Consumer Sensitivity to Pork Prices:
A Comparison of 51 U.S. Retail Markets and 6 Pork Products

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Executive Summary

This project's objective was to determine how sensitive consumer pork purchasing behavior is to price changes across U.S. retail markets and pork products. Knowledge of differential price sensitivity boosts economic understanding of pork market dynamics and provides an in-depth reference for use in an array of future assessments benefiting from refined consumer pork demand information. This project utilized weekly price and quantity purchase retail scanner data from 51 U.S. retail markets and 6 different pork products to estimate market- and product-specific own-price elasticity estimates. The elasticity estimates quantify how sensitive consumers in each market, and for each product, are to changes in prices. Beyond estimating a multitude of elasticities, additional analyses provide example applications.

The full report documents raw data utilized, procedures employed, and results. The report includes multiple tables and figures intended to be references for future refined assessments benefiting from the provided market- and product-specific information. A corresponding Appendix is also included providing supplementary details.

Main findings:

1) Heterogeneity in retail demand is prevalent across markets and pork products.

2) There is a wide range in price-sensitivity spanning from inelastic to elastic demand within product categories and across markets. For example, the own-price elasticity of demand for pork loin ranges from a low of -2.704 to a high of -0.233 across the 51 markets.

3) Changes in prices of beef or chicken have small effects on pork purchases; pork purchases are primarily influenced by the price of pork.

4) Per capita pork consumption varies across retail markets in part due to diversity in household characteristics and composition. For example, markets with larger African American populations are stronger pork markets with this strength most pronounced for shoulder and loin products.

5) The results are used to show the heterogeneity in effects that arise from demographic shifts, a reduction in product availability (e.g., due to policy or COVID-like events), and price increases.

Key Recommendations:

1) Wide heterogeneity in retail demand is prevalent across markets and pork products suggesting approaches treating all markets or products as equal should be made with caution. Said approaches may be reasonable "on average" yet inherently mask notable variation. The range in price-sensitivity warrants refined assessments where feasible. Some markets are inelastic and others are elastic, pointing to notably different economic impacts of anything altering prices or available quantities.

2) Variation in consumer price sensitivity spanning from inelastic to elastic indicates consumer expenditures (and pork seller revenues) will move in the same direction of pork prices in some cases (where demand is inelastic) and move in opposite directions in other cases (where demand is elastic). This points to diverse consumer and producer welfare effects across product-markets for any events altering pork prices or availability.

3) Identifying cross-price effects from beef and chicken to be much lower than the impact of pork price on pork purchasing supports elevated focus on things driving pork's competiveness. Furthermore, across markets and products there is notable variation in substitute and complement relationships suggesting caution in broad-brush responses to adjustments in prices of other proteins.

4) Diversity in per capita consumption aligning with heterogeneity in income, education, age, race, and ethnicity points to opportunities to refine product development and marketing efforts to better align with anticipated shifts in U.S. demographics.

5) The report includes demonstrative examples on how shifts in demographics, external shocks reducing pork availability, and external shocks increasing retail prices impact pork markets. Given evolution in production costs, proposed policies, and other factors, similar application of refined demand insights are encouraged.

6) Learning and appreciation of markets can be enhanced by carefully designed graphics. This report contains a series of national maps presenting state-level approximations richly characterizing U.S. retail pork markets. We recommend these be periodically updated to retain currency and be leveraged in producer engagement and broader educational efforts.

Chapter 1. Introduction

Economists rely on fundamentals of supply and demand to understand agricultural markets. Accordingly, there is persistent need to update supply and demand information to understand developments in agricultural markets and predict changes that may occur as new policies arise or exogenous events occur. An impediment to understanding the distributional impacts market or policy phenomena have on producers and consumers is the lack of granularity in existing elasticity estimates. As general statement, information on pork demand is rather aggregated and hence most existing research provides only national-level estimates. As an example, domestic pork demand indices Dr. Tonsor maintain utilize an own-price elasticity estimate of -0.31. This suggests the volume of pork consumers desire declines by 3.1% for each 10% increase in price. While the aggregate elasticity is a reasonable estimate for purposes of a broad, demand-strength tracking index, it masks important differences across geography, consumers, and pork products. The conventional approach would assume, for example, a 10% price increase will have the same effect on bacon and loin, and cannot identify differences in demand in, say, Chicago, IL vs. Los Angeles, CA.

Obtaining refined insights continues to grow in importance, both in determining market segments and in estimating heterogeneous policy impacts. This growing need serves as this project's motivation. This **project's primary objective** is to determine how sensitive consumer pork purchasing behavior is to price changes across 51 U.S. retail markets and 6 pork products. In meeting this objective, an enriched understanding of U.S. retail pork demand will enable improved decision-making by many industry stakeholders.

Chapter 2. Procedure & Data

This project utilizes multi-outlet retail market scanner data obtained by the National Pork Board from IRI. Specifically, we use data from the 51 markets listed in table 1 covering calendar years 2016-2020. From 2016 to 2020, there are 260 observations of weekly retail data for each market and product examined. Population data specific to each market is also provided by IRI enabling us to derive per capita volume measures.[1] While we believe IRI's coverage over each of the 51 examined markets is sound and as complete as feasible, there is variation nationally as presence of excluded retail outlets varies.[2]

Table 1. Retail Markets Examined

Albany, NY	New England
Atlanta, GA	New Orleans, LA/Mobile, AL
Baltimore, MD/Washington D.C.	New York, NY
Birmingham/Montgomery, AL	Orlando, FL
Boise, ID	Peoria/Springfield, IL
Boston, MA	Philadelphia, PA
Buffalo/Rochester, NY	Phoenix/Tucson, AZ
Charlotte, NC	Pittsburgh, PA
Chicago, IL	Portland, OR
Cincinnati/Dayton, OH	Providence, RI
Columbus, OH	Raleigh/Greensboro, NC
Dallas/Ft. Worth, TX	Richmond/Norfolk, VA
Denver, CO	Roanoke, VA
Detroit, MI	Sacramento, CA
Grand Rapids, MI	San Diego, CA
Harrisburg/Scranton, PA	San Francisco/Oakland, CA
Hartford, CT/Springfield, MA	Seattle/Tacoma, WA
Houston, TX	South Carolina
Indianapolis, IN	Spokane, WA
Jacksonville, FL	St. Louis, MO
Knoxville, TN	Syracuse, NY
Las Vegas, NV	Tampa/St. Petersburg, FL
Los Angeles, CA	Toledo, OH
Louisville, KY	West Texas/New Mexico
Miami/Ft. Lauderdale, FL	Wichita, KS
Nashville, TN	

[1] Specifically, population estimates provided by IRI were derived from 2019 Census data.

[2] As an example, omission of HEB markets is of note in Texas. This is not something that can easily be remedied and we have no particular reason to believe it skews our analysis in any particular way but rather is noted here for transparency.

To retain focus on categories with sufficient volume to support a robust analysis, we combine categories of Leg (Fresh Ham), Offal, Ground, and Ingredients Cuts into a broader All Other Pork category. Table 2 shows the final set of pork products studied with each representing at least 2% of total pork retail expenditures, on average across markets for the five-year period examined.

Table 2. Products Examined

Pork Products	*Aggregate Meat Categories*
Loin	Beef
Ribs	Chicken
Shoulder	Pork
Breakfast Sausage	
Dinner Sausage	
Bacon	
All Other Pork	

Note: Individual product data was available on Leg (Fresh Ham), Offal, Ground, and Ingredient Cuts. However, each category represented less than 2% expenditure share, on average across markets for the full time period, leading us to merge them in with All Other Pork.

Using IRI's total volume and total expenditure measures we derive weighted average sales prices.[3] Sales of the pork products vary widely across major U.S. markets. To demonstrate, consider figures 1-4. Figure 1 presents the weekly per capita volume (lbs) of pork loin over the four major markets of Chicago, IL, Los Angeles, CA, Houston, TX, and Phoenix, AZ. Presenting volume in per capita (or per person) units enables a comparison not confounded with market population. Figure 2 shows weekly pork loin prices ($/lb) for these markets. Figure 3 presents the weekly per capita volume (lbs) of bacon for these four markets. Figure 4 shows weekly bacon prices ($/lb) for these markets.

[3] Throughout this analysis we use the sum of fixed and random weight products to capture total transactions and support improved comparisons across pork categories.

Figure 1. Weekly Per Capita Pork Loin Volume (lbs), Jan. 2016 – Dec. 2020

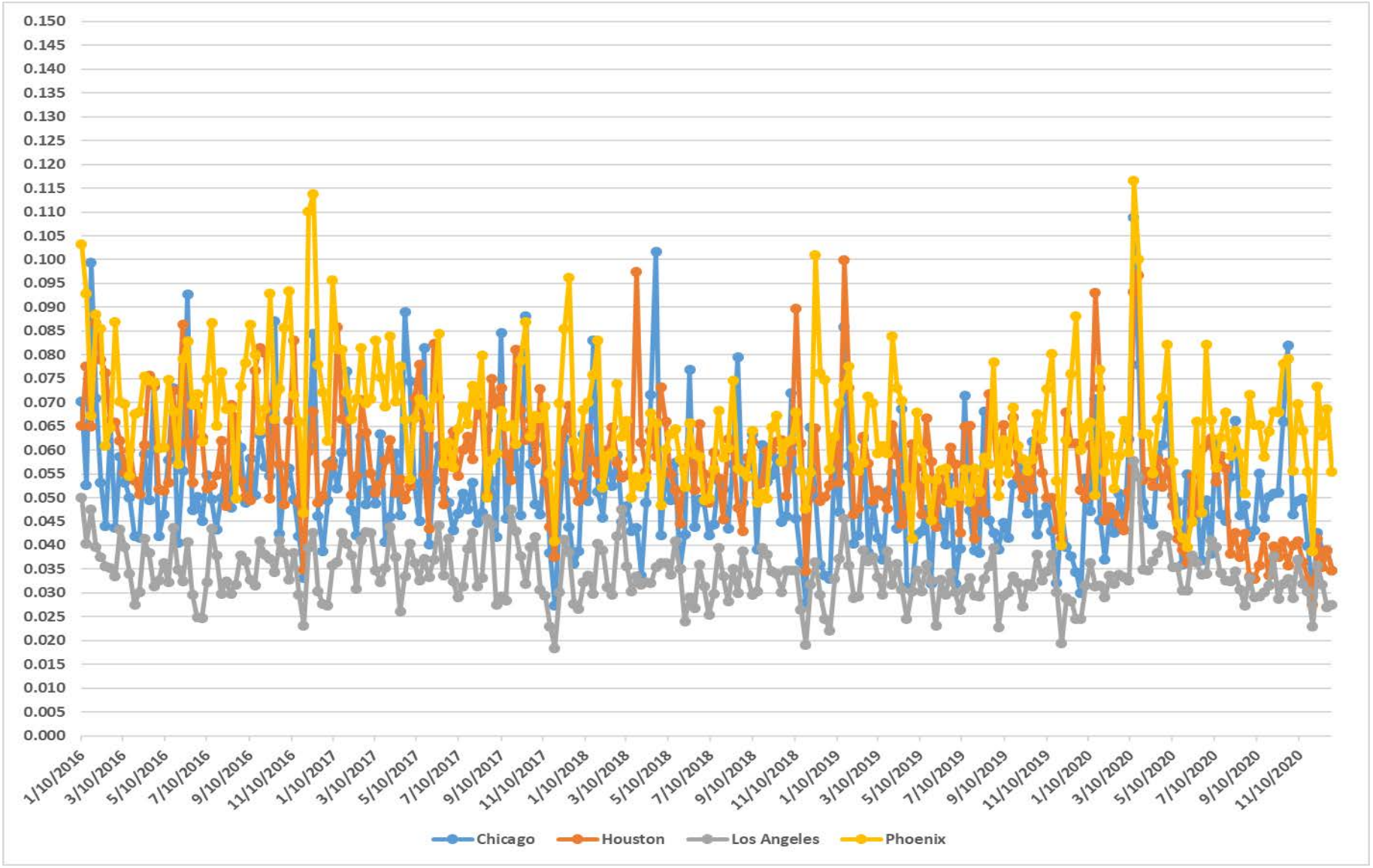


Figure 2. Weekly Pork Loin Prices ($/lb), Jan. 2016 – Dec. 2020

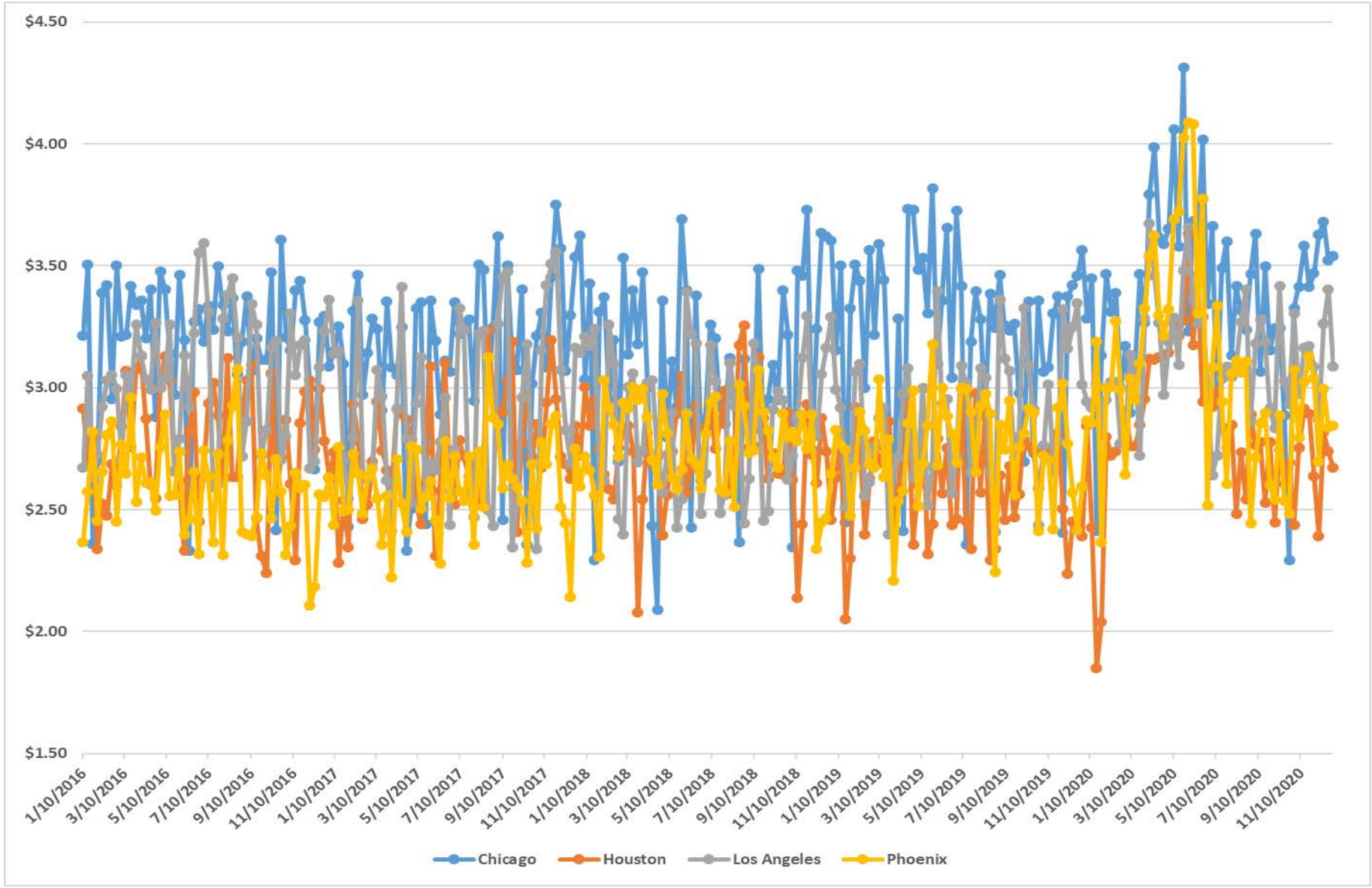


Figure 3. Weekly Per Capita Bacon Volume (lbs), Jan. 2016 – Dec. 2020

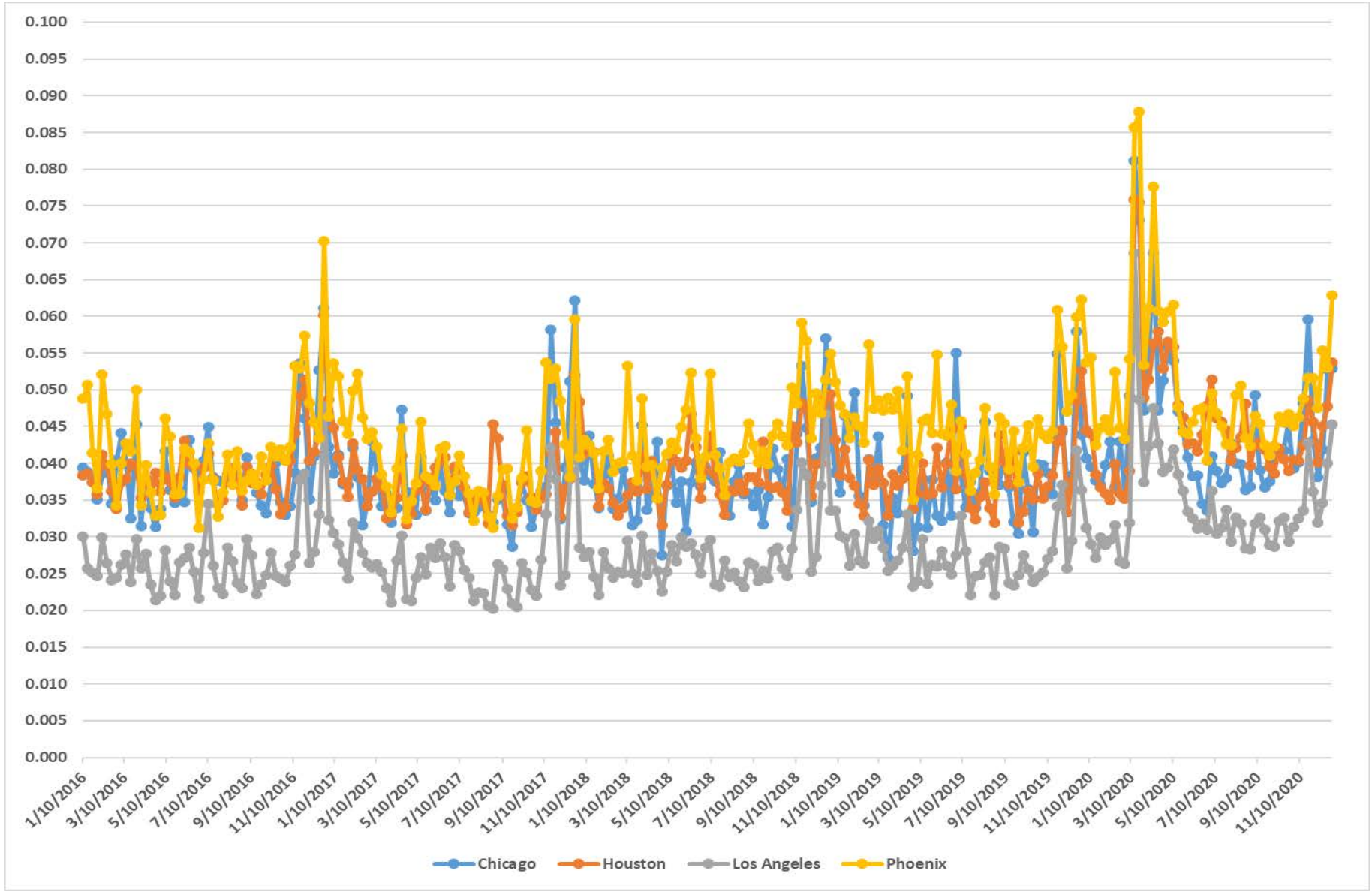
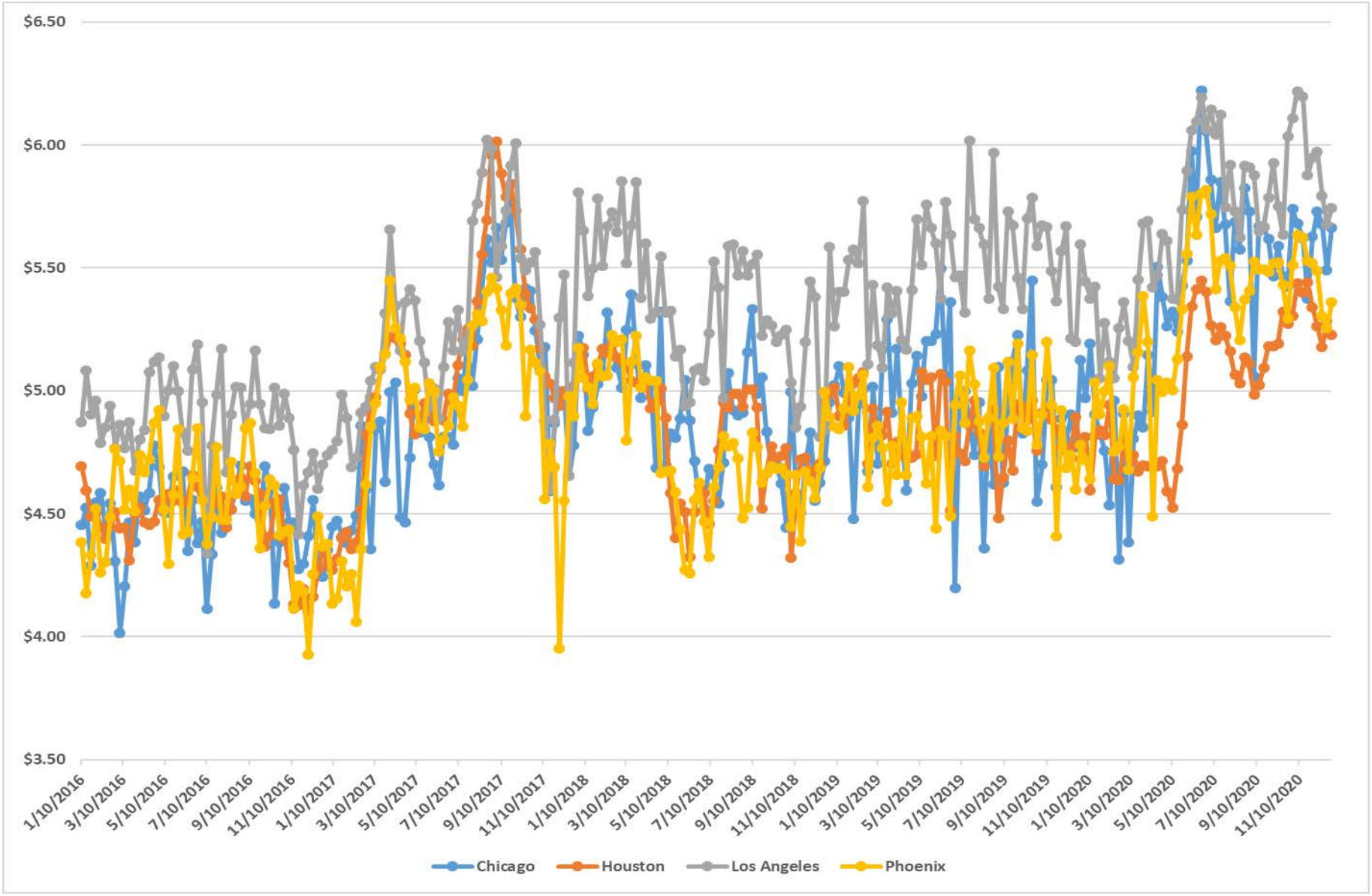


Figure 4. Weekly Bacon Prices ($/lb), Jan. 2016 – Dec. 2020



Across each of these four figures one quickly observes important points. First, even among these four markets, the ranking of volume, price, or total sales often changes week-to-week. Second, loin prices are generally higher in Chicago than Los Angeles (figure 2) while the opposite holds for bacon (figure 4). Given both loin and bacon products are derived from live animals, and hence share many common supply-side, cost-of-production impacts, this indirectly suggests likely differences in consumer demand across the two locations. Combined, this reinforces the value in a targeted, deep-dive into consumer price sensitivity across markets and pork products.

Another observation is the impact of the COVID-19 pandemic. While pandemic effects are not of central focus here, it is important to prudently control for them. Here the week ending March 15, 2020 stands out as a notable surge in consumer purchasing activity, particularly for bacon. More broadly, seasonality in loin and bacon purchasing is evident. We incorporate these observations in our assessment as discussed further below.

The following two tables illustrate important variation across markets.[4] Using average values over the January 2016 – December 2020 period in the four markets discussed above, tables 3 and 4 summarize volume and expenditure shares respectively for loin, ribs, shoulder, breakfast sausage, dinner sausage, bacon, and all other pork.[5]

Table 3. Average Volume Shares of Pork Products (Jan. 2016 - Dec. 2020), by Market

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*All Other Pork*
Chicago, IL	26.6%	15.3%	7.1%	9.6%	17.7%	20.3%	3.4%
Houston, TX	26.3%	21.7%	10.2%	7.8%	7.3%	18.4%	8.2%
Los Angeles, CA	21.8%	22.5%	13.0%	7.3%	9.0%	18.5%	8.0%
Phoenix/Tucson, AZ	28.5%	18.7%	5.9%	8.3%	14.2%	19.3%	5.0%

Table 4. Average Expenditure Shares of Pork Products (Jan. 2016 - Dec. 2020), by Market

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*All Other Pork*
Chicago, IL	24.6%	12.9%	3.7%	10.3%	16.2%	29.4%	2.9%
Houston, TX	24.6%	16.9%	5.4%	8.7%	8.1%	30.8%	5.4%
Los Angeles, CA	20.5%	18.5%	6.7%	7.7%	9.6%	31.6%	5.5%
Phoenix/Tucson, AZ	25.1%	14.4%	3.9%	8.7%	13.6%	30.4%	3.9%

[4] The Appendix contains parallel tables providing estimates for all 51 examined markets.

