UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF ILLINOIS
EASTERN DIVISION

IN RE BROILER CHICKEN ANTITRUST LITIGATION	Case: 1:16-cv-08637
THIS DOCUMENT RELATES TO:	Honorable Thomas M. Durkin
End-User Consumer Plaintiffs	

DEFENDANTS' OPPOSITION TO END-USER CONSUMER
PLAINTIFFS' MOTION FOR CLASS CERTIFICATION

PUBLIC REDACTED VERSION

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The undersigned Defendants respectfully submit their Opposition to the End-User Consumer Plaintiffs' (the "EUCPs" or "Plaintiffs") Motion for Class Certification, Dkt. No. 3971 (the "Motion").

PRELIMINARY STATEMENT

EUCPs' Motion attempts to gloss over the many individualized factors that are fatal to class certification. Through their Motion, EUCPs seek to certify a class of "millions" of consumers who purchased thousands of different raw chicken products at grocery and other retail stores in twenty-five states over a seven-year period.[1] EUCPs' Motion attempts to take the multi-step, complicated processes of producing, selling, and distributing thousands of chicken products to millions of consumers and describe it as an uncomplicated process of selling a "commodity." The reality is that the thousands of chicken products at issue in this Motion are anything but a "commodity" product, and the fundamental complexities that pervade every step of the production, distribution, and sales processes present insurmountable individual issues for the proposed class.

EUCPs' conspiracy claims fail to get out of the starting gates because their alleged "production cuts," which largely took place before EUCPs' Class Period (January 2012 through July 2019), did not involve coordinated or even parallel conduct. An examination of actual production data shows that the Defendants responded differently to "the perfect storm" of challenging economic circumstances—including the Great Recession, historic droughts, and exorbitant feed prices. In the face of these challenges, there were no uninform movements in production. Some Defendants increased production, some decreased production, and others kept

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[1] EUCP Mot. at 20. Although EUCPs assert in their Motion that the class contains "millions of consumers," no EUCP expert actually offered an opinion on the number of proposed class members, and EUCPs offer no explanation as to how many "millions" of class members they seek to represent. Exhibit 1 to the Declaration of Danielle R. Foley, ███████████ ███████████████████████ All Exhibits cited hereto are exhibits to the Foley Declaration.

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production the same. There simply were no coordinated production cuts that could have impacted

the EUCP class. Then, during the EUCP Class Period, production actually increased *each and

every* year.

Against this background, EUCPs' Motion fails to satisfy the elements of Rule 23 for three

reasons. *First*, EUCPs cannot show predominance. EUCPs rely upon the expert report of Dr.

Sunding to attempt to satisfy predominance. ███████████████████████████████

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████████████ None of Dr. Sunding's models come close to making these showings. For one,

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from Plaintiffs' theory of harm.

Even if Dr. Sunding's models were tied to Plaintiffs' theory of harm (which they are not),

they are fundamentally flawed and unreliable and cannot show impact on a class-wide basis. ██

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EUCPs also fail to show that common issues of damages predominate. Again, EUCPs rely upon Dr. Sunding, and again, Dr. Sunding's model cannot show class-wide damages using common proof. [REDACTED]

[REDACTED] On top of these

predominance problems, EUCPs also fail to account for or manageably address the multiple substantive conflicts of law that exist between the 25 jurisdictions whose laws they invoke.

Second, EUCPs' definition of the proposed class is impermissibly broad. As shown by an examination of Dr. Sunding's model, ███████████████████████████████████████

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███ EUCPs do not even address this issue, but instead try to sweep it under the rug by claiming that class members can "self-identify." That argument does not provide any method to weed out the uninjured class members, but rather only highlights the individual inquires that would still need to be done in order to determine class membership. Nor could EUCPs address this issue by attempting to amend the class definition. Any attempt to do so would only result in an unmanageable, individualized inquiry to separate out the uninjured.

Third, EUCPs fail to establish typicality and adequacy. For example, ████████████

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FACTUAL BACKGROUND

I.   THE EUCP CLASS DEFINITION

EUCPs seek to certify a class of "end-user consumers who purchased raw breast meat or raw whole chicken at grocery stores for personal consumption between January 1, 2012 and July 31, 2019." (Mot. at 4).[4] This definition does not include all chicken products purchased by consumers, but instead, as EUCPs describe it, their class products include "tray pack" chicken, which is "often packaged in Styrofoam trays." (*Id.*). Specifically excluded from this description is (a) dark meat that is <u>not</u> sold as part of a "whole cut-up bird[] purchased within a package," and (b) any chicken (including breast meat or whole birds) that is marketed as "halal, kosher, free range, organic, diced, minced, ground, seasoned, flavored, or breaded." (*Id.* at 6). Despite the attempt to simplify the class description, this definition includes over 20,000 individual products purchased by potentially millions of consumers from thousands of different entities in 25 states over a seven-year period. Any attempt to assess potential impact and damages arising from EUCPs' alleged supply restriction conspiracy must consider the complexities of the different types of chicken products that Defendants produced during the Class Period, the processes through which Defendants produced those products, and the complex web of distribution and sales that put those products in the hands of end-user consumers.

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[4] EUCPs' full definition is: "All persons and entities who indirectly purchased the following types raw chicken [sic], whether fresh or frozen: whole birds (with or without giblets), whole cut-up birds purchased within a package, breast cuts or tenderloin cuts, but excluding chicken that is marketed as halal, kosher, free range, organic, diced, minced, ground, seasoned, flavored or breaded – from defendants or co-conspirators for personal consumption in the Repealer Jurisdictions from January 1, 2012 to July 31, 2019." (Mot. at 6). The "Repealer Jurisdictions" are California, District of Columbia, Florida, Hawaii, Illinois, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, and Wisconsin. (*Id.*).

II.   THE REALITIES OF CHICKEN PRODUCTION

In contrast to the picture EUCPs attempt to present, the reality is that the production, distribution, and pricing of the thousands of different products are complex and multi-faceted processes. When these complex processes are considered, EUCPs' allegations of an agreement to restrict supply fall apart, and the impact, if any, of those allegations on EUCPs cannot be established on a class-wide basis.

A.   The Different Market Segments, Cuts, and Chicken Products

While EUCPs focus their class definition on fresh or frozen whole bird and breast meat bought by consumers at retail, those are only a small fraction of the universe of products that Defendants produce. Defendants produce, process, and package thousands of different types of "Broiler" chicken products. Broiler chickens are grown to different sizes (generally called "small bird," "medium bird," and "big bird"), with each size intended for sale to a different customer segment, with different product attributes.[5] Defendants sell products derived from these different bird sizes to thousands of customers, including whole birds sold to club stores, tray packs with boneless skinless breasts to supermarkets for resale to consumers, breast meat to distributors for resale to restaurants, customized cut-up products to fast food restaurants, and chicken wings to wing specialty restaurants.

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Not surprisingly, Defendants orient their businesses in different ways around these different segments. A processor's ability to slaughter a bird of a certain size does not mean it has the ability (or strategic interest) to slaughter birds of all sizes. To the contrary, different production processes—involving different genetic stock and facilities—apply to each of these market segments, and producers cannot easily convert facilities from one size to another.[6] During the Class Period, there was significant variation among the Defendants in their production for each segment. For example, ██

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Further complicating the issue is that Defendants process numerous different preparations and cuts of meat from the birds they produced. Cuts include breast, wings, whole bird, tender, fillet, thighs, drumsticks, legs, and leg quarters, as well as other cuts like feet and gizzards. (Ex. 3, Johnson Report at ¶ 73 and Ex. 5). All of these cuts may be sold fresh, frozen, or further processed – whether marinated, breaded, seasoned, or otherwise, and determining which cut or processing method requires distinct steps along the production process. (Ex. 3, Johnson Report at ¶ 75). Within these cuts and further processing methods, additional product variations exist. For example, some Defendants produce products with additional "attributes," including all vegetable feed, no antibiotics ever ("NAE"), antibiotic free ("ABF"), California-grown, and specific trimming of breast meat, while others produced "yellow" chicken (*i.e.,* chicken that is fed marigold extract to impart a yellow color to the meat, which for some consumers, particularly in the Hispanic community, is considered a premium "niche" product).[8] *See* ████████████████████████

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different products and attributes leads to different supply and demand dynamics.

    B.   EUCPs Fail to Demonstrate that the Alleged Production Cuts Resulted in Less Chicken for Consumers

        1.   *Overall Production Increased, not Decreased, during the Class Period*

EUCP's theory makes little sense given ██████████████████████████████

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EUCPs offer no explanation to reconcile this simple fact with their supposed conspiracy.

Even if EUCPs' allegations of "production cuts" before the Class Period had any bearing

on the injury they purportedly suffered (which they do not) these supposed "production cuts" are

not supported by evidence. While EUCPs focus █████████████████████████

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2.   There were no uniform "Production Cuts"

Despite EUCPs' claims of "unprecedent[ed]" coordinated production cuts, there were no uniform "production cuts" across Defendants, either before or during the alleged Class Period.

EUCPs' claims must be considered in the context of the "perfect storm" of economic circumstances Defendants faced. Beginning in late 2008, the Great Recession weakened demand for many chicken products. Consumer spending habits changed profoundly in ways that impacted the meat industry.[11] This economic shock, which EUCPs' own expert does not allege was part of any conspiracy, overlaps with their "2008 Production Cut" and had long-lasting effects. ██

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█████████████████████████████████   Further, the cost of chicken feed—the largest input cost for raising chickens—soared to unheard-of levels in 2008. This historic run-up in feed cost had two main drivers: (1) "ethanol mandate" legislation massively increased the demand for corn,[12] which, in turn, increased the cost of chicken feed, which is mostly corn[13]; and (2) flooding struck the

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[11] *See, e.g.* Ex. 17, Christopher R. Sims, *Time Series Forecast Analysis in Wholesale Broiler Markets*, University of Arkansas Theses and Dissertations, at 15 (Dec. 2017) ("total meat consumption dropped by approximately 9 percent; poultry accounted for nearly 6 percent of the decline."); Ex. 18, Paul Aho, *The Great Meat Recession*, WattAgNet (Apr. 14, 2014) (per capita meat and poultry consumption dropped 10% in the United States during the Great Recession, and that meat consumption tracks median income levels); *see also* Ex. 23, A. Pauk Dep. Tr. at 149:24-151:2 (explaining that she reduced chicken purchasing when her husband lost his job during the Great Recession).

