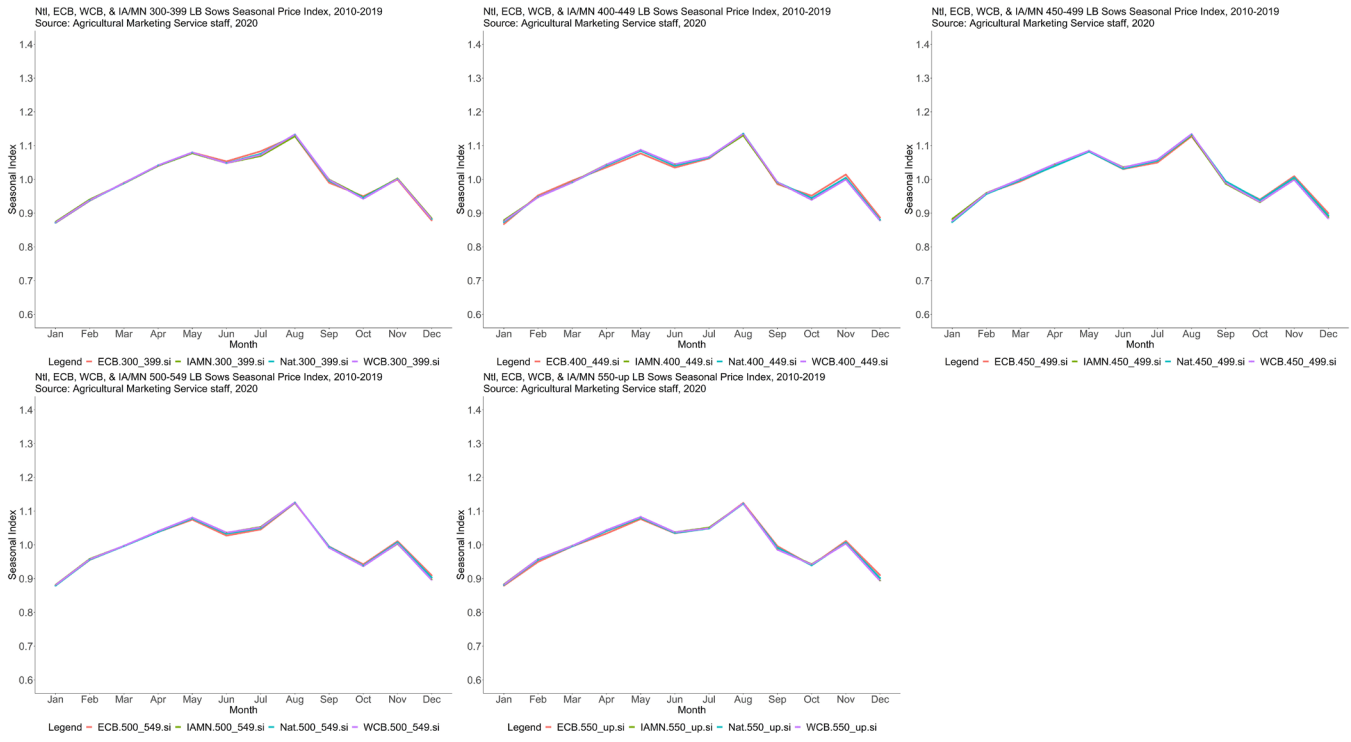

Fig.4

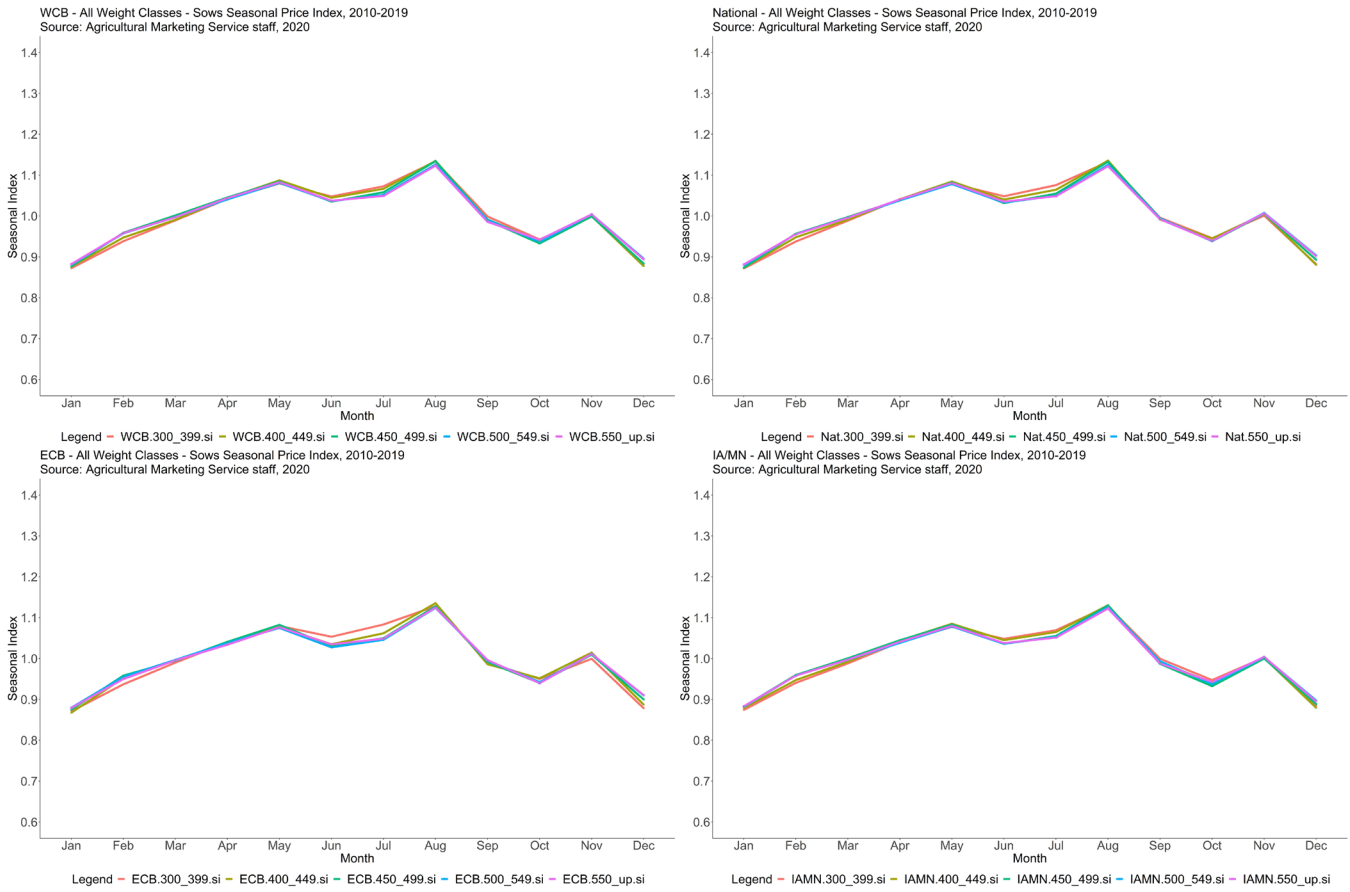

Fig.5

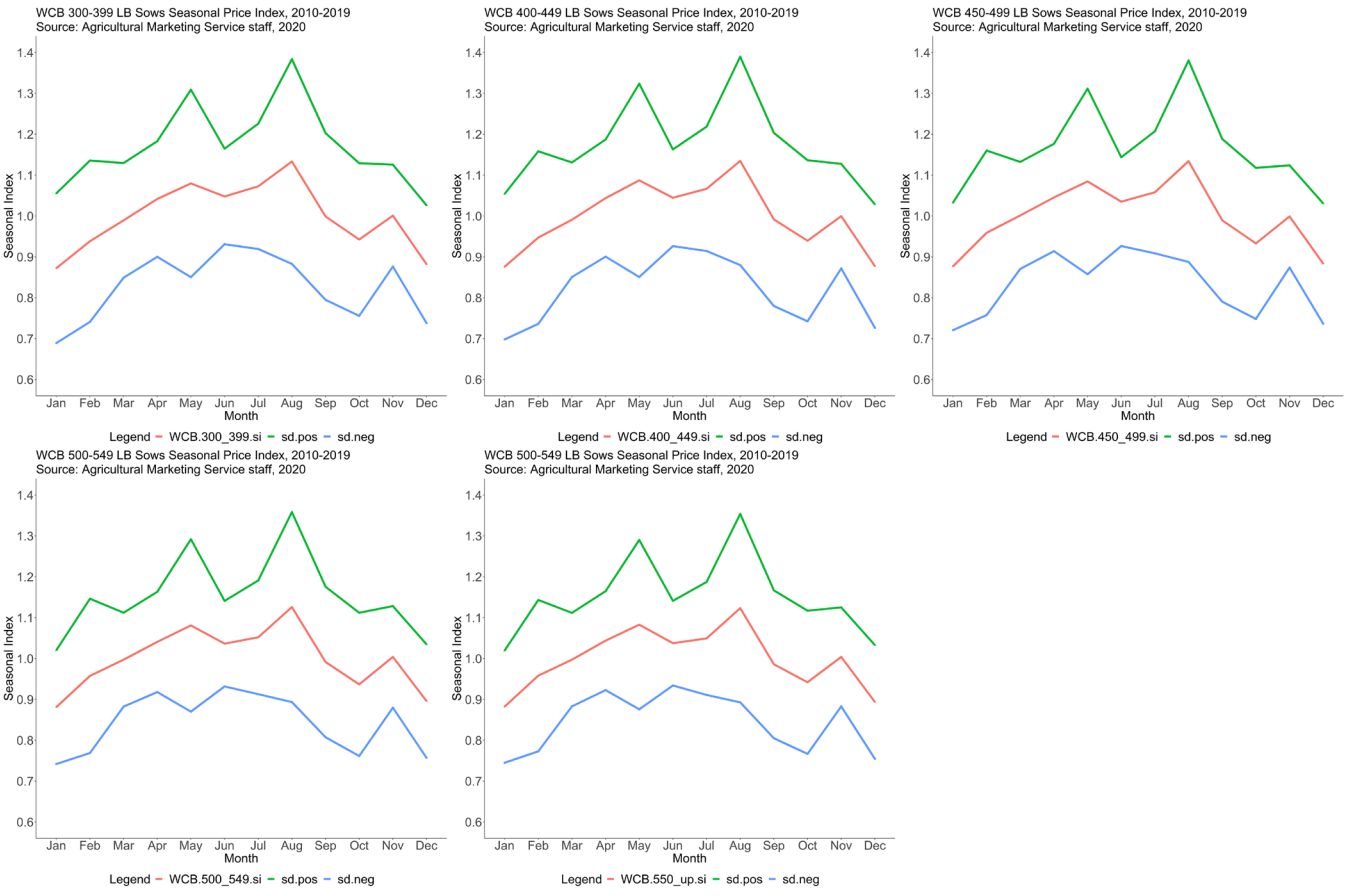

Fig.6

ability in Figure 6 may not consistently reflect the trends of the average seasonal price indices revealed in Figure 5.

Forecasting Hog Prices

We will now show how the previously calculated indices can be used to forecast future cash prices. A combination of seasonal price patterns and current market information offers a straightforward tool to project future prices. Forecasting prices in a future month is done by dividing the current month's average price by the index for the current month, and then multiplying by a future month's index you wish to forecast. This is written as:

$$P_2 = \frac{P_1}{I_1} \times I_2$$

where P_1 is the current month's price,I_1 is the current month's average seasonal price index, P_2 is the future month's predicted price, and I_2 is the future month's average seasonal price index. To account for variability in the forecasted price, one can calculate a price range in which there is a 68% probability the future month's price will fall between. This is done by adding or subtracting one standard deviation from the future month you wish to forecast to the forecasted price, P_2. It can be succinctly written as:

$$R_2 = P_2 \pm 100 \times SD_2$$

where R_2 is the future month's predicted price range, and SD_2 is the standard deviation of the future month you wish to forecast. Tables 1 through 4 provide exact seasonal indices and standard deviations to facilitate these calculations.