[5] As noted in the appendix, other pork categories were also considered. Ultimately we focus on these six pork products, and all-other-pork, as other pork categories represented less than 2% of expenditure shares on average over the evaluated markets and period.

To further summarize product differences nationally, the following two figures show the average volume and expenditure shares across all 51 markets for the full January 2016 – December 2020 period. The leading role of Loin and Bacon immediately is demonstrated. Observing expenditure share to be higher for Bacon and volume share to be higher for Loin reflects Bacon prices exceeding Loin prices.

Figure 5. Volume Shares of Pork Products, Average of 51 Markets (Jan. 2016 – Dec. 2020)

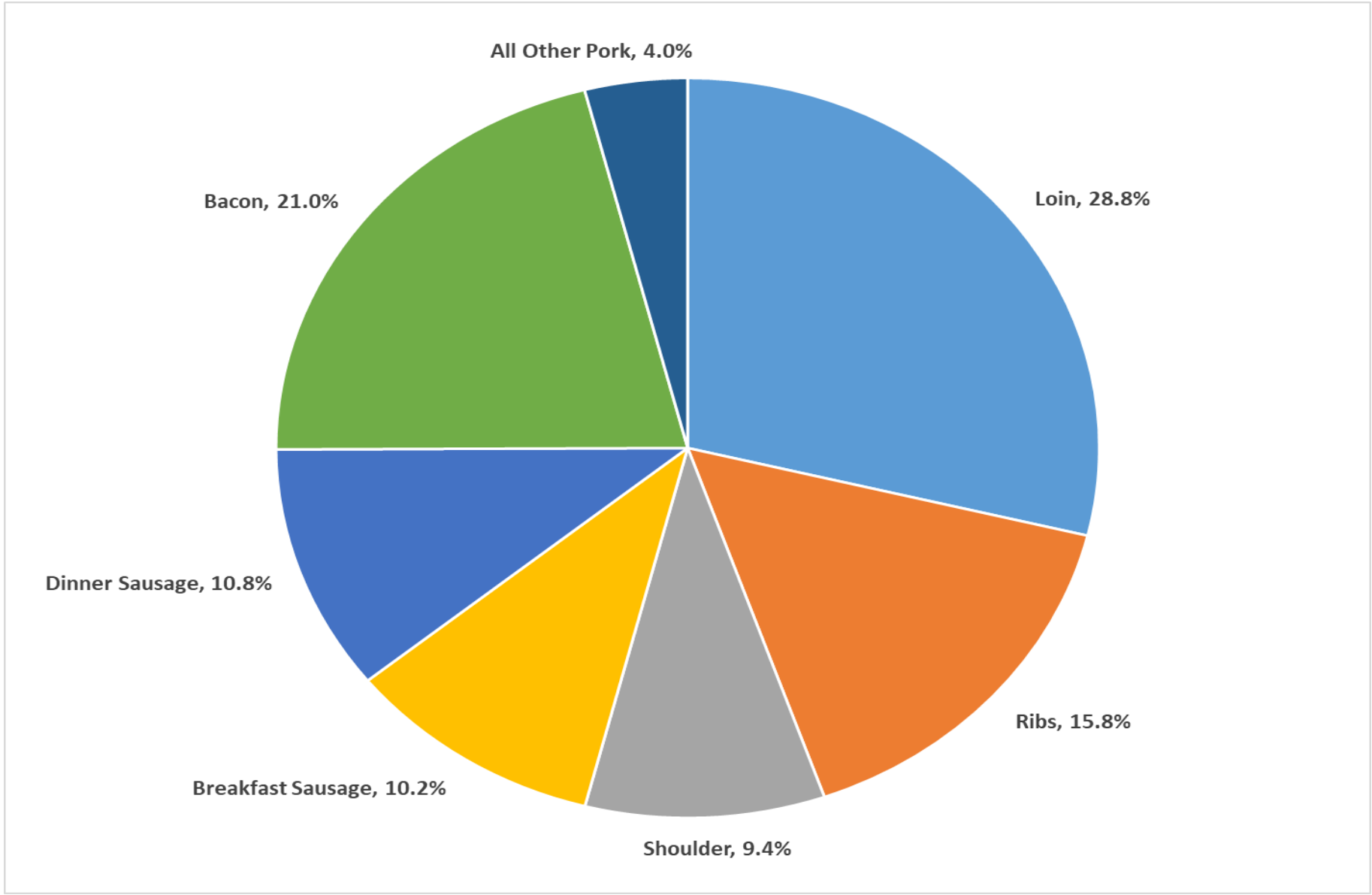
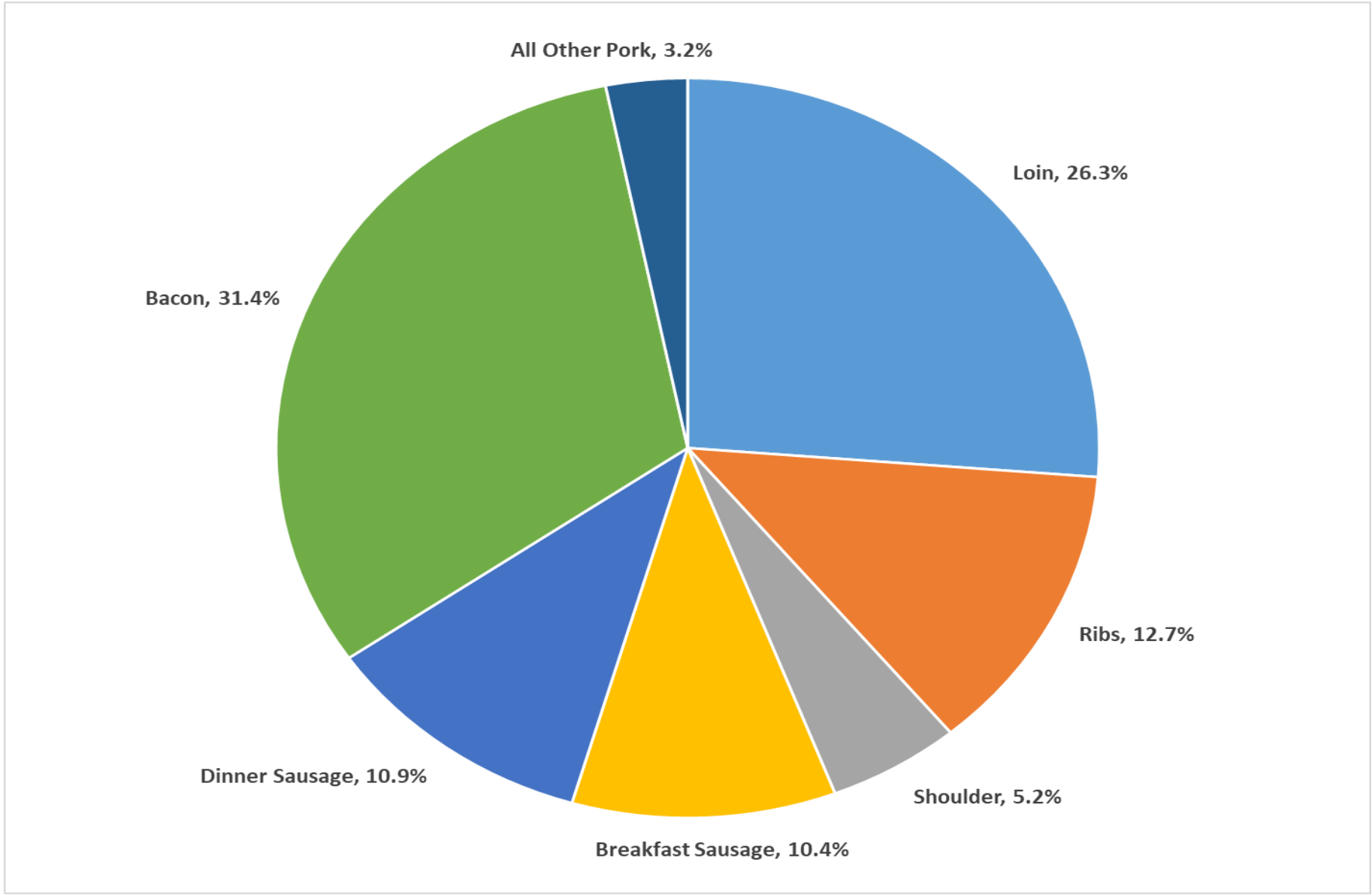


Figure 6. Expenditure Shares of Pork Products, Average of 51 Markets (Jan. 2016 – Dec. 2020)



To build upon the previous figures and illustrate heterogeneity masked in averages, consider the Los Angeles market. Here 22% of pork volume purchases were in the form of loin, which is the lowest of the 51 markets. At the same time, in Los Angeles, 18% of pork expenditures were in the form of ribs, the highest across the 51 markets.[6] This simple example demonstrates a **central point:** the mix of pork products purchased varies notably across U.S. consumer markets.[7]

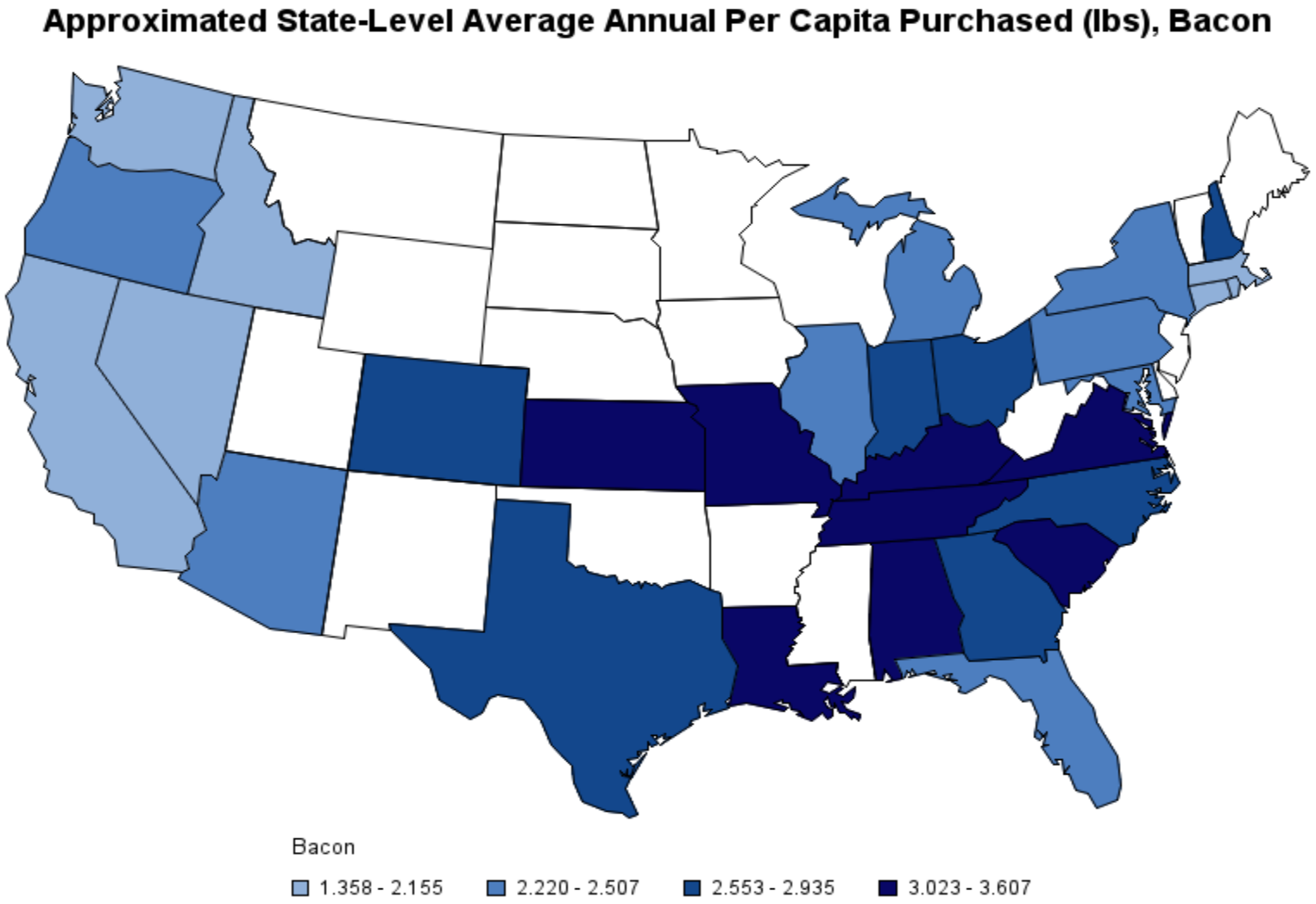
To further document this variation in pork demand patterns figures 7 and 8 were derived. Here state-level values are derived as simple averages from 51 specific market data. We include bacon figures here while the Appendix includes parallel figures for loin, ribs, shoulder, breakfast sausage, and dinner sausage.

Figure 7 shows the average weekly per capita volume of bacon consumed regionally. One-fourth of states (e.g. LA and AL) consume 3.02 lbs of bacon or more per year. Conversely, one-fourth of states (e.g. CA and NV) consume 2.16 lbs of bacon or less per year. Figure 8 presents average bacon prices and indicates one-fourth of states had prices below $4.86/lb (e.g. TX and KS) and one-fourth had prices above $5.29/lb (e.g. CA and FL).

[6] In fact, Los Angeles, CA is one of only two markets (along with Sacramento, CA) to have per capita Rib volume to exceed Loin volume.

[7] The Appendix includes tables listing out the ranking of all 51 markets, for all six pork products, by Total Volume, Total Expenditure, Average Price, and Average Weekly Per Capita Volume. These tables document the heterogeneity noted here by the Los Angeles, CA market example.

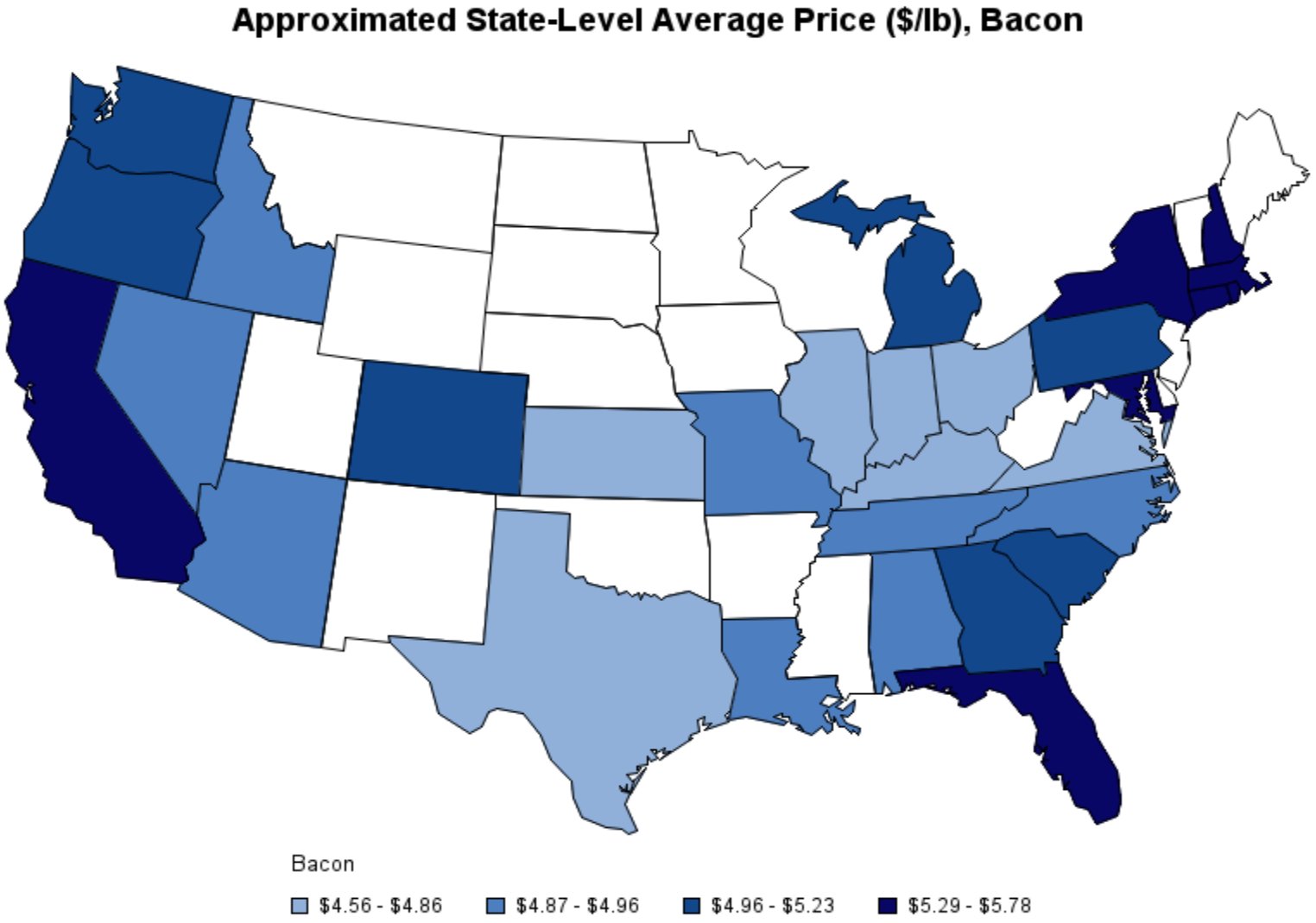
Figure 7. Per Capita Annual Bacon Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



Source: Tonsor & Lusk, 2021

Figure 8.

Figure 8. Bacon Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



Source: Tonsor & Lusk, 2021

Chapter 3. Elasticity Estimation

To further investigate the economic importance of heterogeneity across markets in pork purchasing behavior we proceed to examine consumer price sensitivity by product and market. Specifically, we setup economic models to use variation in prices paid and quantities purchased to derive market- and product-specific own-price elasticity of demand estimates. In designing our model, we control for competing beef and chicken prices, monthly seasonality, annual effects, and COVID pandemic effects. The final model estimated is:

$$(1)\ lnQ = \alpha + \beta lnOwnP + \gamma lnBeefP + \delta lnChickenP + \sum_{i=1}^{11} \mu_i Month_i + \sum_{j=2016}^{2019} \rho_j Year_j + \sigma Covid + \epsilon$$

where *ln* is the natural logarithm operator, *Q* is quantity of pork product purchased, *OwnP* is price of the examined pork product in its own market, *BeefP* is beef price, *ChickenP* is chicken price, $Month_i$ is a dummy variable equal to one for month *i* and 0 otherwise, $Year_j$ is a dummy variable equal to one for year *j* and 0 otherwise, *Covid* is a dummy variable equal to one for weeks March 15, 2020 to May 31, 2020 and 0 otherwise, ϵ is the model's normally-distributed error term, and remaining terms are parameters to be estimated. This model contains 20 parameters to be estimated. We estimate each model separately for every market-product combination yielding market-product specific insights. We omit time and market subscripts from equation (1) for presentation convenience.

Our final, preferred approach applies two-stage least squares methods to avoid assuming pork product prices in a market are exogenous.[8] To implement this approach, instrumental variables for retail pork prices are needed. Such instruments need to be highly correlated with the product price in the respective location but have no direct, independent effect on the outcome of interest, the quantity demanded. In general, such instruments will be cost-side drivers of retail price changes. We utilize two instruments. The first are so-called Hausman-instruments (1996) that have been widely used in the literature (e.g., Nevo, 2001), in which we use the weighted average price in the other 50 markets besides the one being examined as an instrument for the pork product price in the location in question. The assumption is that correlation among prices across two locations is due to common cost shocks, whereas it is assumed demand changes across two locations are likely to be more idiosyncratic. The other instruments include more direct costs to the retail sector: current and up to 8 week-lagged national cutout wholesale values as instruments.[9]

[8] The Appendix includes details comparing results from our instrumental variable approach and simple regression directly using each market's own price.

[9] The national cutout values used as instruments varies to align appropriate primals with retail products. In our loin analysis we use Loin Primal values, for ribs we use Rib Primal values, for shoulder we use Picnic Primal values, for breakfast and dinner sausage we use Butt Primal values, and for bacon we use Belly Primal values. For aggregate category analyses we use the Comprehensive Pork Cutout value.

Ultimately our primary interest is in the β parameter, which quantifies how price sensitive consumers are for a given product in a particular market. Specifically, this parameter is an elasticity estimate representing how a 1% change in a product's price impacts the quantity purchased in a given market. In estimating our model for each market and product, we quickly gain new insight into multiple dimensions of heterogeneous consumer demand patterns.

Table 5 reports our main elasticity results for six separate pork products as well as pork when modeled as an aggregate good.[10] This table reports mean and median statistics of elasticity estimates over the 51 evaluated markets. Further, to highlight the dispersion across markets we report minimum, 1st quartile, 3rd quartile, and maximum estimates. Figure 9 presents the same information in visual format.

First consider the differences across products using median estimates over markets. The aggregate pork category is estimated to have a -1.315 own-price elasticity, suggesting that for each 1% increase in price, aggregate retail pork purchases will decline by 1.315%. Not surprisingly, this aggregate pork estimate masks important variation across products. Bacon (-0.873) and Loin (-1.145) have median estimates suggesting consumers are less sensitive to price changes, than pork when treated as a broad category. Conversely, Breakfast Sausage (-3.294), Ribs (-2.516), Dinner Sausage (-2.404), and Shoulder (-1.508) are four products with median estimates indicating consumers are more sensitive to price changes than pork in aggregate.

While these differences across products are important to appreciate, they represent only one of two key dimensions of dispersion in demand patterns. Examining elasticity estimates across markets is of equal importance. Consider first loin products. The median own-price elasticity estimate is -1.145, yet across the 51 markets, this ranges from -0.233 (Wichita, KS) to -2.704 (Pittsburg, PA). A convenient statistical metric used to summarize dispersion is the interquartile range (IQR), which is the difference between the 3rd quartile and 1st quartile. For loin products, the IQR is 0.44, which is 38% the magnitude of the median estimate reflecting notable variation. Stated differently, in response to a 1% increase in loin prices 25% of the loin markets decrease purchased volume by more than 1.346%, 50% of markets reduce purchased volume by 0.906% to 1.346%, and the remaining 25% of markets decrease purchased volume by less than 0.906%.

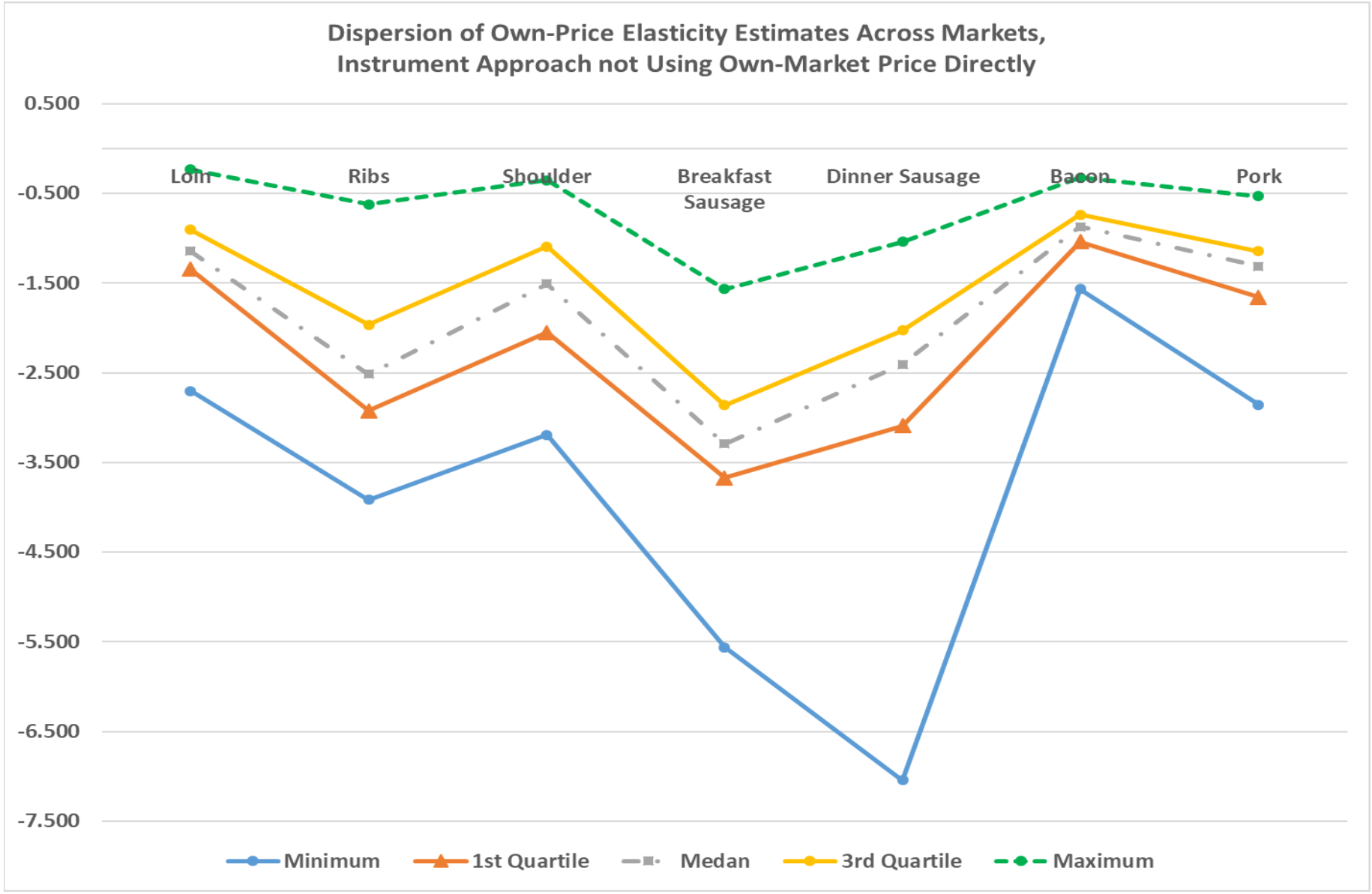
Similar results are observed for all pork products. As a broad statement, using the IQR as a way to compare dispersion, bacon (IQR=0.302) and loin (IQR=0.440) are product categories that are less different across markets while dinner sausage (IQR=1.065), ribs (IQR=0.962), shoulder (IQR=0.957), and breakfast sausage (IQR=0.809) are product categories that differ more across markets.