[12] *See* Ex. 19, D. Streitfield, *U.S. May Free Up More Land for Corn Crops*, NY Times (June 21, 2008) (reporting that a quarter of the entire U.S. corn crop was used for biofuels); Ex. 20, M. Donohue & D.L. Cunningham, *Effects of Grain and Oilseed Prices on the Costs of US Poultry Production*, J. Appl. Poult. Res. 325, 327 (2009).

[13] *See* Ex. 19, Streitfied, *supra* n. 12. (reporting that industry groups urged easing the ethanol mandate to free up corn for animal feed); Ex. 21, Associated Press, *Flooding Will Send Food Prices Soaring*, https://www.dailynews.com/2008/06/23/flooding-will-send-food-prices-soaring/

Midwest in 2008 and drowned cornfields.[14]   Accordingly, chicken producers simultaneously experienced shrinking demand for some chicken products, economic uncertainty surrounding a historic recession, and spiraling input costs.

Against this backdrop, some Defendants, based on their own circumstances, individually decided to reduce production in some areas of their businesses in 2008. ███████████

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The facts surrounding the "2011 Production Cut" are similar. As in 2008, ███████████

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██ EUCPs' assertions about "coordinated

output reductions" are simply inconsistent with reality.

3. EUCPs Offer No Causal Connection Between Alleged "Cuts" and Alleged Overcharges

EUCPs' claims regarding supposed "production cuts" are untethered to reality and the

purported injuries that EUCPs allege occurred *during* the Class Period. Tellingly, despite

allegations about "production cuts" *before* the Class Period even began, EUCPs provide no

explanation of what production would have been but for the alleged conspiracy and no explanation

of how those production cuts caused overcharges *during* the Class Period. While they offer vague

assertions about an agreement to keep "supply short of demand" and another "round of production

cuts" in the Class Period, EUCPs again offer no evidence of what production levels would have

been but for the alleged conspiracy or anyway to separate the alleged impact of the conspiracy

from non-conspiratorial conduct. (*E.g.,* Mot. at 16). ████████████████████████

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III. EUCPS' OVERCHARGE CLAIMS IGNORE THE REALITY OF THE COMPLEX PROCESS OF SELLING AND DISTRIBUTING CHICKEN PRODUCTS

A. EUCPs Ignore the Complexities in Chicken Purchasing

EUCPs also mask the complexity and variability that characterizes purchasing of chicken products. Those products take different paths from Defendants to EUCPs, passing through intermediaries that use unique pricing mechanisms and discounts. Among other things, prices vary in the distribution chains due to pricing mechanisms in upstream contracts; individual intermediaries' bargaining power; individual retailers' pricing and discount strategies; meat preparation, cut, and product; the Defendant in question; the season and region; prices of meat generally; and more. The price variability throughout this purchasing process means that the both the possibility of overcharges and the pass-through of any alleged overcharge would be anything but uniform.

1. The Chicken Purchasing Chain is Complex and Varied

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██ ███████████████████████. Chicken suppliers sell numerous different products to direct purchasers, which include retailers like Costco and Walmart, as well as distributors. Retailers, which often have many different locations around the country, resell chicken products to consumers like EUCPs. Distributors, on the other hand, resell chicken products to one or more additional intermediaries, such as smaller independent grocery stores, before those products change hands for a third time to consumers. EUCPs therefore purchased chicken products from multiple distribution chains, with different kinds and numbers of intermediaries. ████████

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There is significant diversity among the direct purchasers. ████████████████

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Considering the relationships between direct purchasers and individual Defendants reveals still more complexity. ██

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The variation multiplies further at the end of these distribution chains. Plaintiffs' proposed class includes millions of individuals around the country who purchased various kinds of raw chicken from different sources that range from local grocers to national retailers to discount-club stores. Some of these purchases flowed along a distribution chain with one intermediary, while others wound their way through several, each with their own pricing strategies. Therefore, EUCPs' experiences—including the possibility of paying any alleged overcharge—would have diverged in this context.

> **2. Chicken Pricing Mechanisms Vary Widely and Did Not Apply Uniformly Across the Sales Channels that Sold Chicken Products to EUCPs**

Because prices vary dramatically across each link of these distribution chains, there was no uniform price for any EUCP class product. This price variation resulted from a number of factors.

For example, the intermediaries through which consumers obtain chicken products may use many different pricing mechanisms when transacting with Defendants—even when dealing with a single supplier. ██

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3. Individual direct purchasers negotiated with individual Defendants for different volumes of different products

The prices that retailers and distributors paid also varied based on their individual

bargaining power. Large purchasers tend to have more bargaining power, meaning they can often

command a lower price than other entities that are buying the exact same product, from the same

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[23] Ex. 3, Johnson Report ¶ 164; *see also* Ex. 97, C. Thompson Dep. Tr. at 57:16-58:17 (explaining that there are "times where a bracket may jump, but we were told to keep [a customer] in the -- in its current bracket"); Ex. 30, C. Matthews Dep. Tr. at 39:9-40:3, 49:8-50:6; Ex. 44, PILGRIMS-0010293430 (Pilgrim's internal presentation recommending *not* to use a renegotiation clause that would lead to a higher price, in favor of increasing volume).

[24] Ex. 3, Johnson Report ¶ 167 (describing examples of Mountaire and Simmons' contracts with direct purchasers incorporating floor and ceiling pricing). *See also* Ex. 45, Mountaire 30(b)(6) Dep. Tr. at 84:4-85:3.

[25] Many retailers and distributors bought chicken products using more than one of these pricing mechanisms at once. For example, Sanderson's contract with US Foods for private label products prices some parts based on the Georgia Dock, some based on individual Urner Barry indices, and some based on "flat" prices: prices for the 87 unique products in this contract would <u>not</u> change in a uniform way over time. (Ex. 3, Johnson Report ¶ 147).   Costco, which does a significant business in rotisserie chickens, would base the prices it was willing to pay for other chicken products on the price it would pay for rotisserie birds—which are not included within Plaintiffs' class definitions. *Id.*; *see also* Ex. 46, FF-BC-00267499-7520 (internal Foster Farms document describing this pricing dynamic as "The Costco Conundrum"); Ex. 47, WM-BROILERS_0000793450 (discussing the need for Pilgrim's to "balance[]" tray pack and rotisserie products in its bid).

[26] Pilgrim's used many different pricing mechanisms and formulas in its contracts with direct purchasers. *See* Ex. 30, C. Matthews Dep. Tr. at 24:14-25:3, 27:18-28:4, 29:22-30:4.

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EUCPs experienced widely differing prices when purchasing chicken products, whether from retailers that transact directly with Defendants or those that go through distributors. [REDACTED]

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██. These special low prices may result in retailers

taking a loss on that subset of products—known as "loss leaders"[28]—████████████████████

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[28] *See* Ex. 68, James D. Hess, et al., *Loss Leader and Rain Check Policy*, Marketing Science 358-74 (1987).

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Chicken product prices also vary by season and region. For example, d[REDACTED]

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B. EUCPs' Own Experts' Modeling Shows No Overcharges to Large Portions of the EUCP Class

1. Many Direct Purchasers who sold to EUCPs incurred no overcharges

The significant complexity and variability in purchasing and pricing mechanisms discussed

above undercuts EUCPs' assertion that there was widespread overcharge. [REDACTED]

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30 [REDACTED]

[REDACTED] While there are many flaws in Dr. Sunding's market definition discussion that would render it unreliable, addressing that portion of his report is unnecessary for purposes of class certification given all of the other flaws in his opinions. Defendants reserve all rights to address Dr. Sunding's market definition and market power opinions if necessary.

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The absence of overcharges to these direct purchasers and for these products sold to direct purchasers means that there can be *no* overcharges to EUCPs on such purchases from these direct purchasers.

2. Direct Purchasers did not uniformly pass-through any alleged overcharges to End-User Consumers

Even accepting Plaintiffs' allegation of an overcharge (which did not occur), the complexities described above mean that overcharges would not be passed through to EUCPs in a common manner, if at all.

As discussed above, █████████████████████████████████████

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[32] *See, supra,* Factual Background Section III.A.3.

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As a result of all of the issues described above, determining whether any EUCP was injured as a result of the Defendants' alleged conduct, and to what extent, would require highly individualized inquiries. The EUCP class should not be certified under these circumstances.

ARGUMENT

I.   LEGAL STANDARD

Class actions should "not be approved lightly." *Ex parte Citicorp Acceptance Co.,* 715 So. 2d 199, 203 (Ala.1997) *(citing Gen. Tel. Co. of the Sw. v. Falcon,* 457 U.S. 147, 161 (1982)). A class action is "an exception to the usual rule that litigation is conducted by and on behalf of the individual named parties only" and "[t]o come within the exception, a party seeking to maintain a class action 'must affirmatively demonstrate his compliance' with Rule 23." *Foday v. Air Check,*

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Inc., 2017 WL 2672294, at *2 (N.D. Ill. June 21, 2017) (citations omitted). Consequently, class

certification is warranted only if EUCPs "actually *prove*—not simply plead—that their proposed

class satisfies each requirement of Rule 23, including (if applicable) the predominance requirement

of Rule 23(b)(3)." *Halliburton Co. v. Erica P. John Fund, Inc.*, 573 U.S. 258, 275 (2014); *see also*

Dancel v. Groupon, Inc., 949 F.3d 999, 1005 (7th Cir. 2019) ("Rule 23 is more than a mere

pleading standard"); *Retired Chicago Police Ass'n v. City of Chicago*, 7 F.3d 584, 596 (7th Cir.

1993).