We provide an example to show how these equations can be used. For example, suppose the current average carcass price for negotiated barrows and gilts in the Western Corn Belt in August is $35.00. A producer wants to know if hogs should be retained or sold in September. Thus, the producer wants a range of September prices. Using the information in Tables 1–4, the following is calculated: to find a forecasted price in September, divide $35.00 by 1.0749, the seasonal price index for August. Then, multiply that number by 0.9412, the seasonal price index for September, to get $30.65. This can be written as:

$$P^{WCB}_{September} = \frac{P^{WCB}_{August}}{I^{WCB}_{August}} \times I^{WCB}_{September} = \frac{35.00}{1.0749} \times 0.9412 = \$30.65$$

To adjust for the variability in the forecasted September price, add or subtract September's historical standard deviation to find the predicted price range in September of $19.55 to $41.75. This implies that there is a 68% probability—or seven out of every 10 years—that September's price will land between these two prices. This can be written as:

$$R^{WCB}_{September} = P^{WCB}_{September} \pm 100 \times SD^{WCB}_{September} = 30.65 \pm (100 \times 0.1110) = [\$19.55, \$41.75]$$

When examining indices across categories such as weight class or location, keep in mind that insights gleaned from indices are not without limitations. Indices are useful in showing the most common timing of fluctuations within each category. Producers and other market participants look to seasonal indices for information on when prices typically increase and decrease across weight class, location, etc. Knowledge of this timing may be useful in production decisions. On the other hand, the magnitude of the fluctuations in price indices is less useful across categories. Each index category is calculated separately from the other; thus, a fluctuation of a certain magnitude in one category provides no information about a fluctuation of a different magnitude in a separate category.

Evaluating Pricing Alternatives

Forecasts using seasonal price indices are most useful when prices align with fundamental supply and demand assumptions and in stable market conditions. However, many years do not follow typical seasonal price patterns due to varying supply and demand factors. In years where seasonal patterns are not likely to hold, it may be necessary to adjust (either up or down) seasonal price projections to account for other nonseasonal factors. For example, in years of extreme weather, unforeseen shocks to supply or demand, or other exogenous influences, historical seasonal price indices may poorly reflect existing market conditions (Kment, 2020). In those cases, it is advisable to incorporate other risk management tools to one's marketing portfolio to mitigate price volatility (Dohlman, 2020). Price contracts, hedging, options, and price insurance are recommended additions to a successful marketing strategy. Understanding seasonal patterns in is only one tool in the hog marketing toolbox, and a well-rounded approach to marketing—with a firm understanding of seasonal patterns at the core—increases the potential long-term viability of the operation.

NOTES

1. USDA AMS staff (2021) defines the regions as follows: Eastern Corn Belt: AL, CT, DE, FL, GA, IL, IN, KY, MA, MD, ME, MI, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, VA, VT, WV, WI; Western Corn Belt: IA, KS, MN, MO, NE, SD; Iowa/Minnesota: IA, MN; National: United States and Canada

2. Using the empirical rule of normal distributions, 68% of the average seasonal price indices will fall in the range of ±1 standard deviation (Galarnyk, 2018).

3. Average daily gain is approximately 1.6 pounds, and finished hogs are marketed at a weight of 280 pounds (Economic Research Service staff, 2019).