[10] Note the aggregate pork analysis reflects the summation of the six individually reported products as well as the other small category items comprising all other pork.

Table 5. Summary Statistics on Own-Price Elasticities across 51 Markets (Jan. 2016 - Dec. 2020)

	Loin	Ribs	Shoulder	Breakfast Sausage	Dinner Sausage	Bacon	Pork
Mean	-1.179	-2.436	-1.622	-3.389	-2.633	-0.911	-1.408
Minimum	-2.704	-3.916	-3.194	-5.561	-7.043	-1.565	-2.859
1st Quartile	-1.346	-2.926	-2.052	-3.671	-3.092	-1.041	-1.658
Medan	-1.145	-2.516	-1.508	-3.294	-2.404	-0.873	-1.315
3rd Quartile	-0.906	-1.963	-1.094	-2.862	-2.027	-0.740	-1.147
Maximum	-0.233	-0.623	-0.356	-1.569	-1.042	-0.327	-0.532
Count	51	51	51	51	51	51	51
Number Positive	0	0	0	0	0	0	0

Figure 9. Dispersion of Own-Price Elasticity Estimates Across Markets (Jan. 2016 – Dec. 2020)



Complete documentation of market-product specific own-price elasticity estimates is provided in table 6. For each product (down each column), the five most elastic markets are identified in green and the five most inelastic markets are identified in orange. Some locations are consistently among the most inelastic. For example, Syracuse, NY is one of the five most inelastic location for three products: loin, ribs, and shoulder. However, some locations are on either ends of the price sensitivity spectrum depending on product. For example, Phoenix/Tucson is one of the 5 most inelastic locations for loin and shoulder but one of the 5 most elastic locations for dinner sausage, breakfast sausage, and bacon.

Table 6. Own-Price Pork Elasticity of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	-0.857	-1.820	-1.498	-3.623	-2.431	-0.647	-0.952
Atlanta, GA	-1.399	-3.502	-1.654	-4.780	-3.112	-1.081	-1.633
Baltimore, MD/Washington D.C.	-1.030	-1.539	-1.905	-1.569	-2.120	-0.659	-0.894
Birmingham/Montgomery, AL	-1.006	-3.574	-2.339	-2.901	-2.276	-0.665	-1.445
Boise, ID	-0.904	-2.693	-1.139	-2.937	-2.799	-1.211	-1.193
Boston, MA	-1.018	-1.202	-1.260	-3.283	-1.042	-0.760	-0.532
Buffalo/Rochester, NY	-0.755	-1.295	-0.356	-3.697	-2.132	-1.539	-0.910
Charlotte, NC	-1.098	-2.877	-3.194	-3.639	-2.454	-0.765	-1.725
Chicago, IL	-1.885	-2.516	-1.378	-3.394	-3.086	-0.726	-2.492
Cincinnati/Dayton, OH	-1.579	-2.410	-0.723	-3.274	-3.106	-1.022	-1.075
Columbus, OH	-2.103	-2.608	-1.674	-3.456	-3.552	-1.247	-2.026
Dallas/Ft. Worth, TX	-1.154	-1.819	-0.975	-4.221	-1.644	-0.672	-1.232
Denver, CO	-0.776	-3.075	-1.420	-2.803	-2.627	-0.685	-1.343
Detroit, MI	-1.408	-2.354	-0.839	-4.302	-4.439	-0.812	-1.408
Grand Rapids, MI	-1.850	-0.623	-1.001	-3.757	-2.404	-0.587	-0.899
Harrisburg/Scranton, PA	-1.374	-1.455	-1.508	-2.590	-1.749	-1.029	-1.231
Hartford, CT/Springfield, MA	-1.227	-1.363	-1.702	-4.366	-2.222	-1.051	-1.235
Houston, TX	-0.762	-3.131	-1.134	-3.842	-2.375	-0.327	-1.333
Indianapolis, IN	-1.182	-2.016	-1.055	-5.378	-4.037	-1.064	-1.273
Jacksonville, FL	-1.175	-2.746	-2.616	-2.534	-2.017	-0.754	-1.868
Knoxville, TN	-1.203	-3.040	-1.621	-3.294	-2.846	-1.037	-1.267
Las Vegas, NV	-1.260	-3.916	-0.570	-3.645	-7.043	-0.948	-1.864
Los Angeles, CA	-1.189	-3.170	-1.674	-2.729	-1.501	-0.832	-1.823
Louisville, KY	-1.318	-2.455	-0.875	-3.342	-2.688	-1.022	-1.253
Miami/Ft. Lauderdale, FL	-0.991	-2.019	-1.463	-3.346	-2.124	-0.845	-1.645
Nashville, TN	-0.907	-3.161	-1.191	-4.908	-2.873	-0.834	-0.773
New England	-1.049	-1.238	-1.353	-2.615	-1.576	-0.520	-0.656
New Orleans, LA/Mobile, AL	-2.184	-2.687	-2.693	-4.071	-1.497	-0.675	-1.894
New York, NY	-0.803	-1.858	-1.854	-2.823	-2.295	-0.863	-1.241
Orlando, FL	-1.171	-2.565	-2.348	-3.449	-2.086	-0.918	-1.923

Peoria/Springfield, IL	-0.906	-2.333	-0.940	-3.135	-3.098	-0.527	-0.642
Philadelphia, PA	-0.793	-2.401	-1.959	-2.515	-1.935	-1.134	-1.315
Phoenix/Tucson, AZ	-0.687	-3.154	-0.499	-5.561	-6.209	-1.565	-1.532
Pittsburgh, PA	-2.704	-2.692	-1.935	-2.723	-2.209	-1.269	-2.517
Portland, OR	-1.791	-2.628	-2.637	-2.983	-3.745	-1.449	-1.878
Providence, RI	-1.165	-1.844	-1.741	-3.916	-1.225	-0.977	-0.706
Raleigh/Greensboro, NC	-1.046	-2.499	-3.016	-4.416	-2.038	-0.757	-1.291
Richmond/Norfolk, VA	-0.670	-2.907	-2.381	-3.216	-2.696	-0.769	-1.385
Roanoke, VA	-1.045	-2.802	-1.902	-3.033	-2.226	-0.997	-1.143
Sacramento, CA	-1.279	-2.944	-1.443	-3.420	-2.560	-1.013	-1.621
San Diego, CA	-1.537	-3.374	-1.936	-3.110	-1.679	-0.821	-1.593
San Francisco/Oakland, CA	-1.173	-2.695	-1.179	-2.794	-2.965	-0.998	-1.549
Seattle/Tacoma, WA	-1.118	-3.048	-2.145	-3.144	-3.120	-1.046	-1.152
South Carolina	-0.954	-2.470	-2.915	-3.136	-2.004	-0.680	-1.672
Spokane, WA	-1.145	-2.859	-2.521	-2.544	-2.629	-0.868	-1.249
St. Louis, MO	-0.252	-1.911	-2.803	-3.427	-3.132	-0.981	-2.859
Syracuse, NY	-0.629	-1.310	-0.621	-2.568	-2.180	-1.190	-0.886
Tampa/St. Petersburg, FL	-1.471	-2.499	-2.282	-3.257	-1.781	-0.873	-1.940
Toledo, OH	-1.852	-2.039	-1.195	-3.444	-3.502	-1.208	-1.508
West Texas/New Mexico	-1.052	-2.096	-0.961	-2.377	-1.738	-0.625	-1.269
Wichita, KS	-0.233	-3.026	-0.715	-3.567	-3.472	-0.934	-1.070

To further help see relative rankings, Table 7 presents rankings of the 51 evaluated markets by own-price elasticity. These rankings are on values reported in table 6 and are derived in descending order so a rank=1 implies the largest (or least negative, most inelastic) estimate (the maximum value shown in table 5) while a rank=51 applies to the smallest (or most negative, most elastic) estimate (the minimum value in table 5).

Table 7. Own-Price Pork Elasticity Ranking of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	11	10	25	36	27	6	39
Atlanta, GA	40	49	28	48	41	42	16
Baltimore, MD/Washington D.C.	19	8	35	1	16	7	10
Birmingham/Montgomery, AL	17	50	41	14	23	8	7
Boise, ID	12	32	15	15	34	46	19
Boston, MA	18	2	19	25	1	16	11
Buffalo/Rochester, NY	6	4	1	39	18	50	24
Charlotte, NC	24	37	51	37	28	17	27
Chicago, IL	48	26	21	29	38	13	44
Cincinnati/Dayton, OH	44	21	6	24	40	35	38
Columbus, OH	49	28	30	34	46	47	42
Dallas/Ft. Worth, TX	27	9	11	44	6	9	1
Denver, CO	8	43	22	12	30	12	15
Detroit, MI	41	19	7	45	49	19	41
Grand Rapids, MI	46	1	12	40	26	4	37
Harrisburg/Scranton, PA	39	7	26	7	9	37	22
Hartford, CT/Springfield, MA	35	6	31	46	21	40	48
Houston, TX	7	44	14	41	25	1	5
Indianapolis, IN	32	14	13	50	48	41	29
Jacksonville, FL	31	34	45	4	13	14	6
Knoxville, TN	34	41	27	26	35	38	43
Las Vegas, NV	36	51	3	38	51	29	36
Los Angeles, CA	33	47	29	10	4	21	3
Louisville, KY	38	22	8	27	32	36	35
Miami/Ft. Lauderdale, FL	16	15	24	28	17	23	21
Nashville, TN	14	46	17	49	36	22	20
New England	22	3	20	8	5	2	17
New Orleans, LA/Mobile, AL	50	30	47	43	3	10	33
New York, NY	10	12	33	13	24	24	28
Orlando, FL	29	27	42	33	15	27	4
Peoria/Springfield, IL	13	18	9	19	39	3	40
Philadelphia, PA	9	20	38	3	11	43	2
Phoenix/Tucson, AZ	5	45	2	51	50	51	18
Pittsburgh, PA	51	31	36	9	20	48	51
Portland, OR	45	29	46	16	47	49	31
Providence, RI	28	11	32	42	2	30	45
Raleigh/Greensboro, NC	21	25	50	47	14	15	26
Richmond/Norfolk, VA	4	38	43	22	33	18	32

Roanoke, VA	20	35	34	17	22	32	49
Sacramento, CA	37	39	23	30	29	34	13
San Diego, CA	43	48	37	18	7	20	9
San Francisco/Oakland, CA	30	33	16	11	37	33	30
Seattle/Tacoma, WA	25	42	39	21	42	39	12
South Carolina	15	23	49	20	12	11	25
Spokane, WA	26	36	44	5	31	25	14
St. Louis, MO	2	13	48	31	43	31	47
Syracuse, NY	3	5	4	6	19	44	34
Tampa/St. Petersburg, FL	42	24	40	23	10	26	8
Toledo, OH	47	16	18	32	45	45	46
West Texas/New Mexico	23	17	10	2	8	5	23
Wichita, KS	1	40	5	35	44	28	50

To help connect with earlier raw data summary statistics for Chicago, Houston, Los Angeles, and Phoenix markets entries in table 7 are highlighted for these four markets. To demonstrate key differences, consider the rankings for loin and bacon price sensitivity. Own-price, loin elasticities are -0.689 in Phoenix, -0.762 in Houston, -1.189 in Los Angeles, and -1.885 in Chicago. Own-price bacon elasticities are -0.327 in Houston, -0.726 in Chicago, -0.832 in Los Angeles, and -1.565 in Phoenix. Accordingly, the Phoenix market is expected to be the most responsive to bacon price changes yet least responsive to loin price changes. Furthermore, the impact in Phoenix of a 1% change in bacon price is much larger than a 1% change in loin price while the other three markets are more responsive to loin price changes.

As a final method of visualizing diversity in own-price elasticities across markets figures 10 and 11 are included showing how loin and bacon price sensitivities various nationally.[11] Note our elasticity estimates are for specific retail markets representing a broader metropolitan area and not full U.S. states. However, as a manner of presentation convenience and to ease understanding of regional differences it is useful to take our estimates for 51 retail markets and derive simple average values for the 30 states these markets reside in. The resulting maps provide approximate state-level values implied by these simple averages.[12] Furthermore, these maps make it clear which states are not directly assessed in this study (those that are in white) as 20 U.S. states do not contain one of the 51 IRI markets examined.

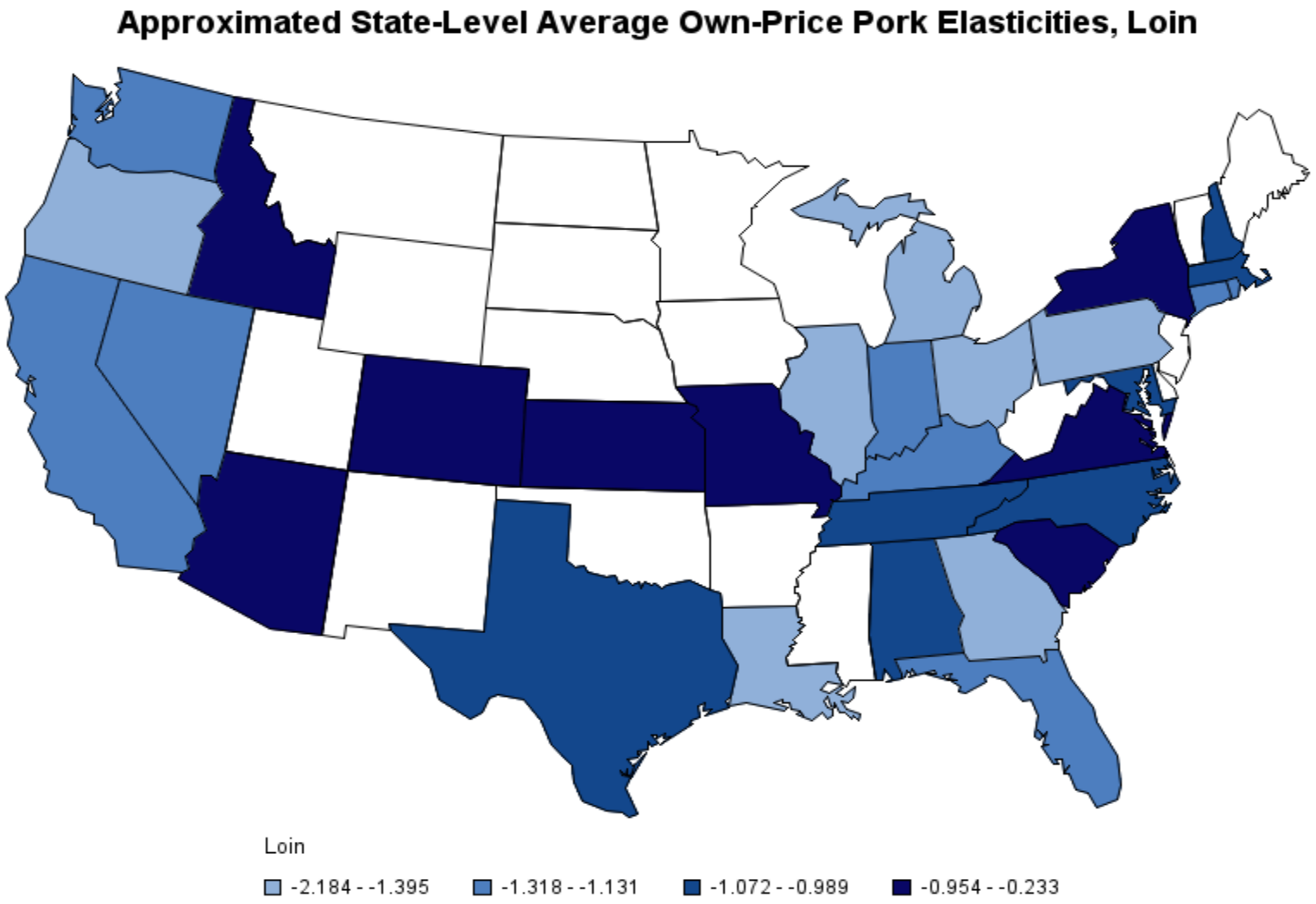
Figure 10 indicates that one-fourth of the states have loin elasticities under -0.954% indicating that loin volume changes are smaller than price changes in those markets which

[11] Parallel figures for Ribs, Shoulder, Breakfast Sausage, and Dinner Sausage are included in the Appendix.

[12] Readers are encouraged to see the full list of markets in table 1 to observe cases where a single market is used to reflect state-level values (e.g. IN and KS) vs. cases where multiple markets are averaged to provide state-level values (e.g. CA and TX). To derive these state-level estimates for "New England" we use Manchester, NH, for "New Orleans/Mobile" we use New Orleans, LA, for "South Carolina" we use Charleston, SC, and for "West Texas/New Mexico" we use El Paso, TX.

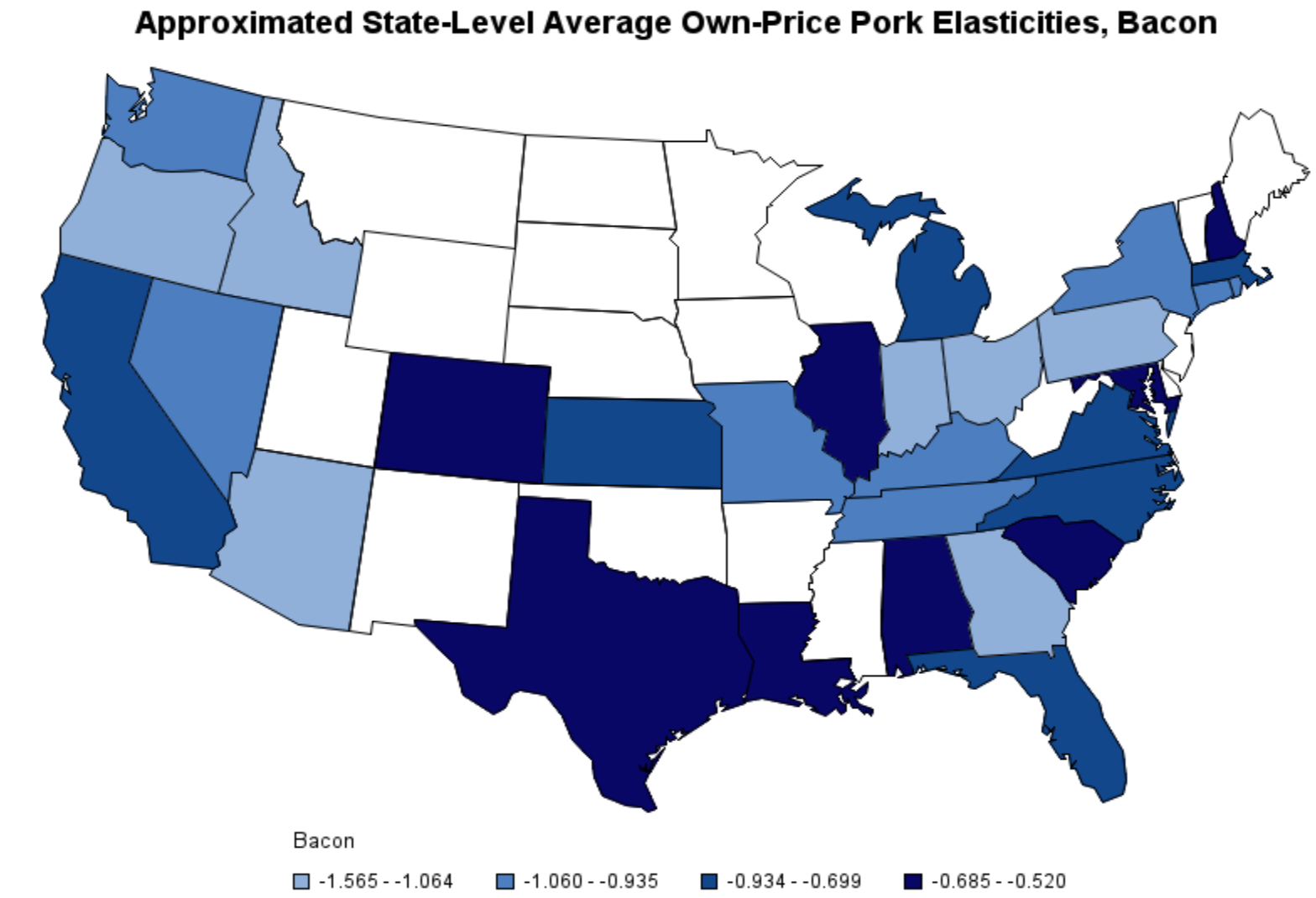
include NY and MO for instance. Conversely, there are one-fourth of the states with loin elasticities of -1.395% or larger (in absolute terms) meaning these markets (e.g. IL and GA) have volume adjustments well above price changes. In figure 11 we see the most elastic states for bacon include AZ and GA while the most inelastic states include TX and IL.

Figure 10. Loin Own-Price Elasticity Map (Jan. 2016 - Dec. 2020)



Source: Tonsor & Lusk, 2021

Figure 11. Bacon Own-Price Elasticity Map (Jan. 2016 - Dec. 2020)



Source: Tonsor & Lusk, 2021

Beyond documenting variation in sensitivity to changes in pork prices, our approach yields new insight into diversity in how beef and chicken price changes impact pork demand. Tables 8 and 9 summarize these cross-price elasticity effects. An immediate point of important context arises when comparing to results in table 5: **pork purchases are much more sensitive to pork's own-price than the price of beef or chicken**. In fact, using median estimates across markets indicates pork purchases are 5 times, and much more in several cases, as sensitive to pork prices as beef or chicken prices.

Using median estimates reveals that overall changes in beef prices have larger impacts on pork demand than changes in chicken prices. For instance, a 1% increase in beef prices boost bacon purchases by 0.445% while a 1% increase in chicken prices only increases bacon purchases by 0.131%.

There is also a full range of complement and substitute relationships across markets and products. In 15 of the 51 markets, an increase in beef price increases loin demand suggesting beef and pork loin are substitutes while in the other 36 markets an increase in beef price decreases loin demand indicating a complimentary relationship. Combined this leads to the -0.219 median estimate suggesting that a 1% increase in beef price corresponds with a 0.219% decline in loin purchases, meaning in that in most locations consumers tend to buy pork loins and beef together.

In 36 markets an increase in chicken prices increases demand for pork loin indicating chicken and pork loin are substitutes. This corresponds with the median cross-price estimate of +0.201% suggesting that a 1% increase in chicken price corresponds with a 0.201% increase in loin purchases.

Table 8. Summary Statistics on Beef Cross-Price Elasticities across 51 Markets (Jan. 2016 - Dec. 2020)

	Loin	Ribs	Shoulder	Breakfast Sausage	Dinner Sausage	Bacon	Pork
Mean	-0.195	0.579	0.398	0.694	0.277	0.493	0.362
Minimum	-1.152	-1.019	-0.935	0.070	-0.665	0.020	-0.315
1st Quartile	-0.528	0.100	-0.060	0.454	0.107	0.295	0.100
Medan	-0.219	0.497	0.339	0.581	0.301	0.445	0.247
3rd Quartile	0.064	1.119	0.718	0.908	0.447	0.606	0.691
Maximum	1.277	2.139	2.570	1.771	1.486	1.615	1.193
Count	51	51	51	51	51	51	51
Number Positive	15	39	33	51	44	51	46

Table 9. Summary Statistics on Chicken Cross-Price Elasticities across 51 Markets (Jan. 2016 - Dec. 2020)

	Loin	Ribs	Shoulder	Breakfast Sausage	Dinner Sausage	Bacon	Pork
Mean	0.241	-0.554	-0.105	0.071	0.060	0.026	-0.035
Minimum	-0.705	-2.281	-1.525	-0.927	-0.749	-0.849	-0.809
1st Quartile	-0.060	-1.180	-0.378	-0.203	-0.154	-0.300	-0.227
Medan	0.201	-0.415	-0.057	0.166	0.006	0.131	0.033
3rd Quartile	0.534	0.008	0.241	0.315	0.197	0.328	0.179
Maximum	1.279	0.716	0.878	0.555	0.957	0.897	0.634
Count	51	51	51	51	51	51	51
Number Positive	36	13	24	32	26	30	27

Chapter 4. Association of Pork Demand with Market Characteristics

In addition to IRI data on pork product prices and quantities, we obtained IRI data characterizing composition of the 51 markets evaluated here. Narrowly, using 2019 Census data IRI approximated the composition of these markets providing insight into how age, educational attainment, race, etc. vary across these markets. Given the above noted wide variation in consumer demand patterns across markets and pork products, a natural question is what market characteristics align with stronger or weaker pork demand.

We address this question by estimating a location-combined model for each evaluated pork product to gain product-specific demand insights. Specifically, we regress per capita consumption against variables included in the model above (see equation 1) and seven market-composition variables. The final model estimated is:

$$(2)\ lnPerCapitaQ = \alpha + \beta lnOwnP + \gamma lnBeefP + \delta lnChickenP + \sum_{i=1}^{11} \mu_i Month_i + \sum_{j=2016}^{2019} \rho_j Year_j + \sigma Covid + \Phi lnIncomeBelow50k + \Psi lnHSorBelow + \Omega lnChildren + \eta lnHOH56plus + \kappa lnHispanic + \pi lnAsian + \epsilon$$

where *IncomeBelow50k* is the share of residents with household income of $50,000 or less, *HSorBelow* is the share of residents with a High School degree or less, *Children* is the share of households with children present, *HOH56plus* is the share of households 56 years of age or older, *Hispanic* is the share of households that are Hispanic, and *Asian* is the share of households that are Asian. Also note, these seven added market-composition terms enter in log terms such that effects can easily be interpreted consistent with elasticity interpretation. Besides these terms, other items are defined in equation (1) or represent parameters unique to equation (2) to be estimated.