As the Rule 23 requirements are "stringent" and "exclude most claims," *Am. Exp. Co. v.*

Italian Colors Rest., 570 U.S. 228, 234 (2013), "certification is far from automatic." *In re Rail*

Freight Fuel Surcharge Antitrust Litig., 725 F.3d 244, 249 (D.C. Cir. 2013).[37] A class action "may

only be certified if the trial court is satisfied, after a rigorous analysis, that the prerequisites [to

certification] have been satisfied." *Gen. Tel. of the Sw.*, 457 U.S. at 161. "The decision whether

to certify a class is one that depends on a careful assessment of the facts, of potential differences

among class members, of management challenges, and of the overall importance of the common

issues of law or fact to the ultimate outcome." *Riffey v. Rauner*, 910 F.3d 314, 318 (7th Cir. 2018);

Swan v. Bd. of Educ. of Chicago, 2013 WL 4047734, at *4. To conduct this analysis, courts must

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[37] EUCPs attempt to side-step their burden to establish common, class-wide impact by claiming
that they are entitled to some "presumption" or "inference" of class-wide impact. (Mot. at 26 &
fn. 120.) This is incorrect and attempts to turn Rule 23 on its head. As the Supreme Court and the
Seventh Circuit have made clear, "Rule 23 does not set forth a mere pleading standard. A party
seeking class certification must affirmatively demonstrate his compliance with the Rule . . . ."
(*Kleen Prods. LLC v. Int'l Paper Co.*, 831 F.3d 919, 922 (7th Circ. 2016) (quoting *Wal-Mart*
Stores, Inc. v. Dukes, 564 U.S. 338,350 (2011). The court "must therefore take a careful look at
the evidence that the [plaintiffs] present[] in support of class certification…." *Id.* Where antitrust
plaintiffs have not satisfied this burden, courts have denied certification. *See*, *e.g.*, *Reed v.*
Advocate Health Care, 268 F.R.D. 573, 581-82 (N.D. Ill. 2009).

"probe behind the pleadings" and conduct a "rigorous analysis" of the law and facts. *See Comcast Corp. v. Behrend*, 569 U.S. 27, 33 (2013) (citation omitted).

Simply put, Plaintiffs' proposed class would be a "nightmare of a class action." *Issacs v. Sprint Corp.*, 261 F.3d 679, 681-82 (7th Cir. 2001). Not surprisingly, courts have denied certification to many end-user antitrust class like the proposed EUCP class. [38]

II. EUCPS FAIL TO ESTABLISH PREDOMINANCE

A critical requirement of Rule 23(b)(3) is the showing that "common proof will predominate with respect to each . . . element[] of [Plaintiffs'] claims," including antitrust impact and resulting damages. *Reed*, 268 F.R.D. at 581 (citations omitted). In particular, "Plaintiffs must affirmatively show how common evidence and a single, reliable methodology will prove [these] element[s] on a simultaneous, class-wide basis." *In re Steel Antitrust Litig.*, 2015 WL 5304629 at *5 (N.D. Ill. 2015). If putative class members would need to present varying evidence regarding

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[38] The long list of end-user/end-payor cases in which courts ***denied*** class certification includes: *In re Aluminum Warehousing Antitrust Litig.*, __ F.R.D. __, 2020 WL 4218329 (S.D.N.Y. July 23, 2020); *In re Epipen Epinephrine Injection.*, No. 17-md-2785-DDC-TJJ, 2020 WL 1180550 (D. Kan. Mar. 10, 2020); *In re Intuniv Antitrust Litig. (Indirect Purchasers)*, No. 1:16-CV-12396-ADB, 2019 WL 3947262 (D. Mass. Aug. 21, 2019); *In re Asacol Antitrust Litig.*, 907 F.3d 42 (1st Cir. 2018); *In re Thalomid & Revlimid Antitrust Litig.*, No. CV 14-6997, 2018 WL 6573118 (D.N.J. Oct. 30, 2018); *Vista Healthplan, Inc. v. Cephalon, Inc.*, No. 2:06-CV-1833, 2015 WL 3623005 (E.D. Pa. June 10, 2015); *In re Skelaxin (Metaxalone) Antitrust Litig.*, 299 F.R.D. 555, 572 (E.D. Tenn. 2014); *In re Florida Cement & Concrete Antitrust Litig.*, 278 F.R.D. 674, 686 (S.D. Fla. 2012); *Sheet Metal Workers Local 441 Health & Welfare Plan v. Glaxosmithkline, PLC*, No. CIV.A. 04-5898, 2010 WL 3855552, at *31 (E.D. Pa. Sept. 30, 2010); *In re Intel Corp. Microprocessor Antitrust Litig.*, No. CA 05-485-JJF, 2010 WL 8591815, at *28–35 (D. Del. July 28, 2010); *In re Flash Memory Antitrust Litig.*, No. C 070086 SBA, 2010 WL 2332081, at *19 (N.D. Cal. June 9, 2010); *Somers v. Apple, Inc.*, 258 F.R.D. 354, 361 (N.D. Cal. 2009); *In re Graphics Processing Units Antitrust Litig.*, 253 F.R.D. 478, 507 (N.D. Cal. 2008); *In re K-Dur Antitrust Litig.*, No. CIV.A. 01-1652 (JAG), 2008 WL 2660723, at *8–14 (D.N.J. Mar. 27, 2008); *California v. Infineon Techs. AG*, No. C 06-4333 PJH, 2008 WL 4155665, at *13 (N.D. Cal. Sept. 5, 2008); *In re Fresh Del Monte Pineapples Antitrust Litig.*, No. 1:04-MD-1628RMB, 2008 WL 5661873, at *5 (S.D.N.Y. Feb. 20, 2008); *Am. Seed Co. v. Monsanto Co.*, 238 F.R.D. 394, 402 (D. Del. 2006); *In re Relafen Antitrust Litig.*, 225 F.R.D. 14, 28 (D. Mass. 2004); *In re Methionine Antitrust Litig.*, 204 F.R.D. 161, 167 (N.D. Cal. 2001).

an essential question, then that question is not common. *Messner v. Northshore Univ. HealthSystem*, 669 F.3d 802, 815 (7th Circ. 2012); *see also Suchanek v. Sturm Foods, Inc.*, 764 F.3d 750, 756 (7th Cir. 2014) ("Where the defendant's allegedly injurious conduct differs from plaintiff to plaintiff . . . no common answers are likely to be found."). Critical to assessing predominance is whether the essential questions can be resolved without a "highly individualized inquiry." *Riffey*, 910 F.3d at 319.

Here, Plaintiffs have not established (and cannot establish) predominance for several independent reasons. First, Plaintiffs' flawed economic model cannot show class-wide antitrust impact; rather, given the many nuances that Plaintiffs' Motion and model ignore, individualized inquiries will overwhelm any common questions of impact. Second, Plaintiffs' damages model cannot show damages on a class-wide basis for the same reasons that Plaintiffs cannot show common proof of antitrust impact. Finally, Plaintiffs cannot establish predominance, or superiority, because they fail to account for or manageably address multiple substantive conflicts in the laws of the 25 jurisdictions that govern their claims.

A. Dr. Sunding's Flawed Model Cannot Show Common Proof of Antitrust Impact

To establish predominance for antitrust impact in this case, Plaintiffs must offer a "common methodology for proving that prices increased on a class-wide, rather than individual, basis." *In re Steel*, 2015 WL 5304629, at *9. This common methodology must offer a "reliable" means for determining impact. *Reed*, 268 F.R.D. at 582. The methodology must be based on record evidence, not speculation or conjecture of an expert. *In re Plastic Additives*, 2010 WL 3431837, at *4, *6 (E.D. Pa. Aug. 31, 2010). The court must "take a hard look at the soundness of statistical models that purport to show predominance." *In re Steel*, 2015 WL 5304629, at *9; *In re Lamictal Direct Purchaser Antitrust Litigation*, 957 F.3d 184,193-94 (3rd Circ. 2020) (the

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court must "scrutinize the evidence to determine what was credible and could be used in the expert analysis;" this scrutiny may include "multi-leveled microeconomic analysis of what each Defendant would or would not have possibly done in the but-for world"); *In re Rail Freight Fuel Surcharge*, 725 F.3d at 255("Rule 23 not only authorizes a hard look at the soundness of statistical models that purport to show predominance—the rule commands it"). A flawed statistical model cannot support class certification because it "measures harm not attributable to the conspiracy, yields false positives, masks uninjured class members by using an 'averaging' mechanism to allocate injury across the class, or otherwise fails to demonstrate with scientific rigor that classwide impact can be established through common proof." *In re Aluminum Warehousing Antitrust Litig.*, No. 14-cv-3116-PAE, 2020 WL 4218329, at *41 (S.D.N.Y. July 23, 2020) (citations omitted).

Here, Plaintiffs assert that they offer "a three-part common proof of impact based on the

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████████████████████████████████ None of Plaintiffs' "three-prongs" suffice to establish predominance as to antitrust impact. Rather, Plaintiffs' purported "common methodology" fails for several different reasons.

1. Dr. Sunding's Impact Analysis Violates *Comcast*

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████████████████ At its core, Plaintiffs' theory is that EUCP class members suffered overcharges due to Defendants' alleged conspiracy, which consisted of three primary components: (i) an agreement by Defendants to cut supply beginning in 2008; (ii) other methods by some Defendants

to "stabilize output and inflate prices," such as manipulating the Georgia Dock index; and (iii) Defendants' sharing of information through Agri Stats. (*See* Mot. at 7-18). However, █

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██ As the Supreme

Court emphasized in *Comcast Corp. v. Behrend*, translating "the *legal theory of the harmful event into an analysis of the economic impact of that event*" is a foundational requirement for modeling

alleged class-wide impact. 569 U.S. 27, 38 (2013) (emphasis in original). Here, ████████

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██████████████████████████████████ In light of this disconnect from

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Plaintiffs' theory of harm, Dr. Sunding's model does not and cannot show common impact to the class. *See Comcast*, 569 U.S. at 35 ("at the class-certification stage…any model supporting a 'plaintiff's damages case must be consistent with its liability case, particularly with respect to the alleged anticompetitive effect of the violation'" (citation omitted)).

2. Dr. Sunding's Impact Analysis Does Not Isolate Unlawful Conduct

Even if Dr. Sunding's model was tied to Plaintiffs' theory of harm (which it is not), it is fundamentally flawed and unreliable because it does not establish a *causal connection* between any alleged production cuts and overcharges in the Class Period. A methodology offered to assess antitrust impact must causally link purported impact to the allegedly anticompetitive conduct at issue. Here, ██

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Importantly, ███████████████████████████████████████

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██ In other words, ██

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[41] ██ is improper
expert testimony. Defendants will fully address all of the bases on which Dr. Sunding's opinions
should be excluded in their forthcoming motion to exclude.

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3.   Dr. Sunding's Overcharge Model is Fundamentally Unreliable

Dr. Sunding's overcharge model is unreliable because it does not (and cannot) show common impact across direct purchasers. Without a reliable method of showing impact to direct purchasers, there can be no reliable method of showing impact to EUCPs. ██████████████

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Dr. Sunding's overcharge model fails for another reason. ███████████████

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████████████████████████████ *In re Aluminum Warehousing Antitrust Litig.*, 2020 WL 4218329,

at *48. Specifically, ███

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██ Without overcharges for large numbers of

direct purchasers, there can be no overcharges for them to "pass through" to any EUCPs.