Supporting Tables

Table 1. Average Seasonal Price Indicies—Barrows & Gilts, 2010–2019

Month	Negotiated				Other Market Formula				Swine/Pork				Other Purchase Agreement			
	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB
Jan	0.9291	0.9291	0.9291	0.9292	0.9589	0.9564	0.9552	0.9597	0.9224	0.9226	0.9222	0.9210	0.9372	0.9342	0.9343	0.9454
Feb	0.961	0.9621	0.962	0.9591	0.9806	0.9802	0.9796	0.9792	0.955	.954	0.9537	0.9574	0.9583	0.9572	.9575	0.9627
Mar	0.9689	0.9704	0.9704	0.9663	1.003	1.0026	1.0021	1.0008	0.9646	0.9641	0.964	0.9653	0.9697	0.9693	0.9698	0.9717
Apr	1.0096	1.0106	1.0115	1.0077	1.021	1.0169	1.0151	1.025	0.9967	.9954	0.9949	0.9993	0.9949	0.9934	.9934	0.9967
May	1.1015	1.1036	1.1038	1.0986	1.0693	1.0709	1.0707	1.071	1.0802	1.0788	1.0785	1.0823	1.0475	1.0512	1.0506	1.0367
Jun	1.1694	1.1702	1.1705	1.1682	1.0727	1.0774	1.0776	1.0701	1.1416	1.1398	1.1393	1.1448	1.0958	1.103	1.0122	1.0778
Jul	1.1749	1.178	1.1783	1.1717	1.0799	1.0938	1.0934	1.0668	1.1619	1.1605	1.1604	1.1653	1.1193	1.1278	1.1272	1.0983
Aug	1.0746	1.075	1.0749	1.0762	1.0256	1.0364	1.0367	1.0123	1.0877	1.0873	1.0879	1.0893	1.07	1.0732	1.0729	1.0611
Sep	0.9392	0.9412	0.9411	0.9345	0.97	0.9671	0.9696	0.9709	0.9557	0.9572	0.9576	0.9522	0.9779	0.9752	0.9758	0.9822
Oct	0.9599	0.9568	0.9565	0.9633	0.963	0.958	0.9602	0.9709	0.9704	0.9719	0.9723	0.9673	0.9808	0.9792	.979	0.9848
Nov	0.8551	0.8509	0.8503	0.8609	0.9258	0.9121	0.9136	0.9402	0.8856	0.8879	0.8884	0.8820	0.9293	0.9233	0.9238	0.947
Dec	0.8568	0.8519	0.8516	0.8643	0.9302	0.9281	0.9262	0.933	878	0.8803	0.8808	0.8737	0.9193	0.9131	.9134	0.9356

Notes: WCB is Western Corn Belt, IA/MN is Iowa/Minnesota, and ECB is Eastern Corn Belt

Table 2. Average Standard Deviations of Seasonal Price Indicies—Barrows & Gilts, 2010–2019

Month	Negotiated				Other Market Formula				Swine/Pork				Other Purchase Agreement			
	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB	National	WCB	IA/MN	ECB
Jan	0.1153	0.1149	0.1152	0.1169	0.0893	0.0917	0.0906	0.0870	0.1075	0.1073	0.1074	0.1079	0.0747	0.0796	0.0787	0.0647
Feb	0.1062	0.1092	0.1096	0.1033	0.0700	0.0760	0.0740	0.0635	0.0988	0.0980	0.0980	0.1008	0.0679	0.0723	0.0711	0.0599
Mar	0.0692	0.0694	0.0696	0.0686	0.0343	0.0379	0.0374	0.0340	0.0675	0.0674	0.0674	0.0684	0.0408	0.0437	0.0435	0.0384
Apr	0.1373	0.1359	0.1366	0.1402	0.0615	0.0631	0.0630	0.0620	0.1203	0.1182	0.1179	0.1255	0.0839	0.0900	0.880	0.0706
May	0.1109	0.1123	0.1126	0.1101	0.0463	0.0476	0.0514	0.0487	0.0926	0.0902	0.0897	0.0986	0.0605	0.0651	0.0635	0.0516
Jun	0.0828	0.0834	0.0833	0.0820	0.0388	0.0447	0.0437	0.0409	0.0655	0.0644	0.0640	0.0680	0.0473	0.0492	0.0484	0.0438
Jul	0.0717	0.0693	0.0687	0.0776	0.0373	0.0428	0.0437	0.0360	0.0733	0.0748	0.0750	0.0717	0.0684	0.0714	0.0713	0.0639
Aug	0.1105	0.1114	0.1117	0.1100	0.0532	0.0605	0.0592	0.0452	0.0894	0.0884	0.0880	0.0914	0.0629	0.0684	0.0680	0.0544
Sep	0.1094	0.1111	0.1116	0.1079	0.0429	0.0481	0.0470	0.0400	0.0955	0.0940	0.0936	0.0996	0.0624	0.0672	0.0665	0.0554
Oct	0.0862	0.0849	0.0853	0.0888	0.0590	0.0565	0.0571	0.0656	0.0790	0.0781	0.0777	0.0819	0.0563	0.0597	0.0593	0.0507
Nov	0.0901	0.0903	0.0905	0.0892	0.0668	0.0643	0.0658	0.0713	0.0693	0.0689	0.0690	0.0720	0.0445	0.0458	0.0450	0.0409
Dec	0.0744	0.0748	0.0752	0.0740	0.0546	0.0569	0.0590	0.0528	0.0581	0.0583	0.0583	0.0587	0.0450	0.0462	0.0462	0.0447