We estimate each model separately for every product yielding product-specific insights that leverage cross-sectional variation in market characteristics across the 51 evaluated markets. We omit time and market subscripts from equation (2) for presentation convenience. Our final, preferred approach applies two-stage least squares methods to avoid assuming pork product prices in a market are exogenous. As before, we utilized the weighted average price in the other 50 markets besides the one being examined along with current and up to 8 week-lagged national cutout values as instruments.

Summary statistics on the seven examined market characteristics are provided in table 10.[13] These values represent the share of market residents. For instance, consider ethnicity across the 51 markets. IRI's data indicate one market has 1.4% residents who are Asian (Toledo, OH) and another market has 24.7% of residents who are Asian (San Francisco/Oakland, CA) with an average prevalence of 4.8%. We keep all seven market characteristic variables in percentage

[13] Some of these market characteristics (e.g. income and education) are highly correlated. To further refine demand insights, in the future use of longer series with data capturing temporal variation in market characteristics or household-level, rather than market-level, data is encouraged.

terms such that when used in equation (2)'s model, results are conveniently interpreted as differences in per capita consumption for each 1% change in a given characteristic. The wide range in characteristics across markets is consistent with variation in demographics nationally.

Table 10. Market Characteristics (% of Residents), Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
Income below $50,000	39.474	6.581	21.672	51.573
High School Graduate or less	40.028	5.433	28.282	53.033
Children Present	31.966	3.251	24.034	39.424
Head of Household, 56 or older	36.792	4.239	27.497	47.300
Hispanic	11.617	10.145	2.061	45.000
African American	12.871	10.039	1.167	38.171
Asian	4.780	4.050	1.358	24.667

Table 11 shows results following product-specific models following equation 2. Here we report values indicating how a 1% increase in the share of residents for each market characteristic corresponds with percentage changes in per capita consumption. Consider the impact of ethnicity. For each 10% increase in the share of a market that is Asian (e.g., going from a market with 4% Asian to one with 4.4% Asian), per capita Pork consumption is 1.9% lower. This aggregate statement however masks variation across products as a 10% increase in Asian market prevalence corresponds with 5.3% lower Rib consumption and 27% lower Loin consumption. Stated differently, markets with larger Asian populations are more likely to be "Rib markets" than "Loin markets." Meanwhile, markets with larger African American populations are stronger pork markets with this strength most pronounced for Shoulder and Loin products.

On a broader level, the diversity in market composition (table 10) coupled with wide span in demand patterns shown in table 11 **reinforce an earlier important point**: there is notable heterogeneity in pork demand patterns across markets and products.

Table 11. Impact of Market Characteristics on Per Capita Pork Consumption (Jan. 2016 - Dec. 2020)

Variable	Loin	Ribs	Shoulder	Breakfast Sausage	Dinner Sausage	Bacon	Pork
Income below $50,000	0.025	0.852*	0.451*	2.290*	-0.753*	0.682*	0.441*
High School Graduate or less	0.317*	-0.682*	-1.285*	-2.376*	-0.085*	-0.751*	-0.421*
Children Present	-1.186*	-0.622*	0.296*	0.555*	0.181*	-0.475*	-0.453*
Head of Household, 56 or older	-0.010	0.048	1.514*	-1.888*	1.262*	-0.511*	-0.032
Hispanic	0.067*	0.168*	0.158*	-0.385*	0.048*	-0.045*	0.024*
African American	0.140*	0.104*	0.211*	0.010	0.059*	0.079*	0.103*
Asian	-0.270*	-0.053*	-0.161*	-0.180*	-0.200*	-0.259*	-0.192*

Note: * denotes statistical significance at the 0.05 level.

Chapter 5. Application of Elasticity Results: Consumer Impacts

In this chapter we include three example applications. The intent is to demonstrate the value of refined insights into pork demand across products and markets. These three examples also provide guidance on how other future users of this report may leverage included estimates.

Demographic Shift Example

Chapter 4 noted how per capita pork consumption varies over markets comprised of diverse resident populations. A natural extension of the analysis is to identify how per capita consumption may change as Hispanic origin prevalence in the U.S. changes. U.S. Census resources indicate that in 2019 18.5% of the U.S. population was Hispanic and projections indicate an increase to 21.1% in 2030. Recall table 11 indicates per capita consumption of loin, ribs, shoulder, and dinner sausage is higher in markets composed of larger Hispanic populations (as a share of total). Combined, the projected 2.6% increase in Hispanic prevalence implies projected increases of 0.17%, 0.44%, 0.41%, and 0.13% in per capita consumption loin, ribs, shoulder, and dinner sausage. Meanwhile, this increased Hispanic prevalence is expected to reduce per capita breakfast sausage and bacon consumption by 1.00% and 0.12%, respectively. In aggregate, an increase of 0.06% in per capita pork consumption follows, with this masking larger growth in ribs and declines in two categories.

Availability Shock Example

The report to this point has largely focused on estimating, documenting, and interpreting elasticities. However, sometimes analysts are more interested in how quantity changes affect prices in a market. For instance, consider production disruptions that occurred early in the COVID19 pandemic which temporarily altered the flow of products to consumers. Another example might include what might happen if a state passes a law that excludes a large volume of pork production entering, which would reduce availability to consumers. Fortunately, price flexibilities can easily be obtained to provide desired insights. A flexibility represents the percentage change in price that follows from a 1% change in quantity. Economists approximate flexibilities as the inverse of elasticities.

Consider the median bacon elasticity estimate of -0.873 in table 3. We approximate the median bacon flexibility as 1/-0.873 = -1.145 which indicates that each 1% reduction in quantity leads to a 1.145% increase in price. More broadly, if a product has elastic demand then flexibility estimates will be less than 1% (in absolute value) while inelastic products have flexibility estimates over 1% (in absolute value).

Table 6 provides elasticity estimates of -1.189, -3.170, -1.674, -2.729, -1.501, and -0.832 for loin, ribs, shoulder, breakfast sausage, dinner sausage, and bacon, respectively in the Los

Angeles, CA market. This in turn implies flexibility estimates of -0.841, -0.315, -0.597, -0.366, -0.666, and -1.202, respectively. So, a 10% reduction in available bacon (loin) would result in 12.02% (8.41%) higher bacon (loin) prices in the Los Angeles market. Similar conversion of elasticity estimates in table 6 easily follow for all products and markets providing flexibility estimates and hence insight into how retail prices change following adjustments in pork product availability.

Retail Price Increase, Consumer Welfare Example

Suppose the pork market experiences an event resulting in 1% retail price increases for all pork products. For instance, this could follow from a production cost shock such as feed costs escalating. Intuitively, when facing higher retail prices, consumers will buy a lower volume of impacted products at a higher price – clearly resulting in economic harm. We can use the elasticity estimates provided in Chapter 3 to gain market and product-specific insights into how this 1% increase in retail prices would impact consumers.

Economists use "consumer surplus" to measure consumer benefits from consuming a product or service. Roughly speaking, consumer surplus is the difference between consumer's maximum willingness to pay and the actual price paid. It is the area below a demand curve and above the market price. Here we follow Lusk and Anderson (2004), Lusk and Tonsor (2021), and Pendell et al. (2010) to estimate change in consumer surplus (in the case of no demand shock) as:

$$(3)\ \Delta CS = -P^0 Q^0 (EP)(1 + 0.5EQ)$$

where P^0 is price before the shock ($/lb), Q^0 is per capita volume before the shock (lbs/person/year), EP is the % change in price, and EQ is the % change in quantity.

Note tables 6, A6, and A8 contain the parameters needed to estimate the change in consumer surplus.[14] Table 12 presents consumer welfare declines following a 1% price increase providing estimates for the annual impact per person in each market, for each product. A 1% increase in Loin prices corresponds with a $0.15 loss for each Albany, NY resident (note: this value only includes the domestic loss coming from the sales of pork through IRI retail establishments and wouldn't include losses that might occur from restaurants or outlets not covered by the IRI data). The five most negative values are highlighted in red while the five least negative are highlighted in green. Consistent with earlier points on demand heterogeneity, the diversity in price-sensitivity, quantities consumed, and base prices paid leads to a range of impacts across markets and products. The Jacksonville, New Orleans, Roanoke, South Carolina, and Tampa markets stand out as having three or more cases of ranking in the top five largest consumer welfare losses on a per person basis.

[14] We then scale these per-person annual effects using 2019 population estimates from IRI yielding aggregate market impacts in table 13 reflecting differences in market size.

Table 12. Change in Annual Consumer Surplus from 1% Price Increase, by Market and Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	-$0.15	-$0.05	-$0.02	-$0.02	-$0.09	-$0.14	-$0.48
Atlanta, GA	-$0.10	-$0.05	-$0.02	-$0.04	-$0.03	-$0.13	-$0.37
Baltimore, MD/Washington D.C.	-$0.08	-$0.04	-$0.01	-$0.04	-$0.04	-$0.12	-$0.35
Birmingham/Montgomery, AL	-$0.11	-$0.05	-$0.02	-$0.06	-$0.02	-$0.18	-$0.47
Boise, ID	-$0.07	-$0.03	-$0.02	-$0.04	-$0.03	-$0.10	-$0.30
Boston, MA	-$0.09	-$0.04	-$0.01	-$0.01	-$0.04	-$0.08	-$0.27
Buffalo/Rochester, NY	-$0.12	-$0.04	-$0.02	-$0.02	-$0.07	-$0.13	-$0.42
Charlotte, NC	-$0.13	-$0.05	-$0.03	-$0.06	-$0.04	-$0.14	-$0.46
Chicago, IL	-$0.09	-$0.04	-$0.01	-$0.03	-$0.06	-$0.10	-$0.34
Cincinnati/Dayton, OH	-$0.13	-$0.05	-$0.02	-$0.08	-$0.03	-$0.14	-$0.46
Columbus, OH	-$0.10	-$0.05	-$0.01	-$0.05	-$0.05	-$0.12	-$0.39
Dallas/Ft. Worth, TX	-$0.10	-$0.06	-$0.02	-$0.04	-$0.03	-$0.13	-$0.40
Denver, CO	-$0.11	-$0.05	-$0.02	-$0.05	-$0.07	-$0.14	-$0.46
Detroit, MI	-$0.09	-$0.05	-$0.01	-$0.05	-$0.04	-$0.12	-$0.37
Grand Rapids, MI	-$0.11	-$0.06	-$0.03	-$0.06	-$0.05	-$0.13	-$0.44
Harrisburg/Scranton, PA	-$0.11	-$0.04	-$0.02	-$0.02	-$0.06	-$0.11	-$0.36
Hartford, CT/Springfield, MA	-$0.13	-$0.05	-$0.02	-$0.01	-$0.06	-$0.11	-$0.39
Houston, TX	-$0.08	-$0.06	-$0.02	-$0.03	-$0.03	-$0.10	-$0.33
Indianapolis, IN	-$0.13	-$0.05	-$0.02	-$0.07	-$0.04	-$0.13	-$0.45
Jacksonville, FL	-$0.14	-$0.07	-$0.04	-$0.05	-$0.04	-$0.16	-$0.51
Knoxville, TN	-$0.14	-$0.05	-$0.02	-$0.09	-$0.03	-$0.17	-$0.49
Las Vegas, NV	-$0.09	-$0.06	-$0.02	-$0.03	-$0.04	-$0.11	-$0.35
Los Angeles, CA	-$0.05	-$0.05	-$0.02	-$0.02	-$0.02	-$0.08	-$0.25
Louisville, KY	-$0.13	-$0.05	-$0.02	-$0.06	-$0.03	-$0.16	-$0.46
Miami/Ft. Lauderdale, FL	-$0.10	-$0.06	-$0.02	-$0.01	-$0.03	-$0.09	-$0.34
Nashville, TN	-$0.11	-$0.05	-$0.02	-$0.06	-$0.03	-$0.16	-$0.45
New England	-$0.13	-$0.05	-$0.02	-$0.03	-$0.06	-$0.14	-$0.42
New Orleans, LA/Mobile, AL	-$0.15	-$0.08	-$0.03	-$0.04	-$0.03	-$0.15	-$0.51
New York, NY	-$0.08	-$0.04	-$0.01	-$0.01	-$0.04	-$0.08	-$0.26
Orlando, FL	-$0.13	-$0.07	-$0.03	-$0.04	-$0.04	-$0.15	-$0.47
Peoria/Springfield, IL	-$0.14	-$0.05	-$0.03	-$0.06	-$0.05	-$0.14	-$0.48
Philadelphia, PA	-$0.11	-$0.05	-$0.02	-$0.03	-$0.06	-$0.11	-$0.38
Phoenix/Tucson, AZ	-$0.09	-$0.05	-$0.01	-$0.03	-$0.05	-$0.11	-$0.37
Pittsburgh, PA	-$0.11	-$0.04	-$0.02	-$0.05	-$0.05	-$0.11	-$0.39
Portland, OR	-$0.08	-$0.04	-$0.02	-$0.04	-$0.03	-$0.11	-$0.32
Providence, RI	-$0.09	-$0.04	-$0.01	-$0.01	-$0.05	-$0.09	-$0.30
Raleigh/Greensboro, NC	-$0.12	-$0.05	-$0.03	-$0.07	-$0.04	-$0.14	-$0.46

Richmond/Norfolk, VA	-$0.13	-$0.05	-$0.03	-$0.06	-$0.05	-$0.16	-$0.50
Roanoke, VA	-$0.14	-$0.04	-$0.02	-$0.08	-$0.03	-$0.18	-$0.49
Sacramento, CA	-$0.06	-$0.06	-$0.03	-$0.03	-$0.02	-$0.10	-$0.31
San Diego, CA	-$0.06	-$0.04	-$0.02	-$0.02	-$0.03	-$0.10	-$0.28
San Francisco/Oakland, CA	-$0.06	-$0.05	-$0.02	-$0.02	-$0.02	-$0.08	-$0.25
Seattle/Tacoma, WA	-$0.07	-$0.04	-$0.02	-$0.04	-$0.03	-$0.11	-$0.32
South Carolina	-$0.14	-$0.07	-$0.03	-$0.06	-$0.04	-$0.16	-$0.53
Spokane, WA	-$0.08	-$0.04	-$0.02	-$0.05	-$0.03	-$0.12	-$0.35
St. Louis, MO	-$0.11	-$0.05	-$0.06	-$0.06	-$0.06	-$0.15	-$0.50
Syracuse, NY	-$0.13	-$0.04	-$0.03	-$0.03	-$0.11	-$0.14	-$0.48
Tampa/St. Petersburg, FL	-$0.14	-$0.07	-$0.03	-$0.04	-$0.05	-$0.15	-$0.49
Toledo, OH	-$0.10	-$0.05	-$0.02	-$0.06	-$0.05	-$0.12	-$0.41
West Texas/New Mexico	-$0.12	-$0.07	-$0.03	-$0.05	-$0.04	-$0.17	-$0.49
Wichita, KS	-$0.13	-$0.06	-$0.03	-$0.06	-$0.04	-$0.15	-$0.48
Average	-$0.11	-$0.05	-$0.02	-$0.04	-$0.04	-$0.13	-$0.40
Minimum	-$0.15	-$0.08	-$0.06	-$0.09	-$0.11	-$0.18	-$0.53
Maximum	-$0.05	-$0.03	-$0.01	-$0.01	-$0.02	-$0.08	-$0.25

Table 13 shows values from table 12 scaled up to reflect population differences. Here we see that the most populated markets (New York, Los Angeles, Chicago, Baltimore, etc.) not surprisingly rank highly as markets experiencing large consumer welfare loss from a 1% retail price increase. It if further important to appreciate cases of lesser populated markets (e.g. South Carolina and St. Louis, MO) ranking highly in terms of consumer welfare loss reflecting table 12 values and elevated per person damages. Again, total aggregate losses from a 10% price increase are larger than those shown in table 13 because our estimates only include the domestic loss coming from the sales of pork through IRI retail establishments and wouldn't include losses that might occur from restaurants or outlets not covered by the IRI data.

To drive-home economic importance of this application, consider again the Los Angeles and Phoenix markets. Table 13 indicates a 1% retail pork price increase would result in consumer loss of $4.49 million annually in Los Angeles. Nearly one-third of this loss is in the bacon market ($1.42 million) and 21% is in the loin market ($930,840). Combined losses in the bacon and loin market comprise 52% of the consumer losses in the Los Angeles market. Meanwhile the annual loss in Phoenix is $2.06 million with 26% of this occurring in the loin market ($524,580) and 30% in the bacon market ($623,950).

Table 13. Change in Annual Consumer Surplus from 1% Price Increase ($1,000 dollars), by Product for each Market

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	-$170.69	-$55.78	-$19.69	-$24.31	-$108.39	-$162.45	-$549.24
Atlanta, GA	-$531.37	-$266.21	-$87.37	-$236.85	-$153.05	-$734.72	-$2,076.59
Baltimore, MD/Washington D.C.	-$737.31	-$324.47	-$123.35	-$361.40	-$340.71	-$1,080.16	-$3,036.27
Birmingham/Montgomery, AL	-$476.84	-$211.10	-$103.07	-$264.89	-$91.52	-$740.09	-$1,961.18
Boise, ID	-$54.31	-$25.61	-$11.42	-$30.48	-$23.01	-$72.67	-$222.01
Boston, MA	-$515.90	-$223.35	-$69.71	-$52.89	-$234.94	-$445.60	-$1,595.92
Buffalo/Rochester, NY	-$298.96	-$105.82	-$57.69	-$60.66	-$173.27	-$316.24	-$1,028.59
Charlotte, NC	-$381.45	-$150.67	-$93.32	-$179.66	-$105.61	-$435.34	-$1,379.56
Chicago, IL	-$774.55	-$407.13	-$128.33	-$316.77	-$508.73	-$911.39	-$3,081.96
Cincinnati/Dayton, OH	-$393.27	-$155.78	-$59.10	-$239.65	-$96.77	-$431.46	-$1,394.77
Columbus, OH	-$226.81	-$99.65	-$29.80	-$116.59	-$108.25	-$254.86	-$848.74
Dallas/Ft. Worth, TX	-$719.73	-$448.28	-$156.49	-$300.96	-$229.32	-$967.53	-$2,945.94
Denver, CO	-$464.59	-$234.44	-$107.19	-$202.63	-$286.58	-$619.00	-$2,004.87
Detroit, MI	-$422.94	-$254.95	-$68.15	-$249.31	-$202.58	-$567.97	-$1,786.58
Grand Rapids, MI	-$193.82	-$104.94	-$50.83	-$107.56	-$85.04	-$239.39	-$786.96
Harrisburg/Scranton, PA	-$521.31	-$163.35	-$89.07	-$105.43	-$269.75	-$490.39	-$1,667.14
Hartford, CT/Springfield, MA	-$410.16	-$151.81	-$64.02	-$39.96	-$196.39	-$366.72	-$1,261.80
Houston, TX	-$566.97	-$396.36	-$132.98	-$196.29	-$181.93	-$703.52	-$2,279.86
Indianapolis, IN	-$305.58	-$129.14	-$50.53	-$156.09	-$94.32	-$321.80	-$1,077.94
Jacksonville, FL	-$253.15	-$134.80	-$67.58	-$85.95	-$65.94	-$301.07	-$937.66
Knoxville, TN	-$154.28	-$55.08	-$18.38	-$98.25	-$29.69	-$191.69	-$557.48
Las Vegas, NV	-$194.80	-$134.20	-$33.88	-$73.20	-$83.81	-$239.31	-$782.66
Los Angeles, CA	-$930.84	-$837.82	-$319.02	-$347.51	-$431.16	-$1,422.93	-$4,492.66
Louisville, KY	-$174.26	-$67.16	-$23.89	-$77.87	-$39.12	-$212.23	-$603.64
Miami/Ft. Lauderdale, FL	-$624.76	-$394.08	-$134.40	-$85.02	-$201.56	-$567.23	-$2,129.77
Nashville, TN	-$235.74	-$97.45	-$41.56	-$123.39	-$61.98	-$334.63	-$920.71
New England	-$444.54	-$160.56	-$58.68	-$85.84	-$188.98	-$464.89	-$1,436.38
New Orleans, LA/Mobile, AL	-$475.91	-$246.86	-$101.80	-$133.76	-$105.79	-$467.14	-$1,607.40
New York, NY	-$1,507.80	-$715.16	-$225.84	-$123.60	-$870.28	-$1,494.88	-$5,066.50
Orlando, FL	-$509.80	-$248.76	-$115.88	-$137.57	-$160.61	-$551.54	-$1,769.38
Peoria/Springfield, IL	-$265.44	-$106.24	-$63.53	-$118.91	-$104.22	-$266.28	-$945.45
Philadelphia, PA	-$727.27	-$310.53	-$100.35	-$215.56	-$388.15	-$731.09	-$2,514.73
Phoenix/Tucson, AZ	-$524.58	-$305.01	-$81.88	-$176.36	-$273.50	-$623.95	-$2,055.49

Pittsburgh, PA	-$277.31	-$102.04	-$43.79	-$128.93	-$130.83	-$277.29	-$972.30
Portland, OR	-$282.11	-$130.47	-$56.66	-$126.08	-$112.59	-$397.10	-$1,124.08
Providence, RI	-$96.14	-$39.71	-$11.63	-$12.56	-$53.53	-$96.81	-$316.60
Raleigh/Greensboro, NC	-$461.85	-$185.86	-$97.25	-$251.18	-$132.02	-$541.34	-$1,712.65
Richmond/Norfolk, VA	-$397.98	-$161.26	-$81.05	-$186.66	-$136.12	-$490.08	-$1,490.99
Roanoke, VA	-$330.03	-$103.71	-$48.79	-$186.82	-$60.66	-$418.68	-$1,167.99
Sacramento, CA	-$198.76	-$174.39	-$80.90	-$88.35	-$75.87	-$307.80	-$954.33
San Diego, CA	-$185.10	-$146.72	-$63.48	-$75.21	-$103.39	-$322.25	-$928.89
San Francisco/Oakland, CA	-$394.17	-$304.04	-$147.22	-$111.92	-$145.54	-$544.97	-$1,689.96
Seattle/Tacoma, WA	-$288.94	-$164.06	-$76.07	-$151.04	-$134.99	-$428.11	-$1,286.53
South Carolina	-$821.95	-$380.77	-$188.11	-$366.82	-$206.07	-$903.50	-$2,978.28
Spokane, WA	-$52.63	-$30.64	-$12.95	-$37.62	-$21.84	-$80.19	-$239.98
St. Louis, MO	-$297.07	-$128.08	-$166.74	-$160.07	-$157.84	-$395.39	-$1,321.93
Syracuse, NY	-$152.97	-$51.13	-$29.81	-$29.18	-$123.29	-$155.93	-$551.96
Tampa/St. Petersburg, FL	-$562.47	-$280.78	-$138.98	-$151.82	-$190.96	-$597.59	-$1,977.28
Toledo, OH	-$209.41	-$99.02	-$33.20	-$126.30	-$104.30	-$238.49	-$818.64
West Texas/New Mexico	-$499.43	-$297.55	-$117.09	-$194.69	-$167.66	-$693.47	-$2,040.20
Wichita, KS	-$108.99	-$50.60	-$25.42	-$50.63	-$33.03	-$125.13	-$401.25
Average	-$407.98	-$206.93	-$84.47	-$148.26	-$168.34	-$485.18	-$1,544.70
Minimum	-$1,507.80	-$837.82	-$319.02	-$366.82	-$870.28	-$1,494.88	-$5,066.50
Maximum	-$52.63	-$25.61	-$11.42	-$12.56	-$21.84	-$72.67	-$222.01

Chapter 6. Implications and Discussion

A key point to appreciating importance of elasticity estimates is how total consumer expenditures, and with it seller revenues, are impacted by price changes. If a good's demand is elastic, then price and consumer expenditures move in opposite direction. Conversely if a product's demand is inelastic, then price and consumer expenditures move in the same direction.

As a simple illustration, things that reduce pork prices (e.g. reduced feed costs, gains in efficiencies, etc.) will result in lower consumer expenditures and seller revenues in markets where demand is inelastic. As shown in table 5 the median estimates for bacon (-0.873) reflect inelastic demand while median estimates for breakfast sausage (-3.294) reflect elastic demand. Accordingly, consumer expenditures in a "typical" market would increase following a bacon price increase and decrease following a breakfast sausage price increase. Perhaps of most importance, even this example using median values masks important heterogeneity. In the case of loin, ribs, shoulder, and bacon across the 51 markets demand spans from being elastic to inelastic such that price increases result in higher consumer expenditures in some markets and lower in others. Conversely, for breakfast and dinner sausage demand is estimated to be elastic in all 51 markets indicating consumer expenditure change will be in the opposite direction of any price change. The application examples in the previous section provide specific demonstrations of this but the broader point should be kept in mind as future users reference this report.

Chapter 7. References

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Appendix

This appendix includes multiple tables and figures designed to further document project details.