For this very reason, in complex markets which involve individualized factors such as

negotiations and discounts – like the ones present here – courts have found that utilizing averages

is *not* an acceptable way to establish predominance for antitrust impact. *See In re Lamictal*, 957

F.3d at 194 (averages operate to "mask individualized injury" that bar predominance); *see also,*

e.g., *In re Aluminum Warehousing Antitrust Litig.*, 2020 WL 4218329, at *48, *53-54 (rejecting

impact model's attempt to "elide[]" complexities in the data through averaging as unreliable and

incapable of proving common impact); *Reed*, 268 F.R.D. at 590-91 ("Measuring average base

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wage suppression does not indicate whether each putative class member suffered harm from the alleged conspiracy. . . it is not a methodology common to the class that can determine impact with respect to each class member."); *Exhaust Unlimited, Inc. v. Cintas Corp.*, 223 F.R.D. 506, 513-14 (S.D. Ill. 2004) (no predominance where "only individual inquiry could account for" factors including "var[iation] over time . . . customer needs, supplier costs, and other factors affecting market price, and would depend on the mix of products and services being considered"); *Blades v. Monsanto Co.*, 400 F.3d 562, 573(8th Circ. 2005) (similar).

4. Dr. Sunding's Pass-Through Model is Fundamentally Unreliable

Even assuming Dr. Sunding's model could reliably show common impact across direct purchasers (which it cannot), Dr. Sunding's "pass-through" model does not provide a reliable, common method for showing impact to EUCPs. First, ▮▮▮▮▮▮

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██ *See In re Graphics Processing Units*

Antitrust Litig., 253 F.R.D. at 505 (denying class certification where pass-through analysis was

flawed); *In re Fla. Cement*, 278 F.R.D. at 684-85 (denying class certification where pass-through

analysis did not account for variations); *In re Bridgestone/Firestone Tires Prods. Liab. Litig.*, 288

F.3d 1012 (7th Cir. 2002) (reversing grant of class certification where putative class members had

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purchased numerous different products, in a complex distribution chain with variations in pricing, discounts, and other factors).[43]

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████████████████████████ issues regarding pass-through cannot possibly predominate. *See In re Graphics Processing Units Antitrust Litig.*, 253 F.R.D. at 505; *In re Hydrogen Peroxide Antitrust Litig.*, 552 F.3d 305, 314 (3d Cir. 2008) (certification inappropriate where the need to incorporate a "multitude of different variables" to determine customers' impact "defeat[s] any reasonable

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notion of proof common to the class").[46]

B. Dr. Sunding's Damages Model Cannot Show Damages on a Class-Wide Basis

In analyzing predominance, a court must also "see if there is a classwide method for proving damages, and if not, whether individual damage determinations will overwhelm the common questions on liability and impact." *Kleen Products LLC*, 831 F.3d at 929; *see also In re Rail Freight Fuel Surcharge Antitrust Litig.*, 292 F. Supp. 3d 14, at 142 (D.D.C. 2017) ("At this stage [] the Court must determine whether plaintiffs have shown by a preponderance of the evidence that there is a reliable means of proving class-wide damages.").[47] Plaintiffs fail on both counts.

First, Plaintiffs fail to provide a reliable method to show damages on a class-wide basis for the same reasons they cannot show common impact. As explained above, ███████████████

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[46] While the Plaintiffs' argue that *Messner* and *Kleen Products* support certification even in the face of these profound individualized questions, they misapply those cases. *Messner* and *Kleen* did not involve the use of a fundamentally flawed and unreliable methodology to show class-wide impact, as here. In fact, those defendants had not even challenged the plaintiffs' proposed methodologies as unreliable. *See Messner*, 669 F.3d at 823-24; *Kleen Products*, 831 F.3d at 922. And while Plaintiffs urge that *Messner* allowed certification of a class alleging antitrust injury in a complex industry with differentiated contracts, the *Messner* plaintiffs' model specifically accounted for and incorporated those complexities—rather than eliding and averaging them out, like Plaintiffs here do. *See Messner*, 669 F.3d at 819-20. As for *Kleen*, the court made clear that "the Defendants' price increases were not tailored to each individual purchaser," a fact that stands in stark contrast to the multi-level price and pass-through variation observed here. *Kleen Products*, 831 F.3d at 925.

[47] While Plaintiffs urge that some individualized proof of damages is not an obstacle to class certification (Motion at 41), this does not obviate the need to establish a class-wide method of proving damages or the need to show that any such individualized proof will not overwhelm common questions. *See Kleen Products*, 831 F.3d at 929. Moreover, even if some individualized proof of damages does not defeat class certification standing alone, it is a factor to consider in the predominance analysis. *See In re Aluminum Warehousing Antitrust Litig.*, 2020 WL 4218329, at *36.

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"method for calculating their individualized damages other than having hundreds, or even thousands, of individualized hearings." *Dailey v. Groupon, Inc.*, 2014 WL 4379232, at *9 (N.D. Ill. Aug. 27, 2014); *see also Riffey*, 910 F.3d at 319 ("[H]ow much money each individual class member is entitled to recoup—is particularly ill-suited for class treatment, because it depends on a myriad of factors particular to each individual [class member]."); *In re Fluidmaster, Inc., Water Connector Components Prods. Liab. Litig.*, 2017 WL 1196900, at *58 (E.D. Ill. March 31, 2017) (declining to certify class and finding predominance issues where indirect purchasers "tr[ied] to prove damages through averages").[48] In short, the EUCPs' proposed damages model is "clearly inadequate." *Reed*, 268 F.R.D. at 595.

Second, without a reliable method of showing class-wide damages through common proof, it is clear that "individual damage determinations will overwhelm the common questions." *See Kleen Products*, 831 F.3d at 929; *see also Reed*, 268 F.R.D. at 595 (denying class certification where "[t]he amount of damages suffered by each [class] plaintiff will necessitate individualized

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inquiries"); *Espenscheid v. DirectSat USA, LLC*, 705 F.3d 770, 773 (7th Cir. 2013) (holding that class certification was improper where no "mechanical, formulaic" damages calculation was possible). ███

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    The damages analysis would be f███████████████████████████████

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███████████████████████████████████ These individual damages inquiries would undoubtedly and "inevitably overwhelm questions common to the class." *Comcast*, 569 U.S. at 34.

C.   EUCPs Cannot Show Predominance Or Superiority Because Of Substantive Variations In The Many State Laws Governing Their Claims

EUCPs request that this Court certify a class asserting claims under materially different state antitrust, consumer protection and unjust enrichment laws from 25 different jurisdictions. This includes claims under the antitrust statutes of 20 states plus the District of Columbia, claims under the consumer protection statutes of 12 states plus the District of Columbia, and claims under common-law unjust enrichment laws of 23 states plus the District of Columbia. However, EUCPs have not even attempted to show how they can establish predominance or superiority and/or avoid individualized inquiries given the variations among the state laws. They do not even address the unjust enrichment laws at all, thus waiving the issue. Despite the fact that the laws under which EUCPs have asserted their claims vary materially from state to state, EUCPs have made no effort to address any such differences and have not sustained their burden of proving predominance or superiority.

EUCPs falter right out of the gate in trying to meet their burden to show how their claims under the 25 different states' laws do not present problems with predominance. In a motion for class certification involving numerous state laws, "the party seeking certification must provide an ***extensive analysis*** of state law variations to address whether the differences in law pose insuperable obstacles." *Doster Lighting, Inc. v. E-Conolight, LLC*, No. 12-C-0023, 2015 WL 3776491, at *15 (E.D. Wis. June 17, 2015) (emphasis added); *see* also *In re Ford Motor Co. Ignition Switch Prods. Liab. Litig. v. Ford Motor Co.*, 174 F.R.D. 332, 349 (D.N.J. 1997); *Vista*, 2015 WL 3623005, at *36-40. EUCPs do not even attempt to carry their burden on this point. EUCPs instead list cherry-picked language from the 21 antitrust statutes and related case law, and claim that those states "have an antitrust or consumer statute that harmonizes with the federal Sherman Act, ensuring that the core questions of liability will be proved with common evidence."

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(Mot. at 44). Providing no analysis of the differences among the state antitrust statutes, EUCPs offer the broad, sweeping, and unsupported statement that "[t]he similarity of these statutes demonstrates predominance under Rule 23(b)(3)." (Mot. at 44). EUCPs do not even identify the consumer protection laws upon which their claims are based, let alone offer any "extensive analysis" of the state consumer protection statures and how those statutes differ.[49] Nor do EUCPs make *any* mention at all of their unjust enrichment claims. EUCPs' efforts to address the state law variations fall woefully short of the extensive analysis required to demonstrate predominance. *See Vista*, 2015 WL 3623005, at *35 (denying class certification where plaintiffs' accounting of state law variances was "not comprehensive and glosse[d] over important differences").

An analysis of the substantive variations in the many state laws governing Plaintiffs' claims reveals that EUCPs cannot demonstrate predominance or superiority. In fact, courts have denied indirect purchaser class certification due (in part) to state law variations in cases involving fewer states/state laws than those alleged by EUCPs. *See, e.g., In re Domestic Drywall Antitrust Litig.*, 2017 U.S. Dist. LEXIS 135758, *46-49 (E.D. Pa. Aug. 24, 2017) (denying class certification for indirect purchasers who brought claims under antitrust, consumer protection and unjust enrichment laws of 11 states).

"Variations in state law may swamp any common issues and defeat predominance." *Grandalski v. Quest Diagnostics, Inc.*, 767 F.3d 175, 180 (3d Cir. 2014) (citation omitted). Even if the law "differ[s] among the states only in nuance . . . nuance can be important," creating significant case management problems such as "differing state pattern [jury] instructions" and

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[49] There are four states—Florida, Hawaii, Massachusetts, and South Carolina—where EUCPs only bring a consumer protection statute claim and not a state antitrust claim. Put differently, they make absolutely no mention of the state laws of these four states under which they purport to proceed.

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"differing judicial formulations." *In re Rhone-Poulenc Rorer, Inc.*, 51 F.3d 1293, 1300 (7th Cir. 1995). As such, courts have long held that class certification is not proper "unless all litigants are governed by the same legal rules." *In re Bridgestone/Firestone, Inc.*, 288 F.3d at 1015, 1015.