Notes: WCB is Western Corn Belt, IA/MN is Iowa/Minnesota, and ECB is Eastern Corn Belt

Table 3. Average Seasonal Price Indices—Sows, 2010–2019

Month	Western Corn Belt					National	IA/MN	Eastern Corn Belt
	300–399 lbs.	400–449 lbs.	450–499 lbs.	500–549 lbs.	550+ lbs.	450–499 lbs.	450–499 lbs.	450–499 lbs.
Jan	0.8723	0.8760	0.8768	0.8811	0.8824	0.8736	0.8828	0.8749
Feb	0.9384	0.9473	0.9589	0.9576	0.9581	0.9566	0.9597	0.9583
Mar	0.9894	0.9909	1.0015	0.9972	0.9973	0.9976	1.0006	0.9944
Apr	1.0417	1.0439	1.0454	1.0406	1.0438	1.0396	1.0448	1.0408
May	1.0798	1.0873	1.0847	1.0810	1.0829	1.0821	1.0833	1.0823
Jun	1.0479	1.0447	1.0352	1.0363	1.0376	1.0317	1.0359	1.0306
Jul	1.0728	1.0666	1.0581	1.0520	1.0492	1.0549	1.0551	1.0498
Aug	1.1334	1.1348	1.1342	1.1259	1.1233	1.1326	1.1300	1.1278
Sep	0.9988	0.9916	0.9895	0.9915	0.9858	0.9943	0.9870	0.9916
Oct	0.9425	0.9395	0.9330	0.9368	0.9419	0.9385	0.9325	0.9403
Nov	1.0010	0.9997	0.9990	1.0040	1.0040	1.0055	1.0000	1.0095
Dec	0.8822	0.8776	0.8836	0.8959	0.8938	0.8930	0.8883	0.8998

Notes: WCB is Western Corn Belt, IA/MN is Iowa/Minnesota, and ECB is Eastern Corn Belt

Table 4. Average Standard Deviations of Seasonal Price–Indices—Sows

Month	Western Corn Belt					National	IA/MN	Eastern Corn Belt
	300–399 lbs.	400–449 lbs.	450–499 lbs.	500–549 lbs.	550+ lbs.	450–499 lbs.	450–499 lbs.	450–499 lbs.
Jan	0.1831	0.1781	0.1560	0.1392	0.1373	0.1542	0.1570	0.1499
Feb	0.1973	0.2111	0.2013	0.1888	0.1852	0.1980	0.1970	0.1948
Mar	0.1402	0.1402	0.1308	0.1149	0.1144	0.1256	0.1302	0.1183
Apr	0.1414	0.1433	0.1313	0.1226	0.1211	0.1267	0.1321	0.1253
May	0.2294	0.2365	0.2271	0.2110	0.2073	0.2228	0.2243	0.2183
Jun	0.1168	0.1183	0.1086	0.1046	0.1035	0.1077	0.1076	0.1068
Jul	0.1533	0.1521	0.1493	0.1392	0.1382	0.1457	0.1477	0.1434
Aug	0.2505	0.2549	0.2465	0.2326	0.2306	0.2429	0.2432	0.2417
Sep	0.2040	0.2118	0.1991	0.1842	0.1809	0.1951	0.1989	0.1886
Oct	0.1868	0.1971	0.1849	0.1753	0.1752	0.1823	0.1838	0.1775
Nov	0.1247	0.1278	0.1250	0.1242	0.1212	0.1267	0.1230	0.1281
Dec	0.1440	0.1511	0.1472	0.1389	0.1391	0.1449	0.1467	0.1459

Notes: WCB is Western Corn Belt, IA/MN is Iowa/Minnesota, and ECB is Eastern Corn Belt

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