Table A1. Contents of Meat Aggregate Categories

Beef	*Chicken*	*Pork*
Brisket	Backs & Necks	Loin
Chuck	Breast	Leg (Fresh Ham)
Flank	Combo Packs	Offal
Ingredient Cuts	Giblets	Ribs
Loin	Ingredient Cuts	Shoulder
Offal	Legs	Ground Pork
Plate	Offal	Ingredient Cuts
Ribeye	Thighs	Breakfast Sausage
Ribs	Whole Bird	Dinner Sausage
Round	Wings	Bacon
Shank	Game Hen	All Other Pork
Sirloin	Ground Chicken	
Ground Beef	All Other Chicken	
All Other Beef		

Table A2. Average Volume Shares of Pork Products (Jan. 2016 - Dec. 2020), by Market

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*All Other Pork*
Albany, NY	35.9%	12.7%	6.8%	3.9%	18.6%	19.9%	2.1%
Atlanta, GA	26.5%	15.9%	6.9%	12.7%	7.8%	25.2%	4.9%
Baltimore, MD/Washington D.C.	27.4%	13.8%	8.4%	11.3%	11.5%	24.4%	3.3%
Birmingham/Montgomery, AL	23.9%	13.3%	9.1%	15.7%	4.8%	27.5%	5.8%
Boise, ID	27.1%	14.0%	7.8%	13.8%	10.6%	23.7%	3.1%
Boston, MA	35.9%	18.8%	8.5%	2.7%	13.5%	16.3%	4.3%
Buffalo/Rochester, NY	31.5%	12.0%	10.7%	5.3%	16.3%	21.4%	2.8%
Charlotte, NC	28.4%	13.0%	13.1%	12.7%	7.5%	21.5%	3.9%
Chicago, IL	26.6%	15.3%	7.1%	9.6%	17.7%	20.3%	3.4%
Cincinnati/Dayton, OH	31.9%	13.8%	5.7%	17.0%	7.3%	21.6%	2.6%
Columbus, OH	29.4%	14.3%	5.4%	13.9%	13.3%	20.8%	2.9%
Dallas/Ft. Worth, TX	26.0%	19.5%	9.2%	10.1%	7.4%	20.7%	7.2%
Denver, CO	24.5%	14.9%	8.7%	10.3%	15.0%	21.0%	5.7%
Detroit, MI	26.6%	17.8%	6.0%	13.3%	12.6%	21.2%	2.5%
Grand Rapids, MI	28.0%	16.4%	9.4%	12.9%	10.9%	19.8%	2.6%
Harrisburg/Scranton, PA	34.8%	11.5%	9.6%	5.3%	16.7%	19.8%	2.4%
Hartford, CT/Springfield, MA	36.0%	14.4%	10.5%	2.7%	14.7%	18.0%	3.8%
Houston, TX	26.3%	21.7%	10.2%	7.8%	7.3%	18.4%	8.2%
Indianapolis, IN	31.0%	14.6%	7.0%	15.2%	8.9%	20.1%	3.2%
Jacksonville, FL	26.9%	17.9%	12.4%	9.4%	7.0%	21.6%	4.9%
Knoxville, TN	30.7%	11.2%	5.7%	20.6%	5.4%	23.9%	2.6%
Las Vegas, NV	28.6%	20.4%	6.6%	8.8%	11.7%	19.9%	4.0%
Los Angeles, CA	21.8%	22.5%	13.0%	7.3%	9.0%	18.5%	8.0%
Louisville, KY	31.7%	14.1%	6.4%	13.6%	6.7%	24.7%	2.8%
Miami/Ft. Lauderdale, FL	29.5%	22.4%	12.2%	3.8%	8.1%	15.8%	8.3%
Nashville, TN	26.4%	13.0%	7.9%	15.2%	7.1%	25.9%	4.6%
New England	36.2%	15.7%	7.8%	5.1%	12.3%	20.1%	2.8%
New Orleans, LA/Mobile, AL	30.4%	18.1%	11.0%	8.5%	6.0%	19.7%	6.2%
New York, NY	34.6%	15.5%	9.7%	1.9%	16.8%	17.1%	4.4%
Orlando, FL	29.3%	17.8%	11.3%	8.0%	9.1%	20.8%	3.7%
Peoria/Springfield, IL	30.4%	13.8%	10.7%	12.2%	10.9%	18.8%	3.1%
Philadelphia, PA	32.3%	13.8%	7.9%	7.6%	15.8%	19.5%	3.1%
Phoenix/Tucson, AZ	28.5%	18.7%	5.9%	8.3%	14.2%	19.3%	5.0%
Pittsburgh, PA	30.0%	12.9%	6.8%	11.8%	13.6%	22.1%	2.8%
Portland, OR	28.1%	14.3%	7.2%	11.1%	10.6%	25.5%	3.2%
Providence, RI	34.1%	17.7%	7.3%	3.2%	16.4%	18.2%	3.2%
Raleigh/Greensboro, NC	28.3%	13.2%	11.1%	14.1%	7.7%	21.9%	3.6%
Richmond/Norfolk, VA	28.1%	13.0%	10.5%	12.9%	9.1%	22.7%	3.7%
Roanoke, VA	30.9%	10.4%	7.9%	17.3%	5.3%	25.8%	2.4%

Sacramento, CA	22.6%	22.9%	14.5%	8.3%	7.3%	19.3%	5.0%
San Diego, CA	22.1%	20.0%	12.9%	7.5%	10.5%	20.3%	6.7%
San Francisco/Oakland, CA	25.5%	23.0%	15.2%	5.7%	7.6%	18.0%	5.1%
Seattle/Tacoma, WA	24.8%	16.4%	9.5%	11.2%	10.6%	23.0%	4.4%
South Carolina	27.8%	15.2%	11.5%	12.5%	6.7%	20.6%	5.8%
Spokane, WA	24.0%	16.2%	8.6%	15.1%	9.2%	24.2%	2.7%
St. Louis, MO	21.9%	11.9%	20.2%	11.2%	11.8%	19.5%	3.5%
Syracuse, NY	31.4%	11.2%	9.8%	4.7%	21.0%	19.6%	2.3%
Tampa/St. Petersburg, FL	28.6%	17.6%	12.3%	7.8%	9.6%	19.9%	4.1%
Toledo, OH	29.0%	14.9%	6.1%	15.1%	12.6%	20.1%	2.1%
West Texas/New Mexico	27.5%	17.4%	9.2%	9.1%	8.5%	23.5%	4.8%
Wichita, KS	29.2%	15.0%	10.4%	12.9%	8.5%	21.4%	2.6%
Average	28.8%	15.8%	9.4%	10.2%	10.8%	21.0%	4.0%
Minimum	21.8%	10.4%	5.4%	1.9%	4.8%	15.8%	2.1%
Maximum	36.2%	23.0%	20.2%	20.6%	21.0%	27.5%	8.3%

Table A3. Average Expenditure Shares of Pork Products (Jan. 2016 - Dec. 2020), by Market

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*All Other Pork*
Albany, NY	30.7%	10.2%	3.5%	4.4%	19.8%	29.4%	2.0%
Atlanta, GA	25.5%	12.8%	4.2%	11.5%	7.4%	35.2%	3.4%
Baltimore, MD/Washington D.C.	24.1%	10.6%	4.0%	11.9%	11.3%	35.5%	2.6%
Birmingham/Montgomery, AL	24.3%	10.8%	5.1%	13.6%	4.7%	37.6%	3.9%
Boise, ID	23.9%	11.4%	5.0%	13.8%	10.4%	32.7%	2.9%
Boston, MA	32.1%	13.9%	4.3%	3.3%	14.7%	27.9%	3.8%
Buffalo/Rochester, NY	28.8%	10.3%	5.5%	5.9%	16.9%	30.3%	2.3%
Charlotte, NC	27.5%	10.9%	6.4%	13.1%	7.7%	31.4%	3.0%
Chicago, IL	24.6%	12.9%	3.7%	10.3%	16.2%	29.4%	2.9%
Cincinnati/Dayton, OH	27.9%	11.1%	3.8%	17.3%	7.0%	30.9%	2.0%
Columbus, OH	26.3%	11.7%	3.3%	13.8%	12.7%	29.9%	2.2%
Dallas/Ft. Worth, TX	24.3%	14.9%	5.1%	10.3%	7.8%	32.8%	4.7%
Denver, CO	23.0%	11.5%	5.2%	10.2%	14.4%	30.7%	5.0%
Detroit, MI	23.2%	14.2%	3.4%	14.1%	11.4%	31.7%	2.0%
Grand Rapids, MI	23.9%	13.2%	5.9%	13.8%	10.7%	30.3%	2.3%
Harrisburg/Scranton, PA	30.7%	9.8%	5.3%	6.4%	16.2%	29.4%	2.2%
Hartford, CT/Springfield, MA	32.2%	12.0%	5.0%	3.1%	15.5%	28.8%	3.3%
Houston, TX	24.6%	16.9%	5.4%	8.7%	8.1%	30.8%	5.4%
Indianapolis, IN	28.0%	11.9%	4.4%	14.8%	8.8%	29.8%	2.3%
Jacksonville, FL	27.0%	14.3%	7.0%	9.2%	7.0%	31.9%	3.6%
Knoxville, TN	27.3%	9.8%	3.3%	17.6%	5.4%	34.3%	2.3%
Las Vegas, NV	24.5%	16.9%	4.2%	9.4%	10.9%	30.5%	3.5%
Los Angeles, CA	20.5%	18.5%	6.7%	7.7%	9.6%	31.6%	5.5%
Louisville, KY	28.5%	11.1%	3.8%	13.0%	6.5%	35.1%	2.1%
Miami/Ft. Lauderdale, FL	29.3%	18.4%	6.0%	4.0%	9.5%	26.5%	6.2%
Nashville, TN	25.5%	10.6%	4.4%	13.6%	6.8%	36.3%	2.8%
New England	30.5%	11.1%	3.8%	6.0%	13.2%	32.4%	3.1%
New Orleans, LA/Mobile, AL	29.5%	15.3%	5.9%	8.4%	6.6%	29.0%	5.3%
New York, NY	29.4%	14.1%	4.3%	2.4%	17.1%	29.3%	3.4%
Orlando, FL	28.8%	14.0%	6.4%	7.8%	9.1%	30.9%	3.0%
Peoria/Springfield, IL	27.9%	11.3%	6.4%	12.7%	11.1%	28.2%	2.4%
Philadelphia, PA	28.5%	12.4%	3.9%	8.6%	15.3%	28.9%	2.3%
Phoenix/Tucson, AZ	25.1%	14.4%	3.9%	8.7%	13.6%	30.4%	3.9%
Pittsburgh, PA	27.3%	10.5%	4.4%	13.4%	13.5%	28.5%	2.4%
Portland, OR	24.6%	11.3%	4.8%	11.2%	10.1%	34.8%	3.1%
Providence, RI	29.7%	12.4%	3.6%	4.0%	16.7%	30.6%	3.0%
Raleigh/Greensboro, NC	26.8%	10.8%	5.5%	14.9%	7.7%	31.5%	2.8%
Richmond/Norfolk, VA	26.5%	10.8%	5.2%	12.6%	9.2%	32.7%	3.0%
Roanoke, VA	28.0%	8.9%	4.1%	16.1%	5.2%	35.7%	2.0%

Sacramento, CA	20.5%	18.1%	8.0%	9.3%	8.0%	32.2%	3.9%
San Diego, CA	19.6%	15.6%	6.4%	8.1%	11.2%	34.6%	4.5%
San Francisco/Oakland, CA	22.4%	17.5%	8.0%	6.6%	8.6%	32.2%	4.6%
Seattle/Tacoma, WA	22.3%	12.6%	5.7%	11.8%	10.5%	33.3%	3.9%
South Carolina	27.4%	12.7%	6.1%	12.4%	6.9%	30.2%	4.2%
Spokane, WA	21.7%	12.5%	5.2%	15.7%	9.1%	33.4%	2.5%
St. Louis, MO	22.2%	9.7%	11.7%	12.3%	12.0%	29.9%	2.2%
Syracuse, NY	27.4%	9.3%	5.3%	5.3%	22.5%	28.1%	2.1%
Tampa/St. Petersburg, FL	28.4%	14.1%	6.8%	7.7%	9.6%	30.0%	3.3%
Toledo, OH	25.1%	12.0%	3.8%	15.5%	12.7%	29.1%	1.7%
West Texas/New Mexico	24.3%	14.3%	5.5%	9.6%	8.3%	33.8%	4.3%
Wichita, KS	26.7%	12.5%	6.2%	12.8%	8.3%	31.2%	2.3%
Average	26.3%	12.7%	5.2%	10.4%	10.9%	31.4%	3.2%
Minimum	19.6%	8.9%	3.3%	2.4%	4.7%	26.5%	1.7%
Maximum	32.2%	18.5%	11.7%	17.6%	22.5%	37.6%	6.2%

Table A4. Total Volume Ranking of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*
Albany, NY	45	45	47	50	37	46
Atlanta, GA	16	16	25	7	21	9
Baltimore, MD/Washington D.C.	7	9	9	4	5	3
Birmingham/Montgomery, AL	24	20	19	6	40	7
Boise, ID	50	51	51	48	50	51
Boston, MA	12	15	22	45	11	29
Buffalo/Rochester, NY	31	42	33	44	20	34
Charlotte, NC	27	30	16	18	33	24
Chicago, IL	5	5	11	5	2	5
Cincinnati/Dayton, OH	23	24	35	8	34	22
Columbus, OH	36	40	44	28	28	40
Dallas/Ft. Worth, TX	4	3	4	3	9	4
Denver, CO	20	18	18	13	7	13
Detroit, MI	18	13	31	9	10	14
Grand Rapids, MI	41	37	37	31	41	43
Harrisburg/Scranton, PA	10	26	20	34	8	18
Hartford, CT/Springfield, MA	22	28	24	46	14	31
Houston, TX	8	4	6	11	13	10
Indianapolis, IN	29	33	36	19	36	33
Jacksonville, FL	38	34	30	37	45	37
Knoxville, TN	46	47	48	30	49	45
Las Vegas, NV	40	31	41	41	39	42
Los Angeles, CA	2	1	1	2	3	1
Louisville, KY	44	44	46	36	47	44
Miami/Ft. Lauderdale, FL	13	7	8	39	19	21
Nashville, TN	39	41	39	23	43	32
New England	14	21	28	40	16	25
New Orleans, LA/Mobile, AL	17	17	17	22	38	20
New York, NY	1	2	2	33	1	2
Orlando, FL	21	19	15	24	22	19
Peoria/Springfield, IL	32	36	32	27	31	38
Philadelphia, PA	6	12	12	16	4	11
Phoenix/Tucson, AZ	9	8	26	17	6	12
Pittsburgh, PA	35	43	40	32	27	36
Portland, OR	33	35	38	29	29	28
Providence, RI	49	49	49	51	46	49
Raleigh/Greensboro, NC	19	22	14	10	24	15
Richmond/Norfolk, VA	25	25	21	15	23	17
Roanoke, VA	28	39	34	12	44	23

Sacramento, CA	42	23	23	38	42	39
San Diego, CA	43	27	27	42	35	35
San Francisco/Oakland, CA	26	11	7	35	26	26
Seattle/Tacoma, WA	34	29	29	25	25	30
South Carolina	3	6	3	1	12	6
Spokane, WA	51	50	50	47	51	50
St. Louis, MO	30	32	5	20	18	27
Syracuse, NY	47	48	43	49	30	47
Tampa/St. Petersburg, FL	15	14	10	21	17	16
Toledo, OH	37	38	42	26	32	41
West Texas/New Mexico	11	10	13	14	15	8
Wichita, KS	48	46	45	43	48	48

Table A5. Total Expenditure Ranking of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*
Albany, NY	45	45	47	50	30	46
Atlanta, GA	11	14	21	10	22	8
Baltimore, MD/Washington D.C.	5	8	10	2	5	3
Birmingham/Montgomery, AL	17	20	15	6	39	7
Boise, ID	50	51	51	48	50	51
Boston, MA	15	19	26	44	9	24
Buffalo/Rochester, NY	30	37	32	43	18	35
Charlotte, NC	26	29	19	17	32	25
Chicago, IL	4	4	11	4	2	5
Cincinnati/Dayton, OH	25	27	35	9	37	26
Columbus, OH	38	41	44	31	31	40
Dallas/Ft. Worth, TX	7	3	5	5	10	4
Denver, CO	19	18	14	12	6	13
Detroit, MI	22	15	30	8	12	15
Grand Rapids, MI	42	39	38	33	41	43
Harrisburg/Scranton, PA	14	23	20	34	8	20
Hartford, CT/Springfield, MA	23	28	28	46	14	31
Houston, TX	10	6	9	13	17	10
Indianapolis, IN	29	33	36	20	38	34
Jacksonville, FL	36	31	27	37	43	37
Knoxville, TN	46	46	48	35	49	45
Las Vegas, NV	41	32	41	42	40	41
Los Angeles, CA	2	1	1	3	3	2
Louisville, KY	44	44	46	40	47	44
Miami/Ft. Lauderdale, FL	8	5	8	39	13	16
Nashville, TN	37	43	40	28	44	32
New England	21	26	33	38	16	23
New Orleans, LA/Mobile, AL	18	17	17	24	33	22
New York, NY	1	2	2	30	1	1
Orlando, FL	13	16	12	23	20	17
Peoria/Springfield, IL	35	36	29	29	34	39
Philadelphia, PA	6	9	16	11	4	9
Phoenix/Tucson, AZ	12	10	22	18	7	12
Pittsburgh, PA	34	40	39	25	27	38
Portland, OR	33	35	34	27	29	30
Providence, RI	49	49	50	51	46	49
Raleigh/Greensboro, NC	20	21	18	7	26	19
Richmond/Norfolk, VA	24	25	23	15	24	21
Roanoke, VA	28	38	37	16	45	28

Sacramento, CA	40	22	24	36	42	36
San Diego, CA	43	30	31	41	36	33
San Francisco/Oakland, CA	27	11	7	32	23	18
Seattle/Tacoma, WA	32	24	25	22	25	27
South Carolina	3	7	3	1	11	6
Spokane, WA	51	50	49	47	51	50
St. Louis, MO	31	34	4	19	21	29
Syracuse, NY	47	47	43	49	28	47
Tampa/St. Petersburg, FL	9	13	6	21	15	14
Toledo, OH	39	42	42	26	35	42
West Texas/New Mexico	16	12	13	14	19	11
Wichita, KS	48	48	45	45	48	48

Table A6. Average Price of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	$2.99	$2.78	$1.84	$3.95	$3.70	$5.13	$3.46
Atlanta, GA	$3.49	$2.94	$2.20	$3.31	$3.46	$5.06	$3.62
Baltimore, MD/Washington D.C.	$3.25	$2.84	$1.79	$3.87	$3.61	$5.34	$3.66
Birmingham/Montgomery, AL	$3.65	$2.94	$2.09	$3.11	$3.51	$4.90	$3.59
Boise, ID	$3.19	$2.93	$2.34	$3.55	$3.49	$4.89	$3.54
Boston, MA	$2.95	$2.44	$1.68	$4.12	$3.57	$5.62	$3.27
Buffalo/Rochester, NY	$3.34	$3.12	$1.90	$4.10	$3.77	$5.22	$3.63
Charlotte, NC	$3.26	$2.83	$1.76	$3.48	$3.45	$4.92	$3.36
Chicago, IL	$3.22	$2.95	$1.99	$3.67	$3.20	$4.92	$3.41
Cincinnati/Dayton, OH	$2.94	$2.70	$2.44	$3.38	$3.18	$4.76	$3.32
Columbus, OH	$3.10	$2.81	$2.20	$3.41	$3.30	$4.90	$3.41
Dallas/Ft. Worth, TX	$2.94	$2.45	$1.81	$3.22	$3.32	$4.96	$3.13
Denver, CO	$3.32	$2.78	$2.16	$3.49	$3.38	$5.17	$3.52
Detroit, MI	$2.99	$2.70	$2.13	$3.57	$3.07	$5.03	$3.36
Grand Rapids, MI	$2.89	$2.66	$2.25	$3.52	$3.28	$5.02	$3.27
Harrisburg/Scranton, PA	$2.98	$2.83	$1.84	$3.97	$3.22	$4.92	$3.31
Hartford, CT/Springfield, MA	$2.95	$2.73	$1.59	$3.97	$3.49	$5.29	$3.27
Houston, TX	$2.74	$2.34	$1.66	$3.24	$3.18	$4.86	$2.91
Indianapolis, IN	$2.98	$2.68	$2.17	$3.17	$3.23	$4.85	$3.26
Jacksonville, FL	$3.65	$2.95	$2.13	$3.59	$3.69	$5.40	$3.65
Knoxville, TN	$3.09	$3.04	$1.99	$2.96	$3.40	$4.93	$3.42
Las Vegas, NV	$2.82	$2.76	$2.12	$3.47	$3.06	$4.96	$3.25
Los Angeles, CA	$2.96	$2.61	$1.70	$3.33	$3.35	$5.34	$3.13
Louisville, KY	$2.94	$2.56	$1.98	$3.11	$3.16	$4.59	$3.23
Miami/Ft. Lauderdale, FL	$3.63	$3.04	$1.89	$3.91	$4.31	$6.15	$3.66
Nashville, TN	$3.40	$2.88	$2.00	$3.15	$3.34	$4.91	$3.50
New England	$2.85	$2.38	$1.76	$3.94	$3.58	$5.36	$3.33
New Orleans, LA/Mobile, AL	$3.30	$2.88	$1.96	$3.35	$3.68	$4.95	$3.38
New York, NY	$2.83	$3.01	$1.53	$4.22	$3.40	$5.70	$3.30
Orlando, FL	$3.66	$2.96	$2.17	$3.65	$3.72	$5.57	$3.73
Peoria/Springfield, IL	$2.97	$2.64	$2.02	$3.35	$3.28	$4.80	$3.21
Philadelphia, PA	$3.03	$3.05	$1.72	$3.84	$3.33	$5.07	$3.40
Phoenix/Tucson, AZ	$2.75	$2.47	$2.07	$3.26	$2.96	$4.87	$3.09
Pittsburgh, PA	$3.63	$3.10	$2.51	$4.29	$3.77	$4.89	$3.81
Portland, OR	$3.24	$2.97	$2.54	$3.70	$3.46	$5.03	$3.63
Providence, RI	$2.92	$2.33	$1.65	$4.14	$3.39	$5.49	$3.27
Raleigh/Greensboro, NC	$3.26	$2.83	$1.78	$3.61	$3.44	$4.94	$3.43
Richmond/Norfolk, VA	$3.16	$2.80	$1.75	$3.28	$3.37	$4.82	$3.34
Roanoke, VA	$3.06	$2.89	$1.79	$3.12	$3.30	$4.64	$3.35

Sacramento, CA	$3.15	$2.75	$2.00	$3.86	$3.73	$5.71	$3.43
San Diego, CA	$2.96	$2.62	$1.73	$3.56	$3.47	$5.59	$3.28
San Francisco/Oakland, CA	$3.30	$2.84	$2.07	$4.24	$4.15	$6.46	$3.61
Seattle/Tacoma, WA	$3.46	$3.00	$2.38	$4.02	$3.80	$5.51	$3.81
South Carolina	$3.35	$2.86	$1.88	$3.37	$3.50	$4.97	$3.39
Spokane, WA	$3.27	$2.85	$2.27	$3.74	$3.55	$4.95	$3.58
St. Louis, MO	$3.30	$2.65	$2.03	$3.53	$3.32	$4.95	$3.26
Syracuse, NY	$3.12	$2.93	$1.94	$4.05	$3.79	$5.11	$3.54
Tampa/St. Petersburg, FL	$3.68	$3.00	$2.13	$3.68	$3.73	$5.60	$3.71
Toledo, OH	$2.89	$2.67	$2.16	$3.37	$3.34	$4.73	$3.27
West Texas/New Mexico	$2.85	$2.70	$2.00	$3.37	$3.12	$4.61	$3.20
Wichita, KS	$2.90	$2.65	$1.91	$3.09	$3.08	$4.56	$3.13

Table A7. Average Price Ranking of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*
Albany, NY	30	29	35	11	10	18
Atlanta, GA	7	13	9	40	23	21
Baltimore, MD/Washington D.C.	19	22	38	14	13	13
Birmingham/Montgomery, AL	4	14	18	48	17	38
Boise, ID	22	15	5	26	20	40
Boston, MA	38	48	47	5	15	5
Buffalo/Rochester, NY	11	1	32	6	6	16
Charlotte, NC	17	24	42	30	24	34
Chicago, IL	21	12	26	20	43	33
Cincinnati/Dayton, OH	41	34	3	33	44	46
Columbus, OH	26	27	8	32	37	37
Dallas/Ft. Worth, TX	39	47	37	44	35	26
Denver, CO	12	30	12	29	29	17
Detroit, MI	31	35	15	24	49	22
Grand Rapids, MI	45	39	7	28	39	24
Harrisburg/Scranton, PA	33	25	36	10	42	35
Hartford, CT/Springfield, MA	37	33	50	9	19	15
Houston, TX	51	50	48	43	45	42
Indianapolis, IN	32	37	10	45	41	43
Jacksonville, FL	3	11	16	23	11	11
Knoxville, TN	27	4	27	51	27	32
Las Vegas, NV	49	31	17	31	50	27
Los Angeles, CA	36	44	46	39	31	14
Louisville, KY	40	45	28	49	46	50
Miami/Ft. Lauderdale, FL	5	5	33	13	1	2
Nashville, TN	9	19	24	46	32	36
New England	46	49	41	12	14	12

New Orleans, LA/Mobile, AL	15	18	29	38	12	29
New York, NY	48	6	51	3	26	4
Orlando, FL	2	10	11	21	9	8
Peoria/Springfield, IL	34	42	22	37	40	45
Philadelphia, PA	29	3	45	16	34	20
Phoenix/Tucson, AZ	50	46	19	42	51	41
Pittsburgh, PA	6	2	2	1	5	39
Portland, OR	20	9	1	18	22	23
Providence, RI	42	51	49	4	28	10
Raleigh/Greensboro, NC	18	26	40	22	25	31
Richmond/Norfolk, VA	23	28	43	41	30	44
Roanoke, VA	28	17	39	47	38	48
Sacramento, CA	24	32	23	15	8	3
San Diego, CA	35	43	44	25	21	7
San Francisco/Oakland, CA	14	23	20	2	2	1
Seattle/Tacoma, WA	8	7	4	8	3	9
South Carolina	10	20	34	36	18	25
Spokane, WA	16	21	6	17	16	30
St. Louis, MO	13	40	21	27	36	28
Syracuse, NY	25	16	30	7	4	19
Tampa/St. Petersburg, FL	1	8	14	19	7	6
Toledo, OH	44	38	13	34	33	47
West Texas/New Mexico	47	36	25	35	47	49
Wichita, KS	43	41	31	50	48	51