At the outset, this Court would have to analyze—for each putative class member—which state's law governs their claims based on their individual chicken purchases over seven years. See *Georgine v. Amchem Prods., Inc.,* 83 F.3d 610, 627 (3d Cir. 1996), *aff'd sub nom Amchem Prods., Inc. v. Windsor*, 521 U.S. 591 (1997) ("[B]ecause we must apply an individualized choice of law analysis to each plaintiff's claims, the proliferation of disparate factual and legal issues is compounded exponentially." (citation omitted)). ██████████████████████████

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██ Moreover, given that not all of these jurisdictions fall within EUCPs' proposed class, the claims relating to purchases in those jurisdictions would need to be excluded. These individualized inquiries, which are incompatible with Rule 23's predominance requirement, would have to be repeated for each putative class member just to determine which state's substantive law applies.

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1. There Are Material Variations Among The Twenty-One Jurisdictions' Antitrust Laws

Even a cursory review of the state antitrust laws shows significant variations among the substantive laws of the many jurisdictions at issue. (*See* Mot. at App. B). For example, only some of the state antitrust laws relied upon by Plaintiffs require that the alleged conspiracy had a substantial effect on intrastate commerce. *Compare Conergy AG v. MEMC Elec. Materials, Inc.*, 651 F. Supp. 2d 51, 61 (S.D.N.Y. 2009) (requiring an effect on "intrastate commerce" under New York's Donnelly Act, N.Y. Gen. Bus. L. § 340(1)); N.C. Gen. Stat. Ann. § 75-1 (prohibiting antitrust conduct "in the State of North Carolina"), *with Arthur v. Microsoft Corp.*, 267 Neb. 586, 597 (Neb. 2004) (Nebraska antitrust law "provide[s] consumers with protection against unlawful practices in the conduct of any trade or commerce which directly or indirectly affects the people of Nebraska"); Or. Rev. Stat. Ann. § 646.715 (explaining that Oregon's antitrust law applies to "intrastate trade or commerce, and to interstate trade or commerce").[51] Because the necessary nexus between alleged conduct and effect varies from one jurisdiction to another, this Court would have to apply differing legal standards in an individualized, unmanageable process.

Similarly, there are critical differences among state antitrust laws with respect to defenses, damages, and duplicative recovery. Several jurisdictions limit or even eliminate recovery when an alleged overcharge has been passed through multiple levels of distribution. *See, e.g.*, *Clayworth v. Pfizer, Inc.*, 233 P.3d 1066, 1086 (Cal. 2010) (permitting a "pass on defense" where "multiple levels of purchasers have sued" for the same antitrust conspiracy); N.Y. Gen. Bus. Law § 340(6)

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[51] *See also, e.g.*, 6 R.I. Gen. Laws Ann. § 6-36-7(c) ("No action or proceeding instituted pursuant to the provisions of this chapter shall be barred on the ground that the activity or conduct complained of in any way affects or involves foreign commerce."); Me. Rev. Stat. tit. 10 § 1101; S.D. Codified L. § 37-1-3.1 to -3.2; S.D. Codified L. § 37-1-3.1; *id.* § 37-13.2; *Freeman Indus., LLC v. Eastman Chem. Co.*, 172 S.W.3d 512, 522-24 (Tenn. 2005).

("[A] defendant shall be entitled to prove as a partial or complete defense to a claim for damages that the illegal overcharge has been passed on to others who are themselves entitled to recover so as to avoid duplication of recovery of damages."). This defense is particularly important here because ███

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███████ But the availability of this defense is not uniform across the 21 jurisdictions implicated by Plaintiffs' state antitrust claims. This nuance further impedes class adjudication of these claims.

There is also variability in the statutes of limitations that would apply. For example, Maine has a six-year statute of limitations; California, Michigan, North Carolina, New Hampshire, and New York have a four-year statute of limitations; and Kansas has a three-year limitations period. *Compare* Me. Rev. Stat. Ann. § 752, *with* Cal. Bus. & Prof. Code § 16750.1; MCLA § 445.781; N.H. Rev. Stat. § 356.12; N.Y. Gen. Bus. Law § 340(5); N.C. Gen. Stat. § 75-16.2, *and with* Kan. Stat. Ann. § 60-512. Even if Plaintiffs could rely on the discovery rule to extend the statute of limitations, reliance on "equitable tolling to save [some of] their claims . . . presents an individual question of law and fact that could predominate over common questions under Rule 23(b)(3)" and therefore precludes class certification. *In re Cmty. Bank of N. Va. & Guaranty Nat'l Bank of Tallahassee Second Mortg. Loan Litig.*, 622 F.3d 275, 294 (3d Cir. 2010).

> ### 2. There Are Substantive Differences Between The Jurisdictions' Consumer Protection Laws

EUCPs also ignore material differences among the 13 consumer protection laws at issue. "State consumer-protection laws vary considerably, and courts must respect these differences rather than apply one state's law to sales in other states with different rules." *In re Bridgestone/Firestone, Inc.*, 288 F.3d at 1018; *see also In re Grand Theft Auto Video Game*

Consumer Litig., 251 F.R.D. 139, 147 (S.D.N.Y. 2008) ("Most of the courts that have addressed the issue have determined that the consumer-fraud . . . laws in the fifty states differ in relevant respects."); *Thompson v. Jiffy Lube Int'l, Inc.*, 250 F.R.D. 607, 625 (D. Kan. 2008) ("[T]here are significant differences among the States' consumer protection laws.").

For instance, "[t]he amount of damages recoverable for a consumer protection violation varies from state to state." *Thompson*, 250 F.R.D. at 625. These key differences mean that Plaintiffs' claims would need to be treated individually, overwhelming common issues. *See In re Epipen* , 2020 WL 1180550, at *54 (D. Kan. Mar. 10, 2020) ("The differences among state consumer protection statutes are significant, they present individual issues, and they overwhelm common questions."). The intent required to prove the allegedly unfair or deceptive act—a potentially dispositive difference in the elements of the claim—also varies among the 13 jurisdictions implicated here. *See Vista*, 2015 WL 3623005, at *36, *40 ("[t]he states vary considerably in their formulation of the intent a plaintiff must prove."). For instance: Utah requires that the act be done "knowingly or intentionally[;]" New Mexico requires that the act be done "knowingly." *Id.* at *36. These differences, too, would overwhelm common issues.

States also apply different standards in determining what qualifies as prohibited conduct under their particular statutes. *See In re Epipen,* 2020 WL 1180550, at *55-57 (denying certification of consumer protection damages class). For example, Florida uses a multifactor test, weighing whether the practice offends public policy or the common law; whether it is immoral, unethical, oppressive, or unscrupulous; and whether it substantially injures consumers. *Id.* at *55 & n.61; *Vista*, 2015 WL 3623005, at *36-37. Nebraska, New Hampshire, and New Mexico apply

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other standards, which are even different from one another, to define prohibited unfair conduct.[52] *In re Epipen*, 2020 WL 1180550, at *55 & n.63. And within California, there is intrastate disagreement about the applicable test. *Id.* at *55 & n.65. Ultimately, these nuanced differences across multiple aspects of the 13 jurisdictions' consumer protection laws create individualized issues and make class adjudication unmanageable. *See In re Processed Egg Prods. Antitrust Litig.*, 312 F.R.D. 124, 143(E.D. Pa. 2015) (rejecting plaintiffs' "attempt[] to place 21 square pegs into a single round hole, asking the Court to envision 21 statewide classes under the antitrust laws of 21 states, the consumer protection laws of seven states, and the unjust enrichment laws of 17 states, all tried in a single proceeding as if it were a nationwide class under federal antitrust law").

3. Plaintiffs Compound The Problem By Bringing Unjust Enrichment Claims Under The Laws of Twenty-Four Jurisdictions

While EUCPs allege in their Complaint that Defendants were unjustly enriched according to the common law of 24 different jurisdictions, EUCPs ***do not even mention their unjust enrichment claims*** in their Motion. For that reason alone, certification of EUCPs' unjust enrichment claims should be denied.[53] If the Court does consider certification of the unjust

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[52] Specifically, Nebraska requires the plaintiff asserting a Nebraska Consumer Protection Act claim to "prove that the practice either '(1) fell within some common-law, statutory, or other established concept of unfairness or (2) was immoral, unethical, oppressive, or unscrupulous.'; New Hampshire applies "the rascality test"…[which] requires that "the objectionable conduct ... attain a level of rascality that would raise an eyebrow of someone inured to the rough and tumble of the world of commerce; and New Mexico's Unfair Trade Practices Act specifically defines the conduct prohibited…"an act or practice ... that to a person's detriment: (1) takes advantage of the lack of knowledge, ability, experience or capacity of a person to a grossly unfair degree; or (2) results in a gross disparity between the value received by a person and the price paid. *See In re Epipen* , 2020 WL 1180550, at n.63.

[53] *See Turner v. Micro Switch*, No. 98-cv-50276, 2001 WL 13255, at *8 n.5 (N.D. Ill. Jan. 3, 2001), *aff'd sub nom. Turner v. Honeywell, Micro Switch Div.*, 54 F. App'x 236 (7th Cir. 2002) (concluding that plaintiff's failure to request class certification waived class action allegations); *Alioto v. Town of Lisbon*, 651 F.3d 715, 721 (7th Cir. 2011) (explaining that "under our case law . . . a person waives an argument by failing to make it before the district court").

enrichment claims, certification should nonetheless be denied because the equitable claims depend on considerations unique to each individual EUCP and vary significantly among the jurisdictions.

In fact, courts have repeatedly held that "multi-state class actions for unjust enrichment are inappropriate." *Muehlbauer v. Gen. Motors Corp.*, 2009 WL 874511, at *5 (N.D. Ill. 2009); *see also Vega v. T-Mobile USA, Inc.*, 564 F.3d 1256, 1274 (11th Cir. 2009). Consequently, "[d]ue to the necessity of this inquiry into the individualized equities attendant to each class member, courts . . . have found unjust enrichment claims inappropriate for class action treatment." *Vega*, 564 F.3d at 1274. *See also Clay v. Am. Tobacco Co.*, 188 F.R.D. 483, 500 (S.D. Ill. 1999) ("Unjust enrichment is an equitable doctrine that . . . depends upon the analysis of each individual situation," and "requires individualized determinations."); *Vista*, 2015 WL 3623005, at *34–35 (finding that "common factual issues do not predominate as to [the] [p]laintiffs' proposed unjust enrichment class" and listing numerous courts that have found that unjust enrichment claims are inappropriate for class certification); *In re Epipen*, 2020 WL 1180550, at *57-58 ("[D]ifferences among state law definitions of unjust enrichment and its availability as a remedy make federal courts, in general, reluctant to certify a nationwide class on this theory"). As one court explained, "[e]ven if it could be said that [EUCPs'] general theory of liability for unjust enrichment, (i.e., that [the defendant] was unjustly enriched when class members paid expenses [defendant] should have paid), is uniform among class members, individual questions remain about whether a particular [member of the proposed class] actually incurred any such expenses." *Commander Props. Corp. v. Beech Aircraft Corp.*, 164 F.R.D. 529, 540 (D. Kan. 1995) (denying class certification). EUCPs cannot overcome this need for individualized inquiry.[54]

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[54] Courts have also concluded that "unjust enrichment [classes] are fraught with procedural and choice-of-law problems that . . . preclude certification." *In re Aqua Dots Prods. Liab. Litig.*, 270

Plaintiffs' varying unjust enrichment claims would quickly devolve into mini trials about which elements apply to any particular class member. For example, 6 of the 24 unjust enrichment laws relied upon by Plaintiffs (Hawaii, Massachusetts, Minnesota, North Carolina, Tennessee, and Utah) require a showing that there is no adequate remedy at law. *See Vista,* 2015 WL 3623005 at *27. Moreover, 11 of the 24 (California, Florida, Kansas, Maine, Massachusetts, Nevada, New Mexico, North Carolina, Tennessee, Utah, and Wisconsin) require a showing that the defendant appreciates or has knowledge of the benefit obtained from their improper conduct. *Id.* at *29. Some states also have materially different statutes of limitations for unjust enrichment; for example, Kansas has a three-year limitations period running from "when the enrichment becomes unjust," while Michigan's is twice as long but runs from when the wrong occurred, regardless of when damage occurred. *See In re Epipen*, 2020 WL 1180550, at *58 & n.68. Again, as with their dozens of state antitrust and consumer protection claims, EUCPs introduce too much variability for class adjudication by invoking the laws of 24 jurisdictions on unjust enrichment.

4. Plaintiffs Have Failed To Demonstrate Manageability

EUCPs bear the burden of demonstrating manageability, and "a court cannot rely on assurances of counsel that any problems with predominance or superiority can be overcome." *In re Ford Motor Co. Ignition Switch Prods. Liab. Litig.*, 174 F.R.D. at 350 (citation omitted).

In light of the many material differences in the state laws, EUCPs have failed to demonstrate that class litigation would be manageable. *See Vista,* 2015 WL 3623005, at *35 (finding that "the variations in state law also render[ed] class litigation unmanageable"). In fact,

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F.R.D. 377, 385 (N.D. Ill. 2010); *Vulcan Golf, LLC v. Google Inc.*, 254 F.R.D. 521, 533 (N.D. Ill. 2008) (collecting cases rejecting multi-state unjust enrichment class).

EUCPs offer no "trial plan" at all and make no effort to demonstrate manageability.[55] Proceeding without such a plan is also fatal as it fails to protect Defendants' Seventh Amendment to a jury trial and Due Process rights. *In re Rhone-Poulenc Rorer, Inc.*, 51 F.3d 1293, 1303 (7th Cir. 1995); *see also In re Loestrin 24 Fe Antitrust Litig.*, 410 F.Supp.3d 352, 403 (D.R.I. 2019) (denying certification of end payor class where the plaintiffs failed to show that their "proposed adjudication" was "protective of defendants' Seventh Amendment and due process rights") (citation omitted).

III.   EUCPS' CLASS DEFINITION CONTAINS A GREAT MANY UNINJURED CONSUMERS AND IS FATALLY OVERBROAD

EUCPs define their proposed class in an overly broad manner that includes a great many class members who could not have been harmed by the alleged conspiracy. This definitional defect cannot be cured through amendment.

An appropriate class definition "must be sufficiently definite to permit ascertainment of class members," but "not [] so broad as to include individuals who are without standing to maintain the action on their own behalf." *Oshana v. Coca-Cola Co.*, 225 F.R.D. 575, 580 (N.D. Ill. 2005) (citations omitted). Where the class definition is so broad that "'a great many' or 'a great number of' putative class members could not have been harmed by defendants' conduct, then the proposed class is too broad and should not be certified." *Riffey v. Rauner*, No. 10 CV 02477, 2016 WL 3165725, at *4 (N.D. Ill. June 7, 2016), *aff'd*, 873 F.3d 558 (7th Cir. 2017), *cert. granted, judgment*

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vacated, 138 S. Ct. 2708, 201 L. Ed. 2d 1094 (2018), and *aff'd*, 910 F.3d 314 (7th Cir. 2018); *see Williamson v. S.A. Gear Co.*, No. 15-CV-365-SMY-DGW, 2018 WL 2735593, at *4–5 (S.D. Ill. June 7, 2018). Although "[t]here is no precise measure for 'a great many,'" the determination is "a matter of degree, and will turn on the facts as they appear from case to case." *Clark v. Bumbo Int'l Tr.*, 2017 WL 3704825, at *4 (E.D. Ill. August 28, 2017).

When a class definition is as "breathtaking in its scope" as that proffered here, *Spano v. The Boeing Co.*, 633 F.3d 574, 586 (7th Cir. 2011), it should come as no surprise that it includes a great many putative class members that could not have been harmed by the alleged conduct. EUCPs contend that the class would encompass millions of people. *See* Mot. at 20. It would include people that bought chicken from sources as disparate as big-box retailers with a global footprint, regional supermarket chains, and even local family-owned grocery stores. These sources, in turn, purchased many different products, in different volumes, under many different pricing mechanisms, from different Defendants (or combinations of Defendants), at different points in time. This is the veritable definition of an unworkably broad class definition.

As explained above, ██████████████████████████████

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no doubt that the EUCPs' class definition "would sweep in countless people who would never have

standing," certification should be denied. *In re Fluidmaster*, 2017 WL 1196900, at *46 (N.D. Ill.

Mar. 31, 2017); *see also Riffey,* 2016 WL 3165725, at *4; *In re Yasmin & Yaz,* 2012 WL 865041, at

*15 (S.D. Ill. Mar. 13, 2012).[57]

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[57] Other courts have denied certification where there were even smaller amounts of uninjured class members. *See, e.g.*, *Vista*, 2015 WL 3623005 at *20-21 (denying class certification based, in part, on a finding that at least 5% of the putative class was uninjured); *In re Intuniv* 2019 WL 3947262, at *7 (denying certification where defendants' expert showed that at least 8% of the putative class members were uninjured); *In re Asacol* , 907 F.3d at 53-54 (reversing grant of class certification where more than 10% of the putative class members were uninjured brand loyalists); *In re Thalomid & Revlimid* , 2018 WL 6573118, at *14 (denying class certification where 10% of the putative class was uninjured); *In re Rail Freight Fuel Surcharge Antitrust Litig.*, 934 F.3d 619, 623-25 (D.C. Cir. 2019) (affirming denial of class certification where plaintiffs' model showed that 12.7% of the putative class members did not experience overcharges).

This "is not a case in which a very small absolute number of class members might be picked off in a manageable, individualized process at or before trial." *In re Asacol,* 907 F.3d at 53-54. Even if EUCPs attempted to amend the class definitions so as to exclude the numerous members who could not have been harmed, any such amended definitions would require an onerous, unmanageable inquiry that would defeat one of the main purposes of class adjudication—efficiency. *See Clark*, 2017 WL 3704825, at *2-4 (rejecting request to amend overly broad class definition because it suffered from more than "a 'minor' overbreadth problem").[58]

Plaintiffs do not even address the overbreadth issues with their proposed class. Instead, they simply claim that the class is somehow ascertainable because "a class member may self-identify simply by looking at the class definition." (Mot. at 44-45). As explained, above, however, simply "self-identify[ing]" as a person who purchased whole birds or breast meat products does not even begin to answer the question of whether that consumer could have incurred an overcharge

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[58] As explained above,

on her purchases.[59] Instead, the court would still need to engage in multiple individual inquiries

just to weed out the uninjured class members.

      Moreover, EUCPs' attempt to show they have somehow "done more" by claiming that █

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[59] EUCPs' reliance on *Mullins,* and the assertion that self-serving class member affidavits would suffice, ignore the right that Defendants would have to challenge such declarations and the claims by class members as to the essential elements of injury and causation. Defendants would reserve the right to challenge such affidavits, resulting in potentially "millions" of mini trials.

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IV. EUCPS FAIL TO ESTABLISH TYPICALITY AND ADEQUACY

As a result of their multiple legal theories and different factual circumstances, EUCPs are unable to satisfy Rule 23's requirements of typicality and adequacy. *See* Fed R. Civ. P. 23(a)(3)-(4). To satisfy typicality, "there must be enough congruence between the named representative's claim and that of the unnamed members of the class to justify allowing the named party to litigate on behalf of the group." *Dvorak v. St. Clair Cty.*, 2018 U.S. Dist. LEXIS 10585, at *13 ((S.D. Ill. January 23, 2018) (citation omitted). The "adequacy requirement is satisfied when the named representative has 'a sufficient interest in the outcome of the case to ensure vigorous advocacy' and 'does not have interests antagonistic to those of the class.'" *Id.* at 19 (citation omitted). "The 'presence of even an arguable defense peculiar to the named plaintiff or a small subset of the plaintiff class may destroy the required typicality of the class as well as bring into question the adequacy of the named plaintiff's representation.'" *Id.* at 13 (quoting *CE Design Ltd. v. King Architectural Metals, Inc.*, 637 F.3d 721, 726 (7th Cir. 2011)). Put differently, "[f]or class certification, it is not enough for [a named plaintiff] to demonstrate that [it] *could* prevail at trial; rather, [the named plaintiff] must demonstrate, at the very least, [it] is as well-positioned to prevail as an ordinary member of the putative class." *Al Haj v. Pfizer Inc.*, 2020 WL 13330367, at *4 (N.D. Ill. Mar. 23, 2020).

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[62] There are numerous additional problems with Mr. Azari's opinion. For example, ███████

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███████████████████████████████████████ Defendants will address the myriad flaws with Mr. Azari's opinion in a forthcoming motion to exclude.

The named plaintiffs here cannot advance the same factual and legal arguments as the putative class—indeed, even the class representatives are differently situated from one another, and their claims would present unique issues that diverge from the interests of the putative class.