Table A8. Average Annual Per Capita Volume (lbs) of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*	*Pork*
Albany, NY	5.002	1.768	0.943	0.548	2.590	2.774	13.917
Atlanta, GA	2.756	1.654	0.718	1.317	0.807	2.620	10.383
Baltimore, MD/Washington D.C.	2.598	1.311	0.793	1.073	1.088	2.313	9.489
Birmingham/Montgomery, AL	3.127	1.738	1.186	2.058	0.628	3.607	13.098
Boise, ID	2.314	1.199	0.666	1.180	0.907	2.028	8.555
Boston, MA	2.999	1.573	0.713	0.223	1.129	1.358	8.352
Buffalo/Rochester, NY	3.654	1.387	1.236	0.613	1.889	2.483	11.590
Charlotte, NC	3.898	1.789	1.792	1.745	1.027	2.946	13.729
Chicago, IL	2.686	1.546	0.719	0.970	1.783	2.052	10.096
Cincinnati/Dayton, OH	4.410	1.906	0.793	2.353	1.009	2.975	13.803
Columbus, OH	3.356	1.636	0.620	1.583	1.516	2.377	11.417
Dallas/Ft. Worth, TX	3.316	2.488	1.170	1.289	0.940	2.637	12.757
Denver, CO	3.242	1.979	1.153	1.358	1.982	2.775	13.237
Detroit, MI	2.923	1.959	0.659	1.462	1.382	2.324	10.978
Grand Rapids, MI	3.810	2.231	1.277	1.753	1.478	2.691	13.592
Harrisburg/Scranton, PA	3.852	1.270	1.067	0.587	1.848	2.189	11.076
Hartford, CT/Springfield, MA	4.298	1.722	1.248	0.316	1.748	2.143	11.929
Houston, TX	2.969	2.451	1.153	0.883	0.826	2.071	11.272
Indianapolis, IN	4.322	2.038	0.983	2.121	1.248	2.799	13.957
Jacksonville, FL	3.799	2.517	1.752	1.320	0.981	3.043	14.103
Knoxville, TN	4.447	1.628	0.825	2.981	0.784	3.459	14.504
Las Vegas, NV	3.086	2.202	0.711	0.954	1.257	2.151	10.790
Los Angeles, CA	1.764	1.817	1.053	0.591	0.724	1.492	8.085
Louisville, KY	4.524	2.018	0.921	1.935	0.952	3.532	14.281
Miami/Ft. Lauderdale, FL	2.794	2.118	1.156	0.357	0.764	1.495	9.466
Nashville, TN	3.380	1.667	1.015	1.947	0.912	3.317	12.824
New England	4.600	1.991	0.987	0.649	1.561	2.553	12.691
New Orleans, LA/Mobile, AL	4.665	2.773	1.680	1.304	0.926	3.023	15.321
New York, NY	2.710	1.217	0.757	0.151	1.313	1.336	7.832
Orlando, FL	3.703	2.252	1.430	1.012	1.154	2.631	12.648
Peoria/Springfield, IL	4.589	2.082	1.617	1.844	1.651	2.844	15.098
Philadelphia, PA	3.611	1.544	0.885	0.853	1.766	2.176	11.185
Phoenix/Tucson, AZ	3.430	2.249	0.712	0.997	1.709	2.319	12.016
Pittsburgh, PA	3.117	1.344	0.710	1.225	1.410	2.294	10.388
Portland, OR	2.490	1.262	0.641	0.979	0.939	2.254	8.851
Providence, RI	3.122	1.619	0.668	0.291	1.498	1.669	9.160
Raleigh/Greensboro, NC	3.788	1.769	1.478	1.889	1.030	2.925	13.365
Richmond/Norfolk, VA	4.202	1.942	1.564	1.926	1.364	3.398	14.950

Roanoke, VA	4.565	1.529	1.160	2.560	0.782	3.811	14.760
Sacramento, CA	2.048	2.076	1.314	0.751	0.664	1.745	9.052
San Diego, CA	1.893	1.714	1.110	0.645	0.903	1.739	8.576
San Francisco/Oakland, CA	1.814	1.636	1.080	0.404	0.538	1.280	7.114
Seattle/Tacoma, WA	2.105	1.390	0.810	0.954	0.903	1.956	8.492
South Carolina	4.344	2.375	1.796	1.951	1.050	3.221	15.645
Spokane, WA	2.337	1.579	0.837	1.471	0.900	2.353	9.738
St. Louis, MO	3.408	1.844	3.151	1.749	1.829	3.036	15.560
Syracuse, NY	4.275	1.525	1.338	0.634	2.857	2.667	13.604
Tampa/St. Petersburg, FL	3.833	2.359	1.642	1.045	1.284	2.668	13.380
Toledo, OH	3.660	1.875	0.776	1.909	1.594	2.542	12.623
West Texas/New Mexico	4.254	2.689	1.423	1.411	1.308	3.638	15.457
Wichita, KS	4.552	2.342	1.613	2.017	1.317	3.330	15.572

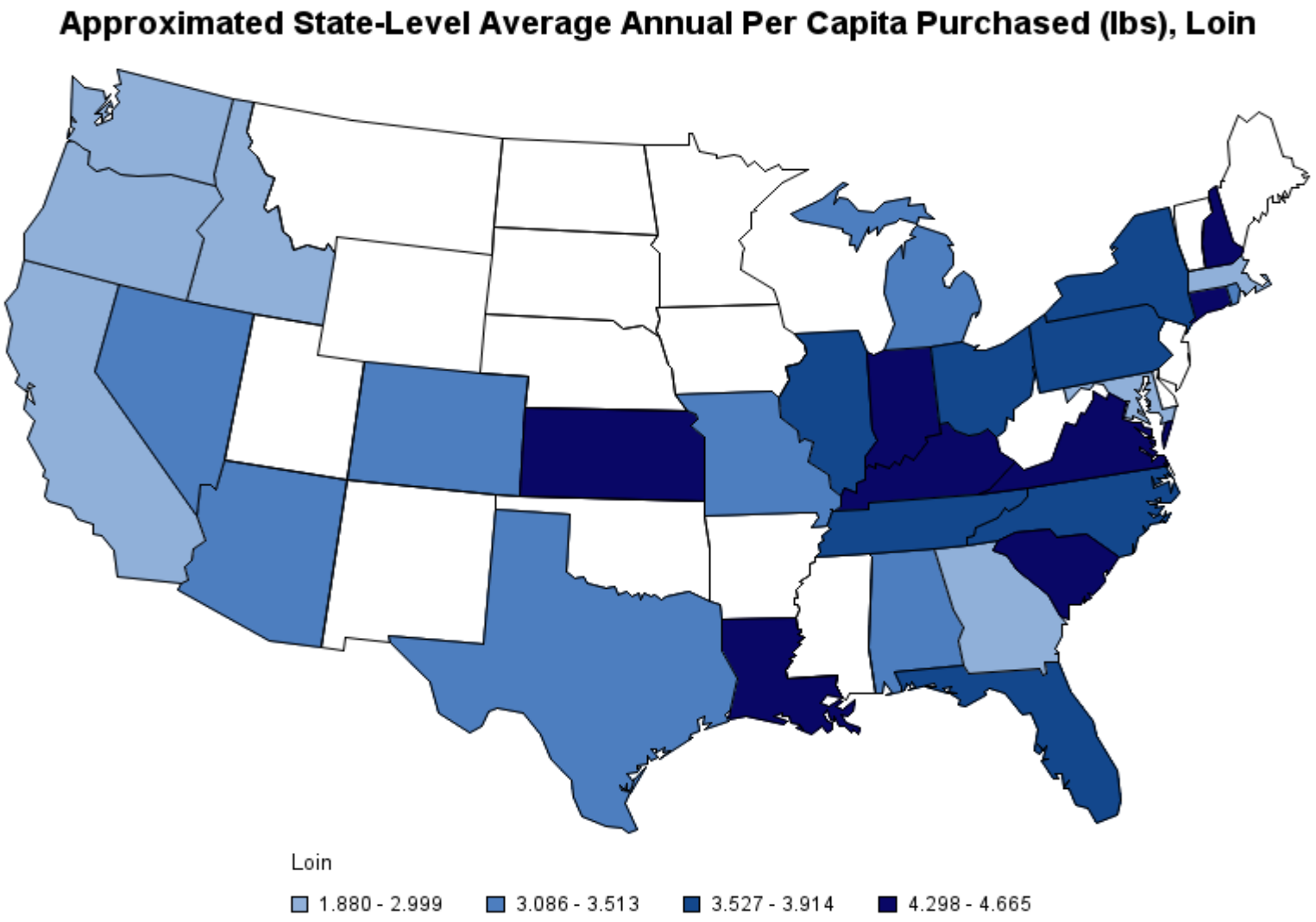
Note: These values are derived multiplying simple average weekly values by 52.

Table A9. Average Per Capita Volume Ranking of Markets (Jan. 2016 - Dec. 2020), by Product

Market	*Loin*	*Ribs*	*Shoulder*	*Breakfast Sausage*	*Dinner Sausage*	*Bacon*
Albany, NY	1	28	31	45	2	19
Atlanta, GA	40	33	42	23	44	25
Baltimore, MD/Washington D.C.	43	47	37	28	28	33
Birmingham/Montgomery, AL	32	29	18	5	50	3
Boise, ID	46	51	48	27	39	42
Boston, MA	36	39	43	50	27	49
Buffalo/Rochester, NY	24	45	17	42	4	28
Charlotte, NC	16	26	3	16	31	14
Chicago, IL	42	40	41	33	7	41
Cincinnati/Dayton, OH	9	22	38	3	32	13
Columbus, OH	29	34	51	17	14	29
Dallas/Ft. Worth, TX	30	4	19	25	35	23
Denver, CO	31	19	22	21	3	18
Detroit, MI	38	20	49	19	18	31
Grand Rapids, MI	19	11	15	14	16	20
Harrisburg/Scranton, PA	17	48	26	44	5	36
Hartford, CT/Springfield, MA	12	30	16	48	9	39
Houston, TX	37	5	23	36	43	40
Indianapolis, IN	11	16	30	4	25	17
Jacksonville, FL	20	3	4	22	33	10
Knoxville, TN	8	36	35	1	45	5
Las Vegas, NV	35	12	45	35	24	38
Los Angeles, CA	51	25	27	43	48	48
Louisville, KY	7	17	32	9	34	4
Miami/Ft. Lauderdale, FL	39	13	21	47	47	47
Nashville, TN	28	32	28	8	38	8
New England	3	18	29	39	13	26
New Orleans, LA/Mobile, AL	2	1	5	24	37	12
New York, NY	41	50	40	51	21	50
Orlando, FL	22	9	11	30	26	24
Peoria/Springfield, IL	4	14	7	13	11	16
Philadelphia, PA	25	41	33	37	8	37
Phoenix/Tucson, AZ	26	10	44	31	10	32
Pittsburgh, PA	34	46	46	26	17	34
Portland, OR	44	49	50	32	36	35
Providence, RI	33	37	47	49	15	46
Raleigh/Greensboro, NC	21	27	10	12	30	15
Richmond/Norfolk, VA	15	21	9	10	19	6

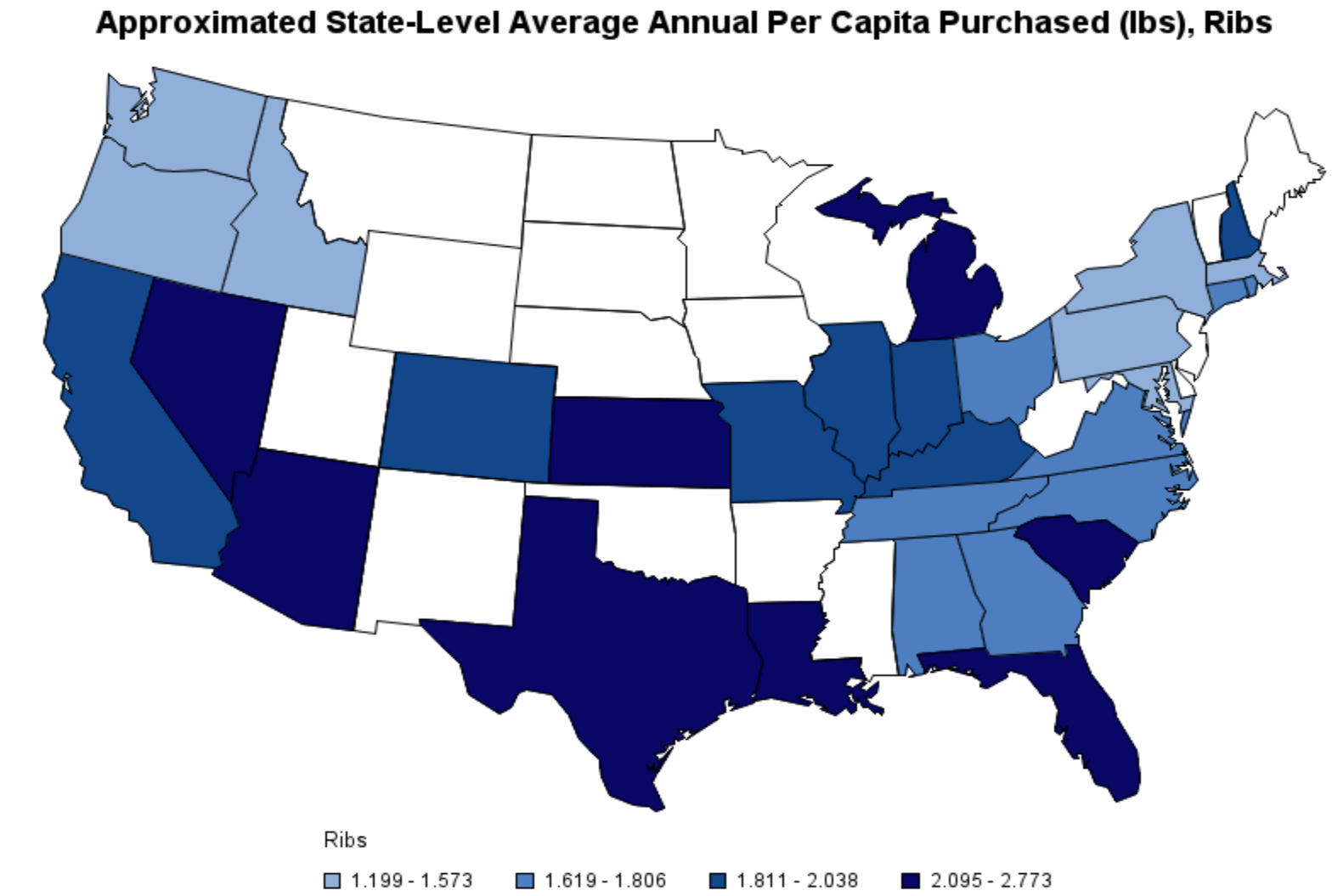
Roanoke, VA	5	42	20	2	46	1
Sacramento, CA	48	15	14	38	49	44
San Diego, CA	49	31	24	40	40	45
San Francisco/Oakland, CA	50	35	25	46	51	51
Seattle/Tacoma, WA	47	44	36	34	41	43
South Carolina	10	6	2	7	29	9
Spokane, WA	45	38	34	18	42	30
St. Louis, MO	27	24	1	15	6	11
Syracuse, NY	13	43	13	41	1	22
Tampa/St. Petersburg, FL	18	7	6	29	23	21
Toledo, OH	23	23	39	11	12	27
West Texas/New Mexico	14	2	12	20	22	2
Wichita, KS	6	8	8	6	20	7

Figure A1. Per Capita Annual Loin Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



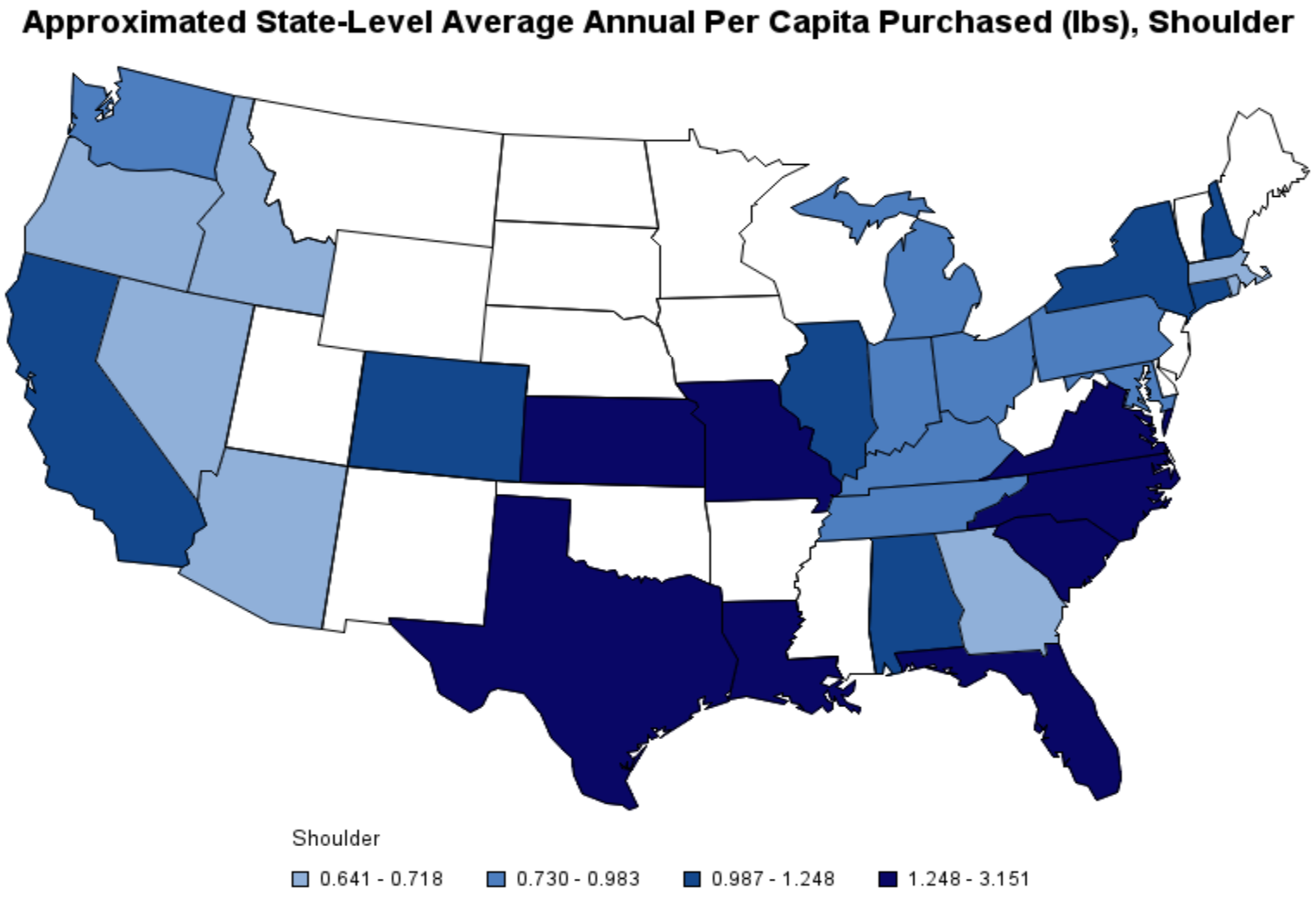
Source: Tonsor & Lusk, 2021

Figure A2. Per Capita Annual Ribs Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



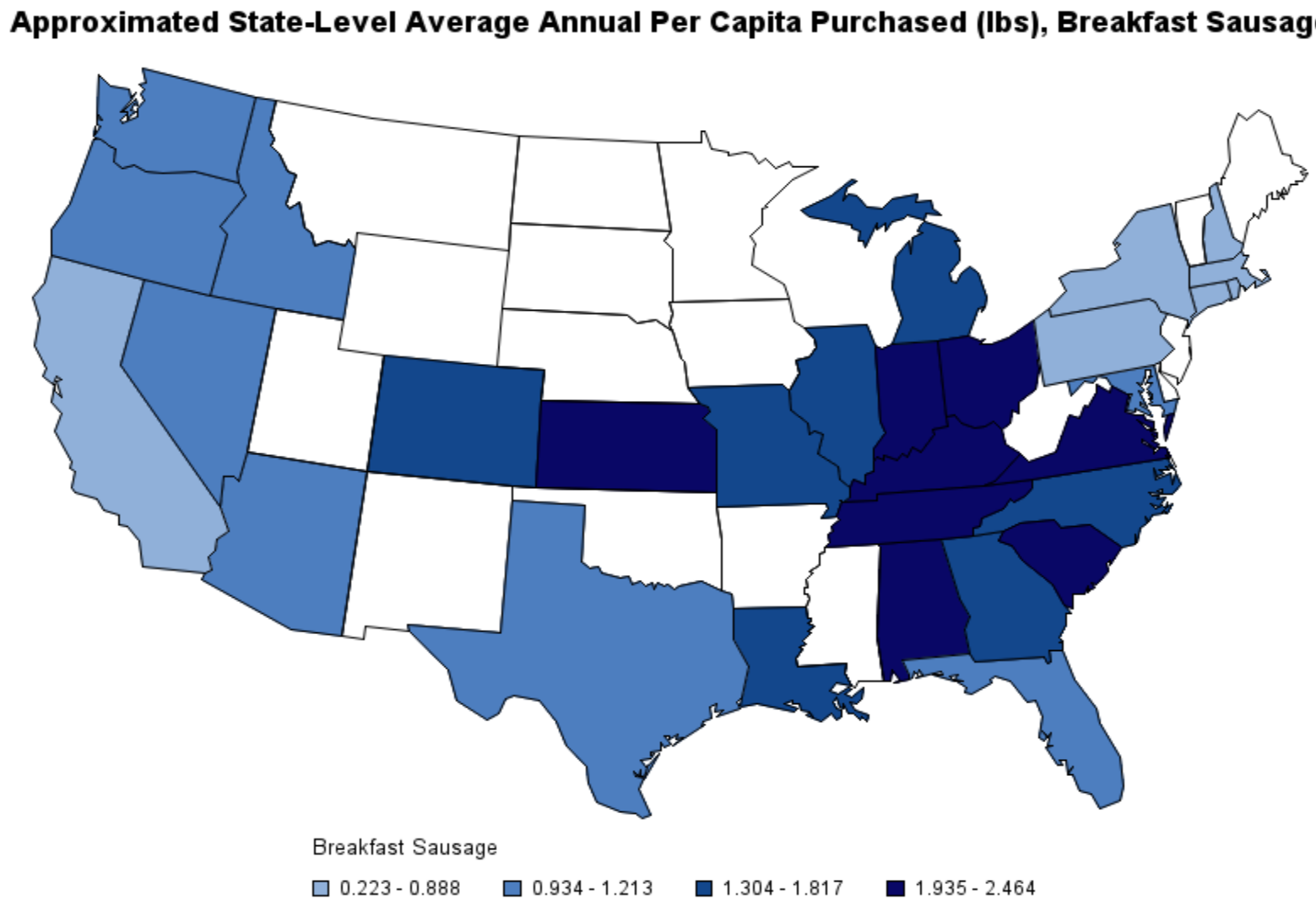
Source: Tonsor & Lusk, 2021

Figure A3. Per Capita Annual Shoulder Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



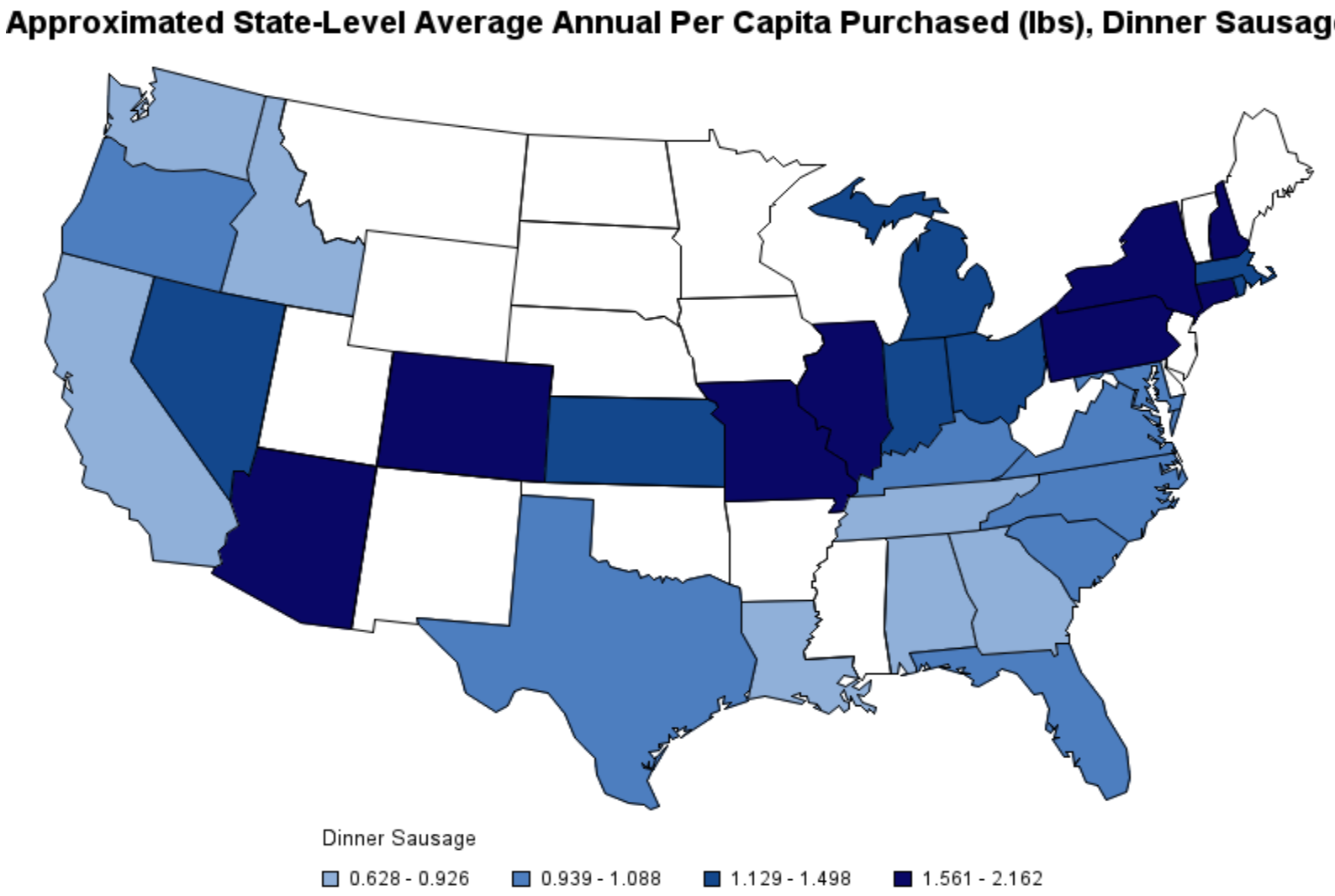
Source: Tonsor & Lusk, 2021

Figure A4. Per Capita Annual Breakfast Sausage Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



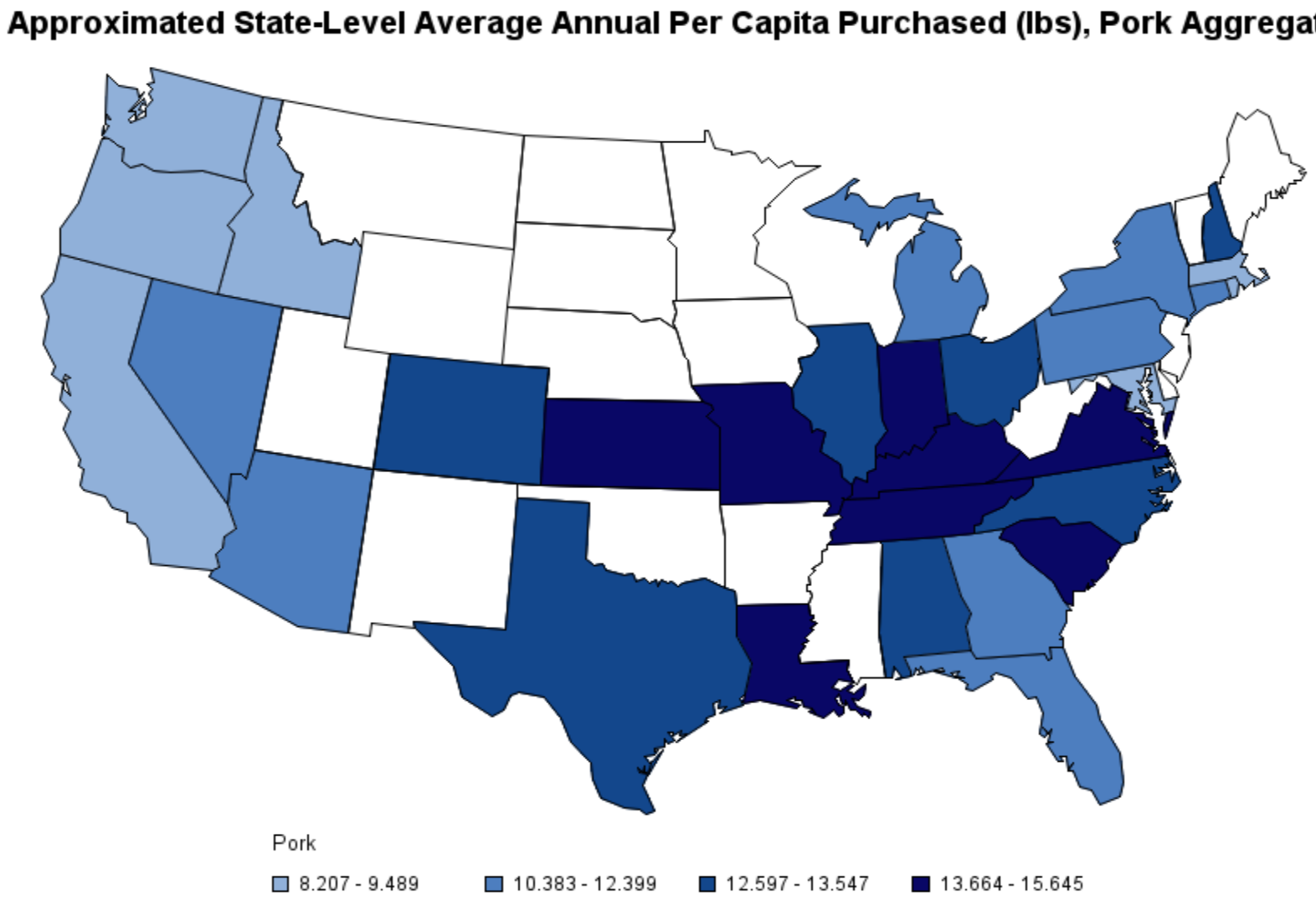
Source: Tonsor & Lusk, 2021

Figure A5. Per Capita Annual Dinner Sausage Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



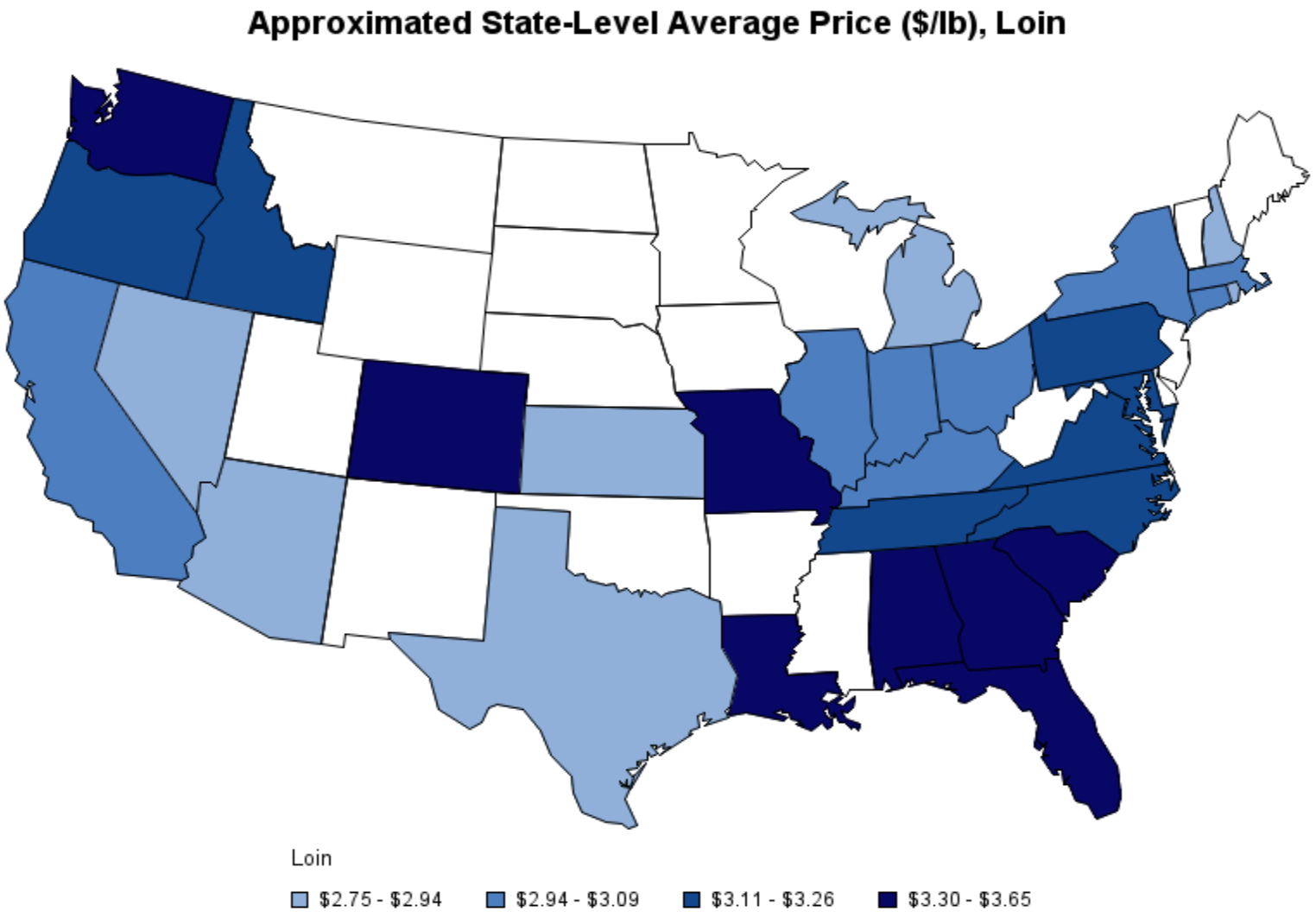
Source: Tonsor & Lusk, 2021

Figure A6. Per Capita Annual Pork Purchased (lbs), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



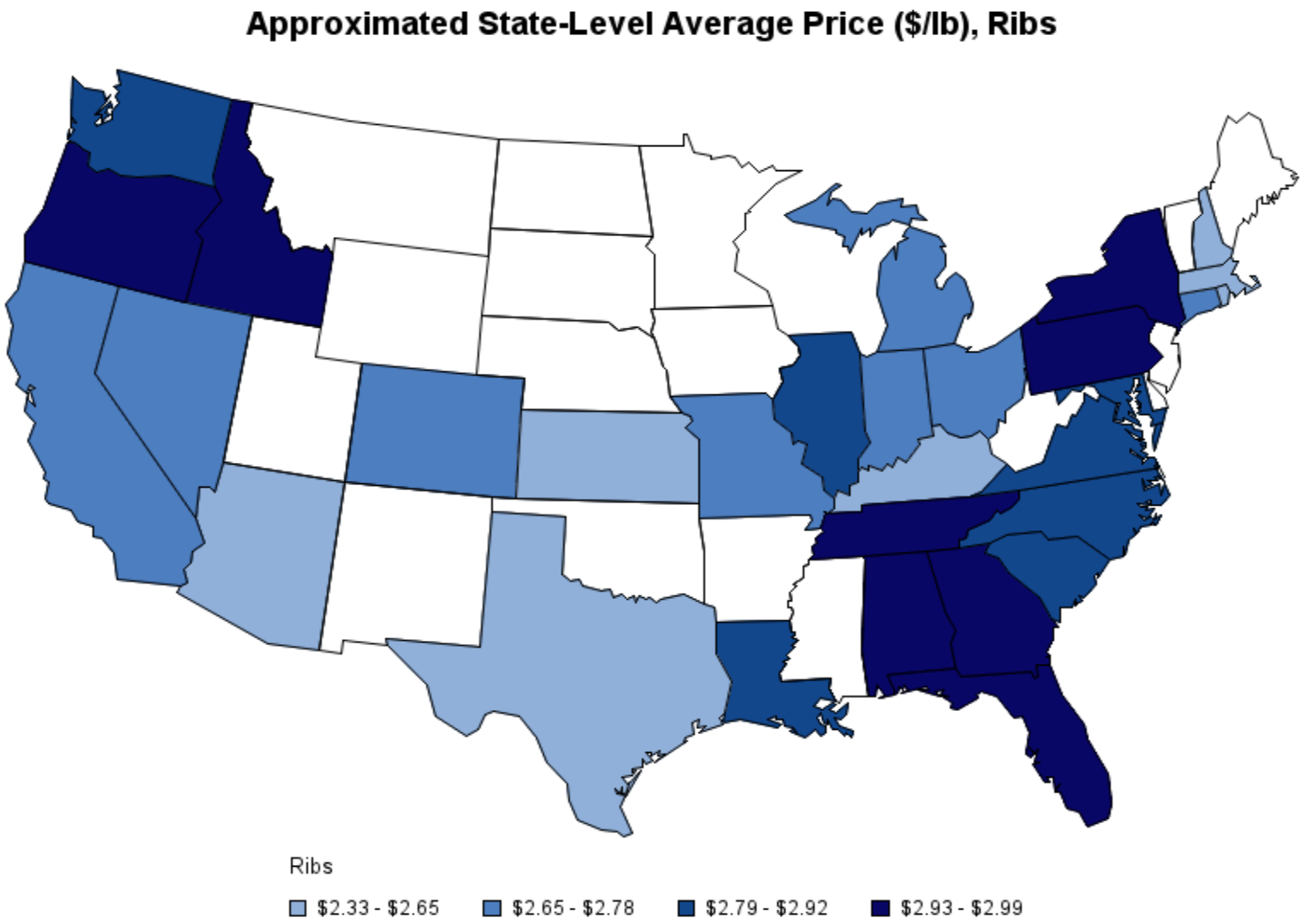
Source: Tonsor & Lusk, 2021

Figure A7. Loin Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



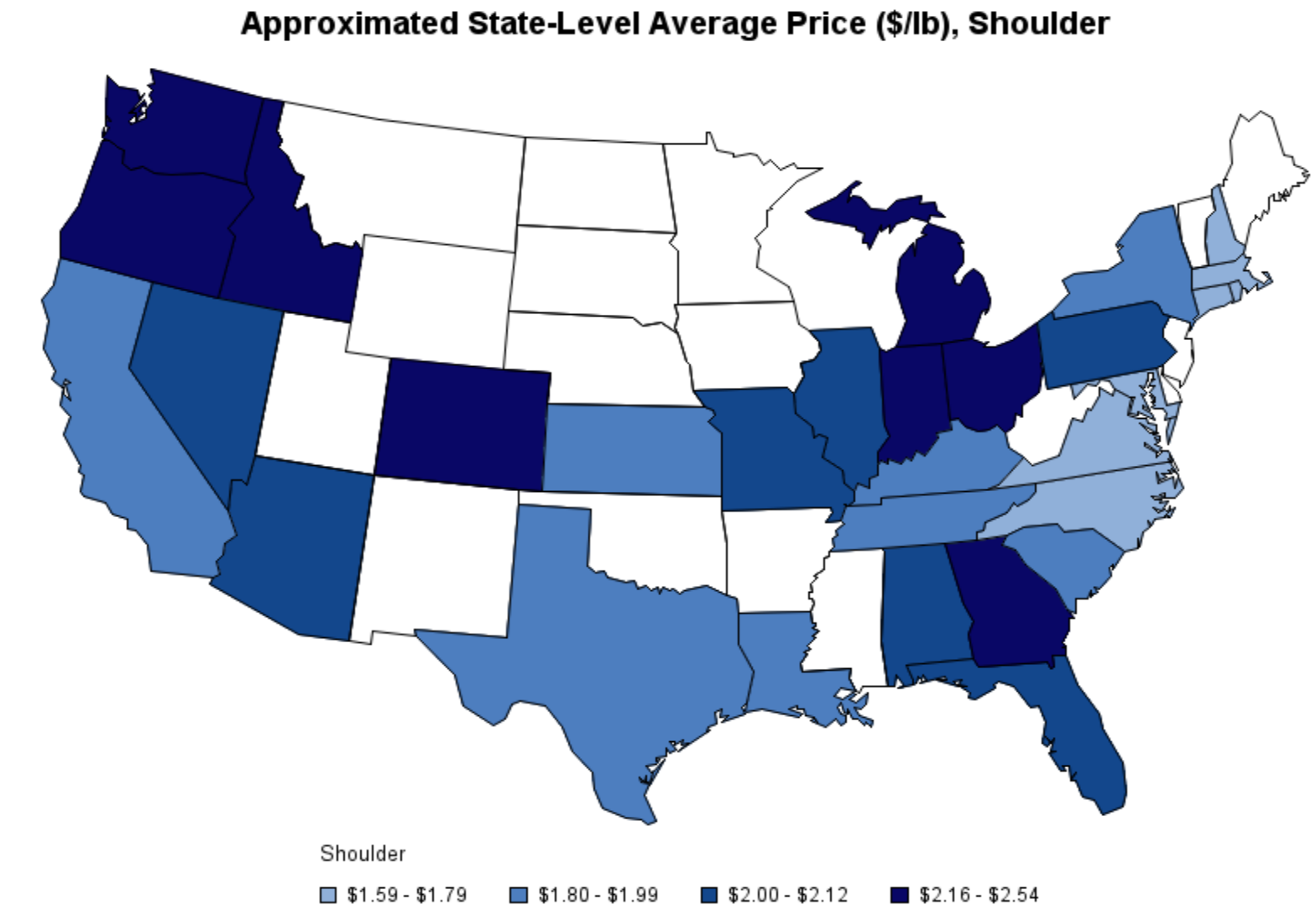
Source: Tonsor & Lusk, 2021

Figure A8. Ribs Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



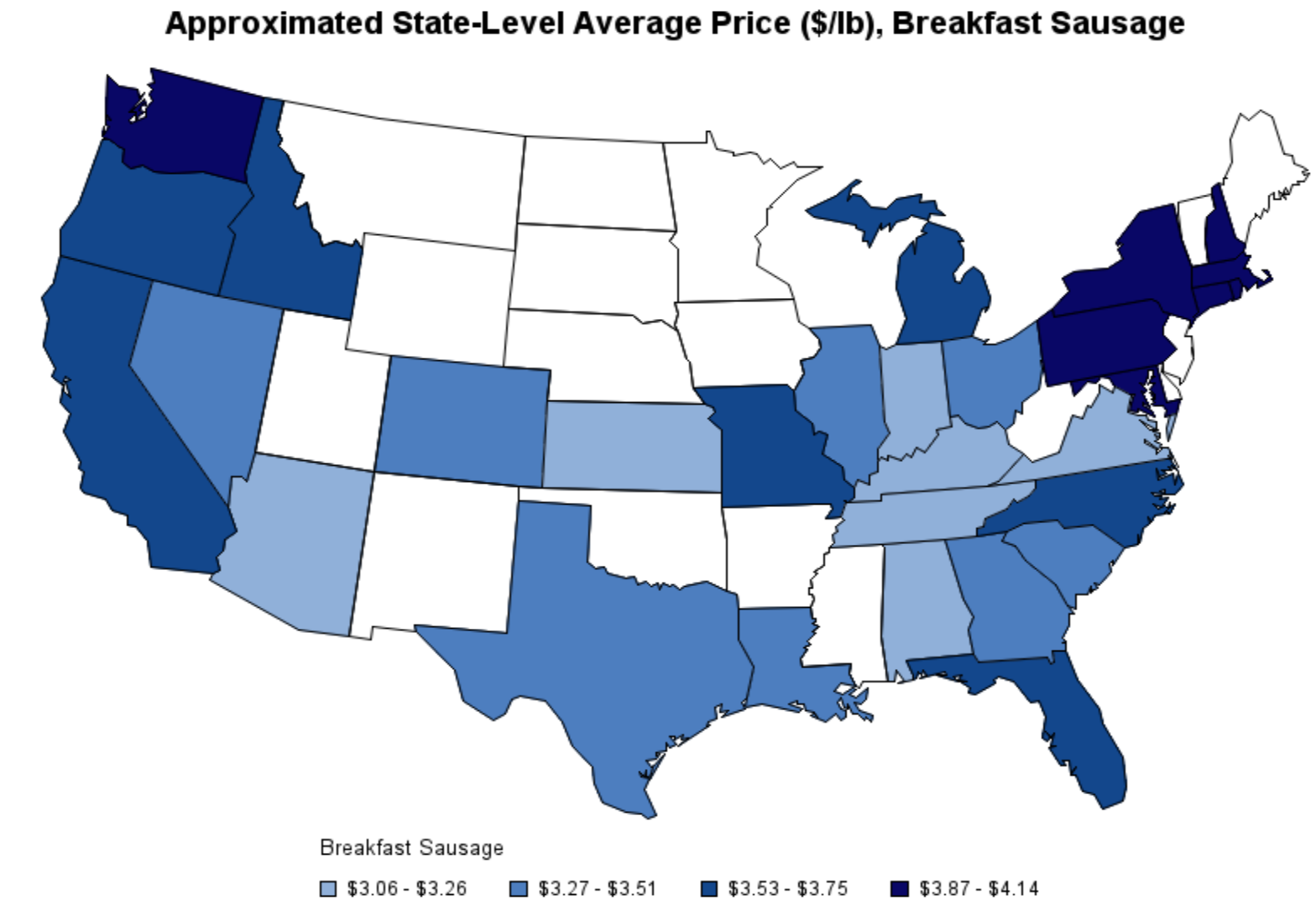
Source: Tonsor & Lusk, 2021

Figure A9. Shoulder Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



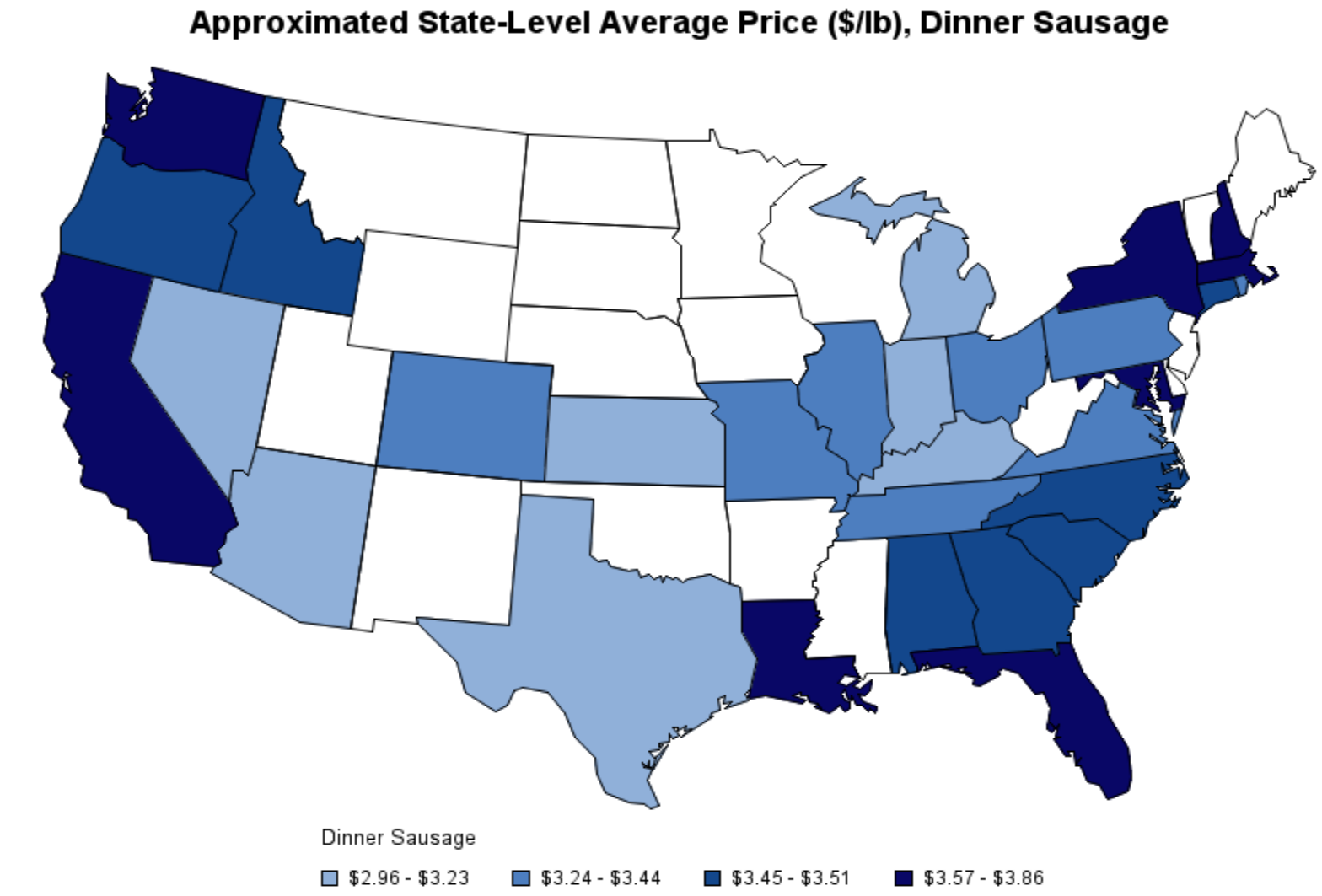
Source: Tonsor & Lusk, 2021

Figure A10. Breakfast Sausage Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