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████████ *See, e.g.*, *Mowry v. JP Morgan Chase Bank, N.A.*, 2007 WL 1772142, at *3-4 (N.D. Ill. June 19, 2007) ("close friend" of class counsel for 6 years inadequate); *Susman v. Lincoln Am. Corp.*, 561 F.2d 86, 91 (7th Cir. 1977) ("Courts also have expressed fear as to the danger of champerty because of the close relationship between the putative class representative and counsel."); *Martz v. PNC Bank, N.A.*, 2007 WL 2343800, at *4 (W.D. Pa. Aug. 15, 2007). For both of these reasons, ███████████████████████████████████████ those claims

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should be dismissed. *See In re Dairy Farmers of Am., Inc. Cheese Antitrust Litig.*, 2013 WL 4506000, at *8 (N.D. Ill. Aug. 23, 2013).

Second, ███

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██████████████████████████ Because these behaviors create defenses "peculiar to [such] named plaintiff," they "destroy[s] the required typicality of the class." *CE Design Ltd.*, 637 F.3d at 726; *see also Retired Chicago Police Ass'n*, 7 F.3d at 597-98 (where class representative was not subject to the same allegedly injurious treatment as the putative class, typicality not established).

Third, the named plaintiffs exhibit a variety of unique purchasing behaviors that distinguish them from members of the putative class. ████████████████████████████

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████████████████████████████████████ Similarly, as noted above, ████

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████████████████████████████████████ These unique defenses render each of these named Plaintiffs an inadequate representative. *See Randall v. Rolls-Royce Corp.*, 637 F.3d

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818, 824 (7th Cir. 2011) ("named plaintiffs who are subject to a defense that would not defeat unnamed class members are not adequate class representatives.").[66]

Finally, it is not clear that EUCPs are capable of identifying the nature, location, quantity, or price of their chicken purchasing over the years—further undermining the typicality of their claims. ██

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███████████   This is just another reason why they fail to demonstrate that they "can advance the same factual and legal arguments" as putative class members. *Mace v. Van Ru Credit Corp.*, 109 F.3d 338, 341 (7th Cir. 1997).

CONCLUSION

For the reasons stated above, Plaintiffs' Motion should be denied. Defendants respectfully request the Court to set a hearing on EUCPs' Motion.

DATED: January 22, 2021

<div style="text-align:right">

Respectfully submitted,
VENABLE LLP
By: /s/ *J. Douglas Baldridge*
J. Douglas Baldridge (#437678)
Lisa Jose Fales (admitted *pro hac vice*)
Danielle Foley (admitted *pro hac vice*)
Andrew Hernacki (admitted *pro hac vice*)
600 Massachusetts Avenue, NW
Washington, DC 20001
Telephone: (202) 344-4000
Facsimile: 202-344-8300
jdbaldridge@venable.com
ljfales@venable.com
drfoley@venable.com
athernacki@venable.com
Attorneys for Defendants Perdue Farms, Inc. and Perdue Foods LLC

</div>

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DEFENDANTS' ATTORNEYS

WEIL GOTSHAL & MANGES LLP

By: */s/ Carrie C. Mahan*
Carrie C. Mahan (#459802)
Christopher J. Abbott (#1014487)
2001 M Street N.W., Ste. 600
Washington, D.C. 20036
Telephone: (202) 682-7000
Facsimile: (202) 857-0940
carrie.mahan@weil.com
christopher.abbott@weil.com

Pravin R. Patel (#0099939)
Brian G. Liegel (#0119269
1395 Brickell Avenue, Ste. 1200
Miami, FL 33131
Telephone: 305-577-3100
pravin.patel@weil.com
brian.liegel@weil.com

EIMER STAHL LLP

Michael L. McCluggage (#01820966)
224 South Michigan Avenue, Ste. 1100
Chicago, IL 60604
Telephone: (312) 660-7665
Facsimile: (312) 692-1718
mmccluggage@eimerstahl.com

*Attorneys for Defendant Pilgrim's Pride
Corporation*

VENABLE LLP

By: /s/ *J. Douglas Baldridge*
J. Douglas Baldridge (#437678)
Lisa Jose Fales (admitted *pro hac vice*)
Danielle Foley (admitted *pro hac vice*)
Andrew Hernacki (admitted *pro hac vice*)
600 Massachusetts Avenue, NW
Washington, DC 20001
Telephone: (202) 344-4000
Facsimile: 202-344-8300
jdbaldridge@venable.com
ljfales@venable.com
drfoley@venable.com
athernacki@venable.com

FALKENBERG IVES LLP

Kirstin B. Ives
30 N. LaSalle St., Ste 4020
Chicago, IL 60602
Telephone: (312) 566-4803
Facsimile: (312) 566-4810
kbi@ffilaw.com

*Attorneys for Defendants Perdue Farms, Inc.
and Perdue Foods LLC*

By: /s/ *John W. Treece*
John W. Treece (#3122889)
1135 West Montana Street
Chicago, IL 60614
Telephone: (312) 961-7808
jtreece@jwtreece.com

ROSE LAW FIRM

Amanda K. Wofford (admitted *pro hac vice*)
Bourgon Reynolds (admitted *pro hac vice*)
120 East Fourth Street
Little Rock, Arkansas 72201
Telephone: (501) 375-9131
Facsimile: (501) 375-1309
awofford@roselawfirm.com
breynolds@roselawfirm.com

*Attorneys for Defendants Mountaire Farms
Inc., Mountaire Farms, LLC and Mountaire
Farms of Delaware, Inc.*

MAYER BROWN LLP

By: /s/ *Carmine R. Zarlenga*
Carmine R. Zarlenga (#90784529)
William H. Stallings (admitted *pro hac vice*)
Stephen M. Medlock (admitted *pro hac vice*)
Oral D. Pottinger (admitted *pro hac vice*)
1999 K Street N.W.
Washington, DC 20006
Telephone: (202) 263-3000
Facsimile: (202) 263-3300
czarlenga@mayerbrown.com
wstallings@mayerbrown.com
smedlock@mayerbrown.com
opottinger@mayerbrown.com

*Attorneys for Defendant Foster Farms, LLC
and Foster Poultry Farms, a California
Corporation*

NOVACK AND MACEY LLP

By: /s/ *Stephen Novack*
Stephen Novack
Stephen J. Siegel
Christopher S. Moore
100 North Riverside Plaza
Chicago, IL 60606
Telephone: (312) 419-6900
Facsimile: (312) 419-6928
snovack@novackmacey.com
ssiegel@novackmacey.com
cmoore@novackmacey.com

Attorneys for Defendants Koch Foods Incorporated, JCG Foods of Alabama LLC, JCG Foods of Georgia LLC and Koch Meat Co., Inc.

VEDDER PRICE P.C.

By: /s/ *Gregory G. Wrobel*
Gregory G. Wrobel (#3122900)
222 N. LaSalle Street
Chicago, IL 60601
Telephone: (312) 609-7722
Facsimile: (312) 609-5005
gwrobel@vedderprice.com

JORDAN PRICE WALL GRAY JONES & CARLTON, PLLC

Henry W. Jones, Jr. (admitted *pro hac vice*)
1951 Clark Avenue
Raleigh, NC 27605
Telephone: (919) 828-2501
Facsimile: (919) 834-8447
hjones@jordanprice.com

Attorneys for Defendant House of Raeford Farms, Inc.

KIRKLAND & ELLIS LLP

By: /s/ *Daniel E. Laytin, P.C.*
Daniel E. Laytin, P.C.
Christa C. Cottrell, P.C.
Stacy Pepper
300 North LaSalle Street
Chicago, IL 60654
Telephone: (312) 862-2000
Facsimile: (312) 862-2200
dlaytin@kirkland.com
ccottrell@kirkland.com
stacy.pepper@kirkland.com

Attorneys for Defendants Sanderson Farms, Inc., Sanderson Farms, Inc. (Foods Division), Sanderson Farms, Inc. (Processing Division), and Sanderson Farms, Inc. (Production Division) and Liaison Counsel for Defendants

PROSKAUER ROSE LLP

By: /s/ *Christopher E. Ondeck*
Christopher E. Ondeck (admitted *pro hac vice*)
Stephen R. Chuk (admitted *pro hac vice*)
1001 Pennsylvania Ave., NW, Ste 600 South
Washington, DC 20004
Telephone: (202) 416-6800
Facsimile: (202) 416-6899
condeck@proskauer.com
schuk@proskauer.com

Attorneys for Wayne Farms LLC

62

KUTAK ROCK LLP

By: /s/ *John P. Passarelli*
John P. Passarelli (admitted *pro hac vice*)
James M. Sulentic (admitted *pro hac vice*)
1650 Farnam Street
Omaha, NE 68102
Telephone: (402) 346-6000
Facsimile: (402) 346-1148
john.passarelli@kutakrock.com
james.sulentic@kutakrock.com

J.R. Carroll (admitted *pro hac vice*)
Jeffrey M. Fletcher (admitted *pro hac vice*)
234 East Millsap Road, Ste 200
Fayetteville, AR 72703-4099
Telephone: (479) 973-4200
Facsimile: (479) 973-0007
jr.caroll@kutakrock.com
Jeffrey.fletcher@kuakrock.com

Kimberly M. Hare (#6323326)
One South Wacker Drive, Ste 2050
Chicago, IL 60606-4614
Telephone: (312) 602-4100
Facsimile: (312) 602-4101
kimberly.hare@kutakrock.com

Attorneys for Defendants O.K. Foods, Inc.,
O.K. Farms, Inc., and O.K. Industries, Inc.

EDWARD C. KONIECZNY LLC

By: */s/ Edward C. Konieczny*
Edward C. Konieczny (admitted *pro hac vice*)
400 Colony Square, Ste 1501
1201 Peachtree Street, NE
Atlanta, GA 30361
Telephone: (404) 380-1430
Facsimile: (404) 382-6011
ed@koniecznylaw.com

SMITH, GAMBRELL & RUSSELL, LLP

David C. Newman (admitted *pro hac vice*)
W. Parker Sanders (admitted *pro hac vice*)
1230 Peachtree Street, N.E.
Promenade, Ste 3100
Atlanta, GA 30309
Telephone: (404) 815-3500
Facsimile: (404) 815-3509
dnewman@sgrlaw.com
psanders@sgrlaw.com

James L. Thompson
Lynch Thompson LLP
150 S. Wacker Drive, Suite 2600
Chicago, IL 60606
T: (312) 445-4623
F: (312) 896-5883
jthompson@lynchthompson.com

Attorneys for Defendants Mar-Jac Poultry,
Inc.