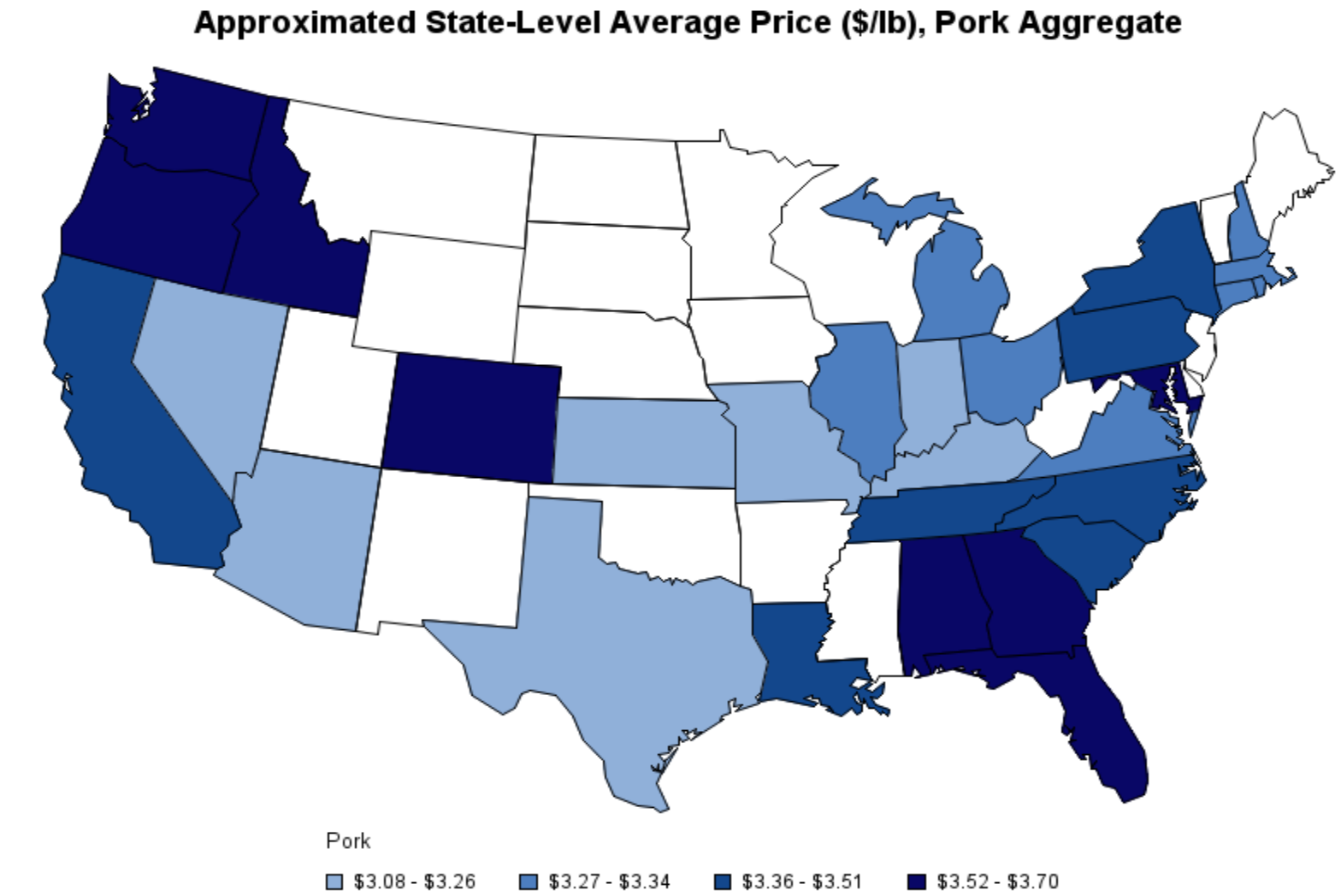
Source: Tonsor & Lusk, 2021

Figure A11. Dinner Sausage Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



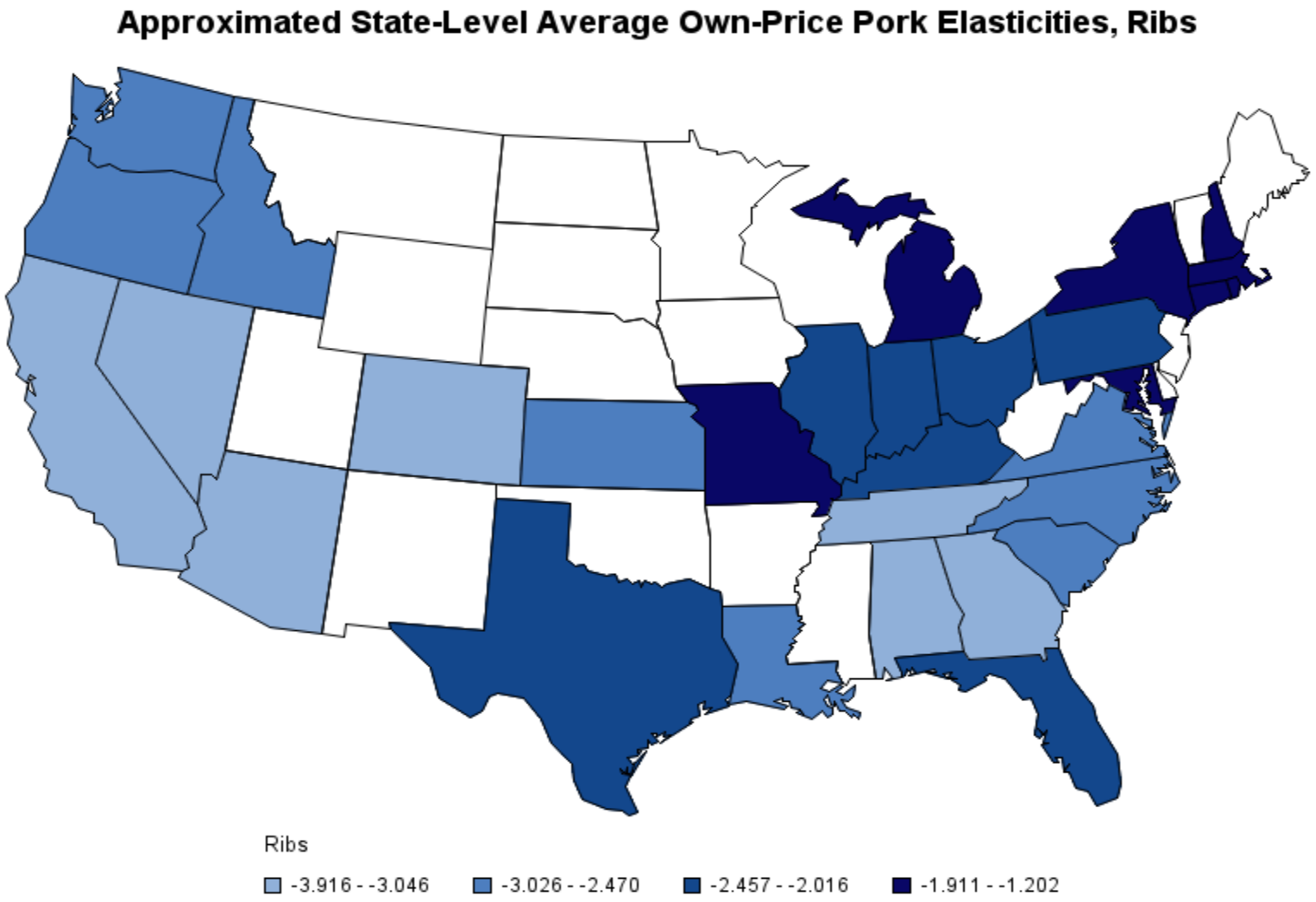
Source: Tonsor & Lusk, 2021

Figure A12. Pork Price ($/lb), Approximated State-Level Average (Jan. 2016 – Dec. 2020)



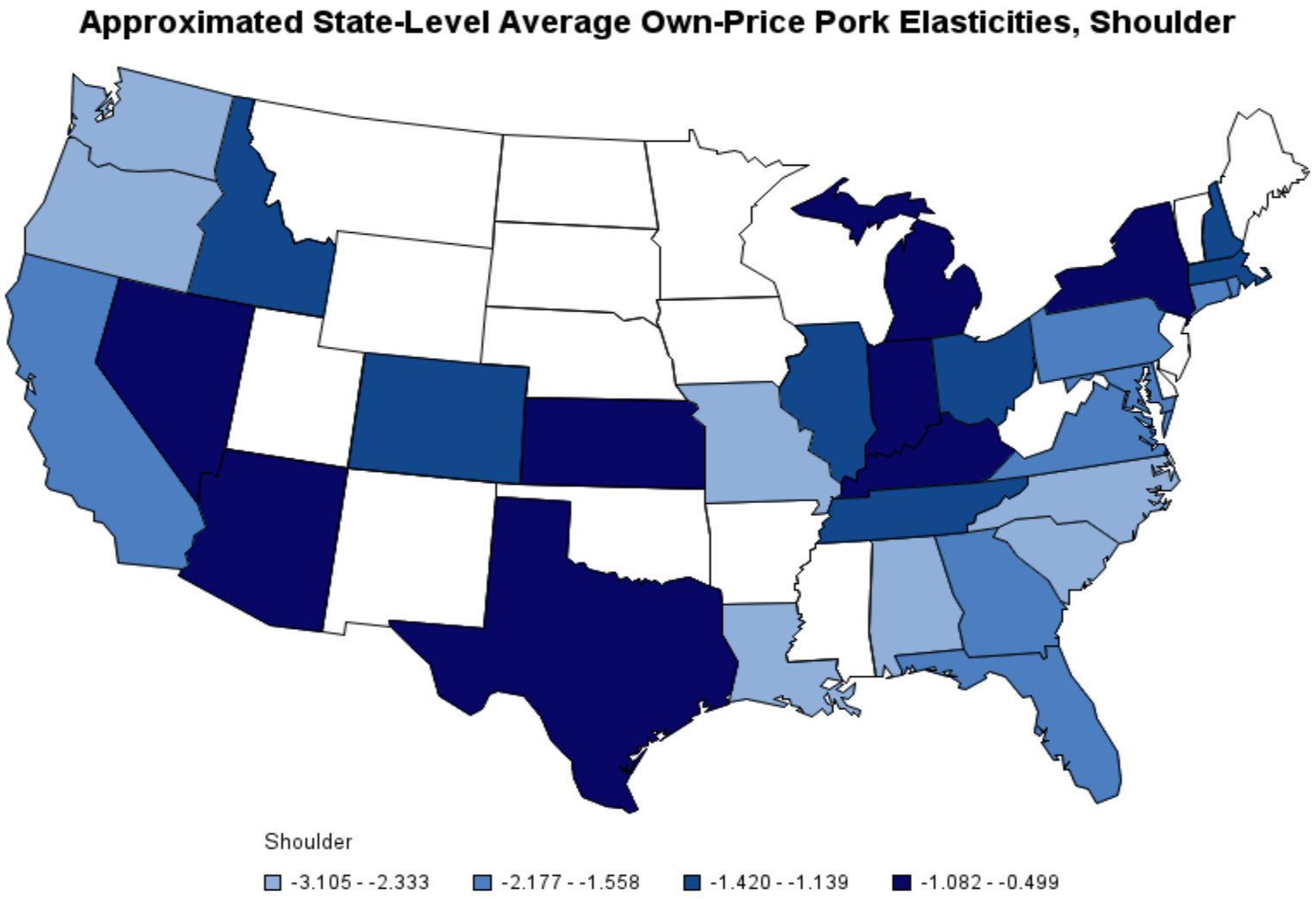
Source: Tonsor & Lusk, 2021

Figure A13. Ribs Own-Price Elasticity Map



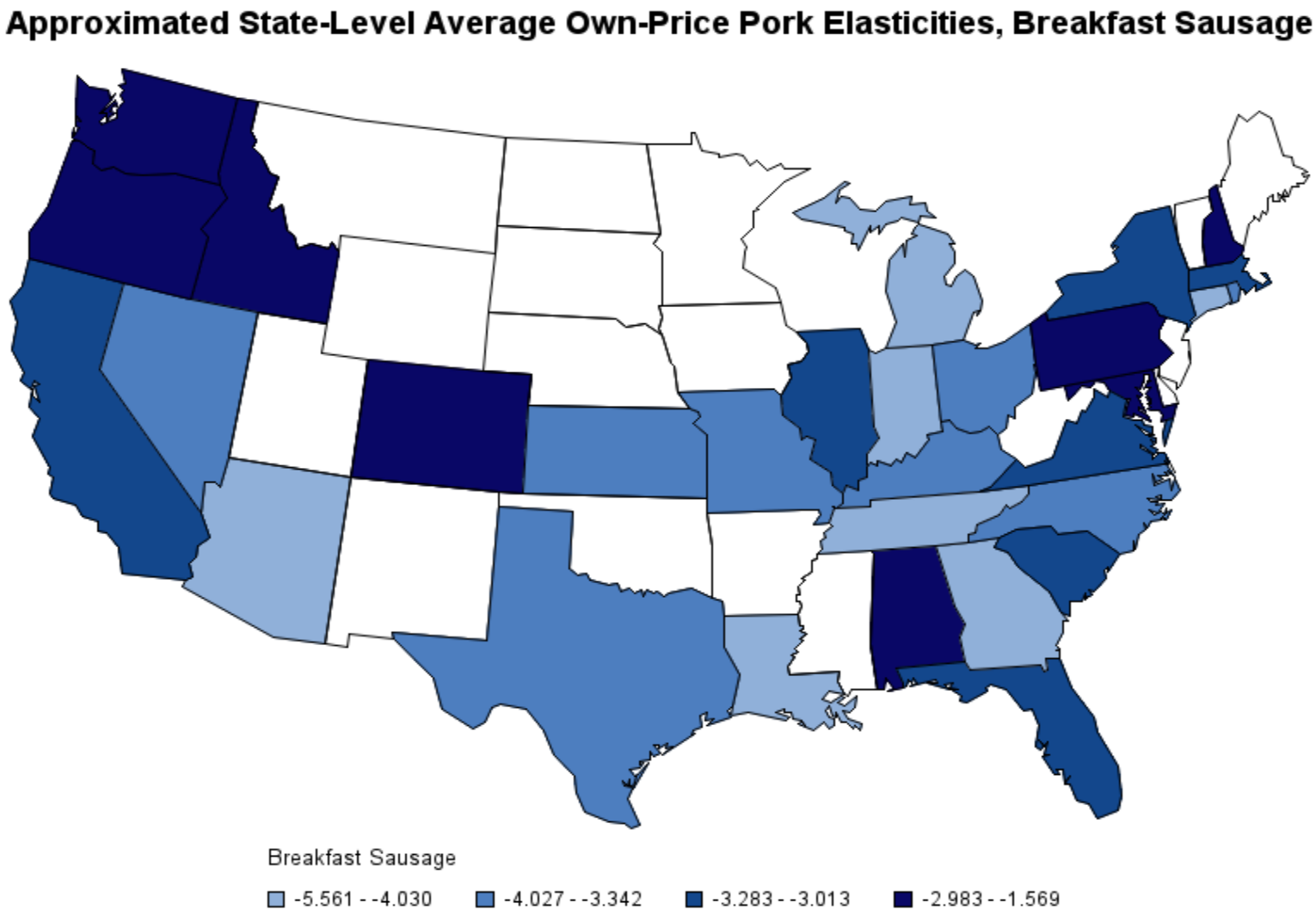
Source: Tonsor & Lusk, 2021

Figure A14. Shoulder Own-Price Elasticity Map



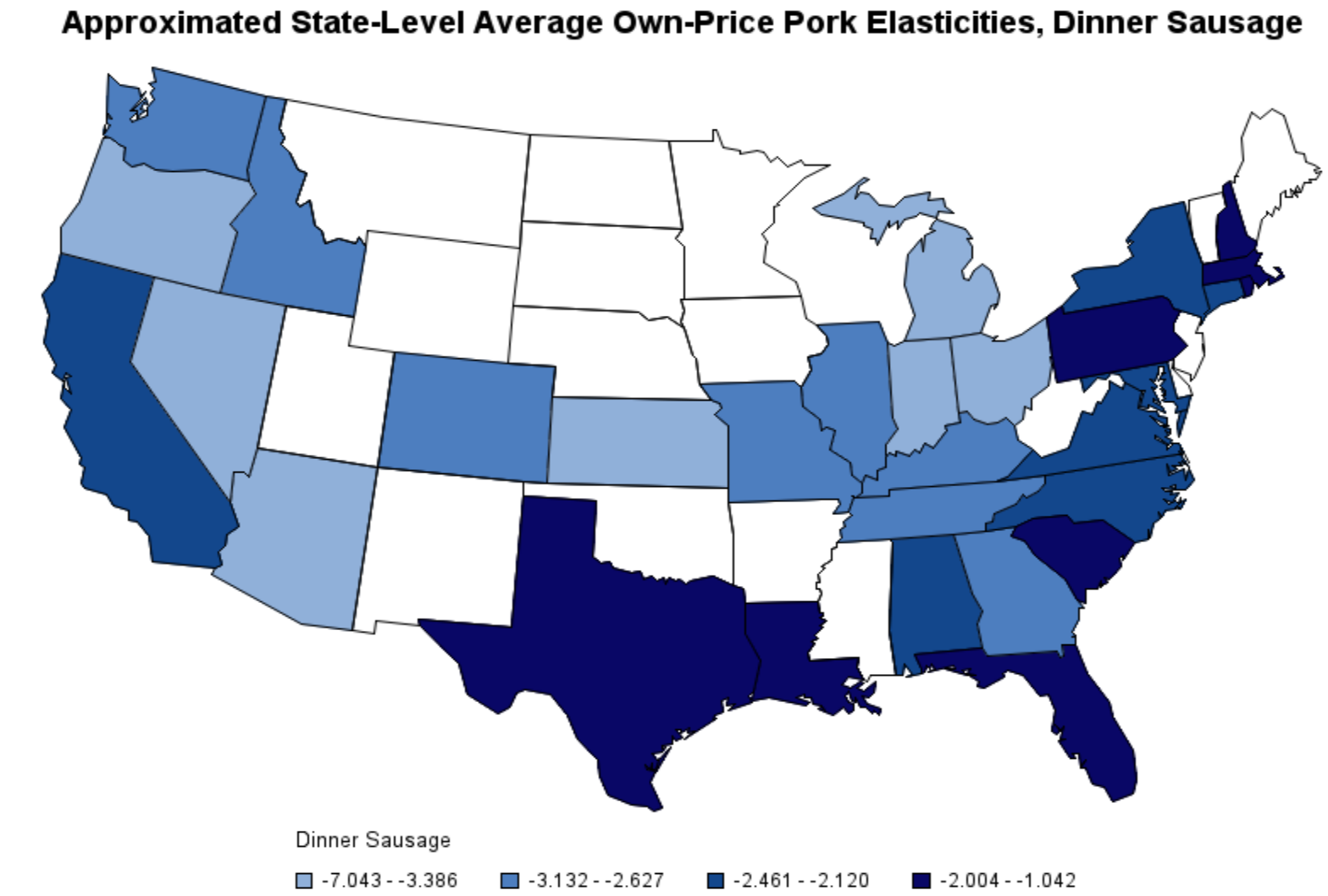
Source: Tonsor & Lusk, 2021

Figure A15. Breakfast Sausage Own-Price Elasticity Map



Source: Tonsor & Lusk, 2021

Figure A16. Dinner Sausage Own-Price Elasticity Map



Source: Tonsor & Lusk, 2021

Figure A17. Median Own-Price Elasticities, Comparison of Using Own-Price Directly vs. Two-Stage Instrument Approach

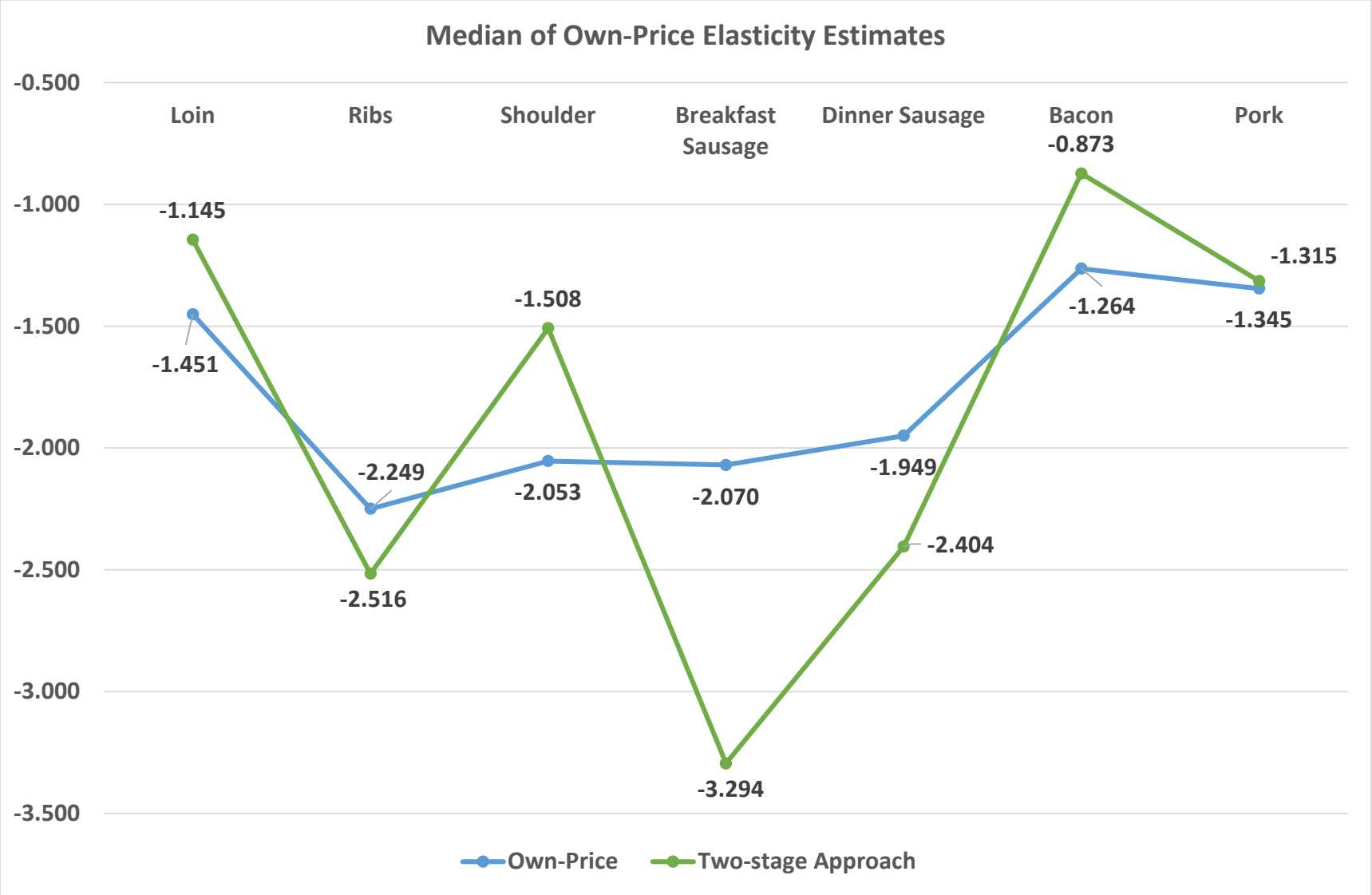


Figure A18. Dispersion of Own-Price Elasticities, Using Own-Price Directly (Jan. 2016 – Dec. 2020)

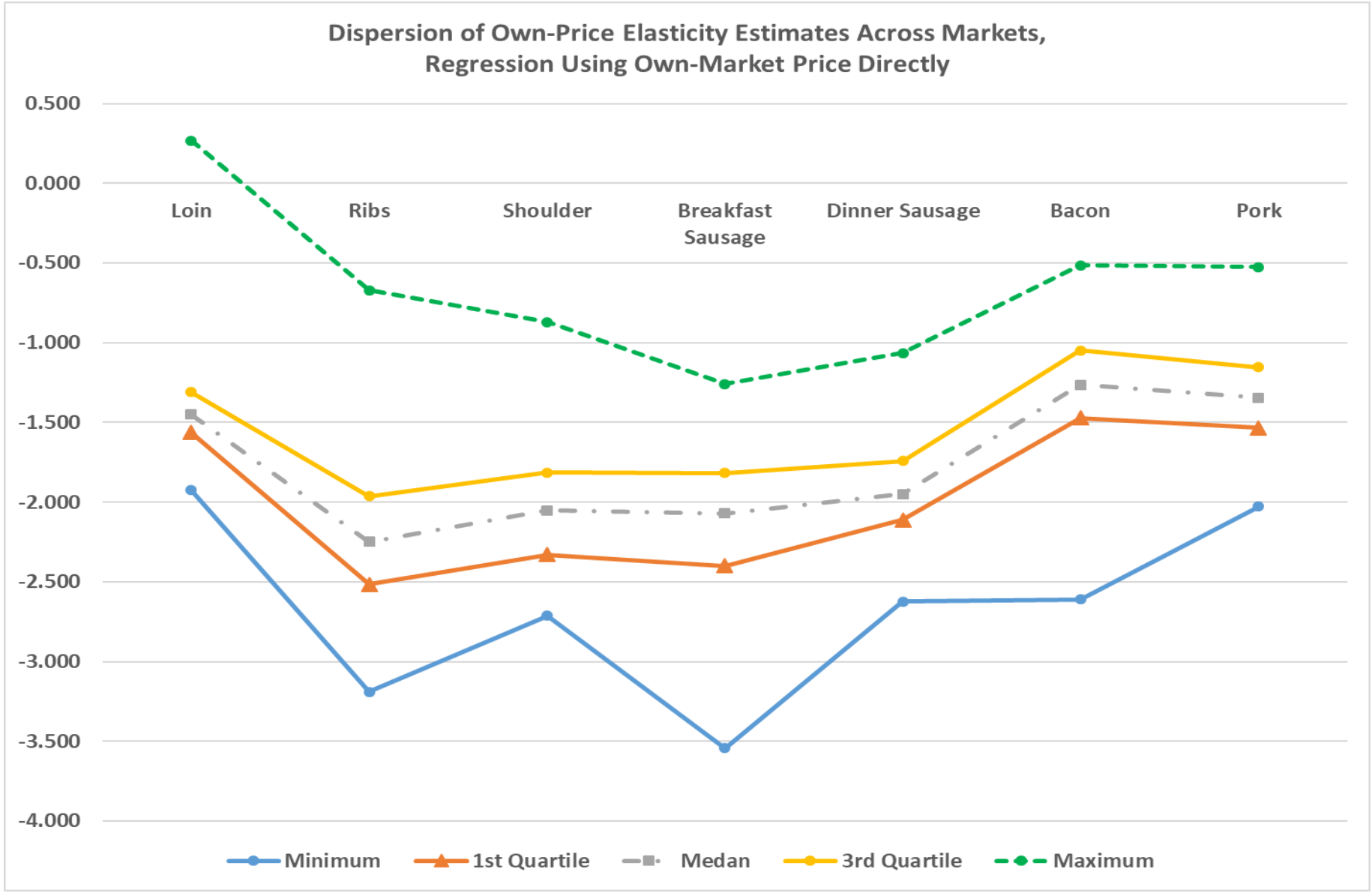


Table A10. Summary Statistics on Own-Price Elasticities across 51 Markets (Jan. 2016 - Dec. 2020), Estimated Using Own-Market Price Directly

Using Own Price	Loin	Ribs	Shoulder	Breakfast Sausage	Dinner Sausage	Bacon	Pork
Mean	-1.345	-2.201	-2.042	-2.142	-1.903	-1.279	-1.360
Minimum	-1.926	-3.191	-2.714	-3.544	-2.623	-2.611	-2.028
1st Quartile	-1.563	-2.515	-2.330	-2.401	-2.110	-1.472	-1.533
Medan	-1.451	-2.249	-2.053	-2.070	-1.949	-1.264	-1.345
3rd Quartile	-1.310	-1.964	-1.815	-1.818	-1.741	-1.048	-1.154
Maximum	0.268	-0.672	-0.870	-1.259	-1.066	-0.515	-0.526
Count	51	51	51	51	51	51	51
Number Positive	1	0	0	0	0	0	0

Note: One loin market is estimated to have a positive own-price elasticity which reinforces our final, two-stage instrumental approach.