63

VAUGHAN & MURPHY

By: /s/ *Charles C. Murphy, Jr.*
Charles C. Murphy, Jr. (admitted *pro hac vice*)
690 S Ponce Court NE
Atlanta, GA 30307
Telephone: (404) 667-0714
Facsimile: (404) 529-4193
cmurphy@vaughanandmurphy.com

WINSTON & STRAWN LLP

James F. Herbison
Michael P. Mayer
35 West Wacker Drive
Chicago, Illinois 60601
Telephone: (312) 558-5600
Facsimile: (312) 558-5700
jherbison@winston.com
mmayer@winston.com

Attorneys for Defendant Norman W. Fries, Inc. d/b/a Claxton Poultry Farms

HOGAN LOVELLS US LLP

By: /s/ *William L. Monts III*
William L. Monts III (admitted *pro hac vice*)
Justin W. Bernick (admitted *pro hac vice*)
555 Thirteenth Street, N.W.
Washington, D.C. 20004-1109
Telephone: (202) 637-5910
Facsimile: (202) 637-5911
william.monts@hoganlovells.com
justin.bernick@hoganlovells.com

MILLER, CANFIELD, PADDOCK, AND STONE P.L.C.

Jacob D. Koering
225 West Washington Street, Ste 2600
Chicago, Illinois 60606
Telephone: (312) 460-4272
Facsimile: (312) 460-4201
koering@millercanfield.com

Attorneys for Defendant Agri Stats, Inc.

64

SHOOK HARDY & BACON LLP

By: /s/ *Lynn H. Murray*
Lynn H. Murray
111 S. Wacker Dr., Ste 4700
Chicago IL 60606
Telephone: (312) 704-7700
Facsimile: (312) 558-1195
lhmurray@shb.com

Laurie A. Novion
2555 Grand Blvd.
Kansas City, MO 64108
Telephone: (816) 474-6550
Facsimile: (816) 421-5547
lnovion@shb.com

CONNER & WINTERS

John R. Elrod
Vicki Bronson (admitted *pro hac vice*)
4375 N. Vantage Drive, Ste. 405
Fayetteville, AR 72703
Telephone: (479) 582-5711
jelrod@cwlaw.com
vbronson@cwlaw.com

Attorneys for Defendant Simmons Foods, Inc.
and Simmons Prepared Foods Inc.

EVERSHEDS SUTHERLAND (US) LLP

By: /s/ *Patricia A. Gorham*
James R. McGibbon (admitted *pro hac vice*)
Patricia A. Gorham (admitted *pro hac vice*)
Peter M. Szeremeta (admitted *pro hac vice*)
Kaitlin A. Carreno (admitted *pro hac vice*)
Dylan de Fouw (admitted *pro hac vice*)
999 Peachtree Street, N.E., Ste 2300
Atlanta, Georgia 30309-3996
Telephone: (404) 853-8000
Facsimile: (404) 853-8806
jimmcgibbon@eversheds-sutherland.com
patriciagorham@eversheds-sutherland.com
peterszeremeta@eversheds-sutherland.com
katilincarreno@eversheds-sutherland.com
dylandefouw@eversheds-sutherland.com

SMITH AMUNDSEN LLC

Ronald Balfour
150 N. Michigan Avenue, Ste 3300
Chicago, Illinois 60601
Telephone: (312) 894-3369
Facsimile: (312) 997-1816
rbalfour@salawus.com

Attorneys for Defendant Harrison Poultry,
Inc.

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CERTIFICATE OF SERVICE

I hereby certify that on January 22, 2021 a true and correct copy of the foregoing document was electronically filed with the Clerk of the Court using CM/ECF system, which will send notification of such filing to all counsel of record.

/s/ J. Douglas Baldridge.

J. Douglas Baldridge

EXHIBIT 17

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Time Series Forecast Analysis in Wholesale Broiler Markets

Christopher R. Sims
University of Arkansas, Fayetteville

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Time Series Forecast Analysis in Wholesale Broiler Markets

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Agricultural Economics

by

Christopher R. Sims
University of Arkansas
Bachelor of Science in Agricultural Food and Life Sciences, 2015

December 2017
University of Arkansas

This thesis is approved for recommendation to the Graduate Council.

_____
Dr. H. L. Goodwin, Jr.
Thesis Director

_____   _____
Dr. Andrew M. McKenzie   Dr. Rodolfo N. Nayga
Committee Member   Committee Member

_____
Dr. Bruce L. Dixon
Committee Member

Abstract

In 2016 the chicken industry provided nearly 1.2 million jobs, 68 billion dollars in wages, 313 billion dollars in economic activity and 24 billion dollars in government revenue (John Dunham & Associates, Inc., 2016). Broiler production has changed dramatically from the early 90's to the turn of the 21st century. Technological advancements, continuous improvements, production efficiencies and industry changes have made the industry the global market it is today. The poultry industry is an extremely volatile market with prices constantly fluctuating in response to input price volatility and demand and supply changes. These changes are often driven by world economic conditions which impacts the roughly 20% of U.S. production that is exported. Due to these variations, accurate forecasting of poultry prices is difficult.

Economic modeling is complex at best; this paper examines a comparison between vector autoregression (VAR) and autoregressive (AR) techniques. Urner Barry average monthly northeast wholesale poultry parts price data was used for this research. Parts analyzed are; drumstick (DRUM), jumbo boneless skinless breast tender out (BSBTO), leg quarter (LQ), thigh (THIGH), small wing (SMWING), jumbo wing (JMWING), tender (TENDER) and whole bird without giblets weighing 2 ¼ lbs. (WOG). This modeling will focus on the technical aspects of modeling to initiate a strong foundation for further research. Key fundamental aspects are discussed to give economical understanding of the challenges the broiler industry faces. This research concludes that AR modeling is superior to VAR modeling techniques.

It is important for the broiler industry to understand pricing strategies for contracts with food retail operators[1]. Price forecasting has the potential to help poultry companies increase their

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[1] Food retail operators are business within the foodservice industry such as McDonalds, Kentucky Fried Chicken, Taco Bell, and Sonic.

returns on revenue. Wholesale broiler parts today are extensively further processed and value added today than in previous years. This causes the wholesale price to have little influence in processors determined price within contracts. Knowing price interaction will allow processors to determine alternate cuts of meat that can be substituted for products during times of high prices.

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Dedication

I would like to dedicate my thesis to my family and friends that have been my supporters throughout the entire process. I am forever greatful for their profound support, words of encourangement, and always being there for me.

Special thank you to my family for their support as I became the first college graduate from our family, and continued my education through my masters program. Their continuous support and guideance throughout school and life has left me with many lessons that I will never forget. They have pushed me to be successful in everything that I do and continue to always be looking forward for constant progress in life.

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Section I - Introduction

Current Pricing Situation and Importance

Poultry companies have evolved their pricing strategy with the ever-changing market and consumer base and have expanded their product portfolios beyond traditional whole/rotisserie chicken, 8-piece cut-up[2], and tray pack[3]. The chicken business has expanded beyond only retail customers to encompass foodservice establishments as well. In the 80's companies began to see a shift of consumers wanting further processed value-added[4] products. The shift comes from changes in consumers taste, preferences, and lifestyles.

The U.S. broiler industry is rapidly evolving from where it was 15, 10 and even 5 years ago, at the turn of the century. It has grown to have a global presence. Issues that affect the industry now have an even bigger impact than before. Companies have evolved with the help of technological advancements to increase production and efficiencies. Broiler industry expansion has been growing at an increasing rate and is important to the United States economy. Over the years, broiler consumption rose slowly and in 1993 surpassed individual consumption of beef or pork (National Chicken Council, 2017). In the decade of the 90's, ready to cook (RTC) broiler[5] pounds produced increased nearly 10 billion pounds (National Chicken Council, 2017). Consumers' behaviors began to change with their tastes and preferences, prompting the increase in broiler consumption.

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[2] This refers to the way a bird is cut-up and offered to consumers. Two of each of the following pieces comes from the bird once cut-up; breast halves, wings, thighs, and drums. (United States Department of Agriculture, 2000).

[3] Poultry that is fresh packed on a tray and then individually wrapped tightly with a plastic film. (Dawson, 2008).

[4] Further processed value added food products have been changed physically in a way to enhance the value of the original product. (University of Maryland Extension, 2017).

[5] Processed young poultry and its parts which are ready to be cooked with very little additional preparation (The Poultry Site, 2003)

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In the 50's there were over 200 broiler companies. By the 90's and early 2000's, several acquisitions and mergers had been completed within the industry. By 2000, there were fewer than 50 companies and as of 2017 there were only about 35. WATT PoultryUSA's January 2001 issue discusses the time of acquisitions for the industry as the top three companies slowly gained more share of the total industry (WATT Poultry, 2001). 2001 was a big year for the industry because numerous acquisitions occurred. Vertical integration has also been key to processors becoming more efficient in cost savings and production as they are today, continuing to give rise to the number of acquisitions within the industry. Increases in production efficiencies have allowed the development of more wholesale and retail product cuts to be offered.

"For decades, producers made their money on the front half of the bird but lost money on the back half," said Bill Roenigk, senior vice president and economist with the National Chicken Council (Business Insider, 2012). This began changing in the 1990s as the industry found new markets for the back half in Russia, Asia, and Latin America (Business Insider, 2012). Americans overwhelmingly desire white meat chicken portions over dark meat. This means the excess dark meat portions are exported out of the United States. Thus, white meat chicken parts are the drivers behind the pricing of all parts. In the past, consumers strongly preferred breast meat. In research conducted by Goodwin et al., investigating the usefulness vector autoregression models to explain chicken part pricing, they found "strong evidence suggests a significant price relationship between boneless skinless breast (BSB) and the whole carcass without giblets (WOG). Shocks in the BSB market have a great effect on WOG market prices compared with price shocks resonating within dark meat markets" (Goodwin, Jr., McKenzie, & Djunaidi, p. 483-495, 2003). Breast meat has led the pricing strategy for all other parts. However, over the years, volatility in prices of all parts has been increasing and consumer

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preferences are shifting to alternate chicken products. Parts pricing is extremely important for processors to understand when negotiating contract base prices with customers. Prices are listed by unbiased third party vendors, which give integrators (Pilgrim's Pride, Tyson Foods, Perdue, etc.) a benchmark, which they use to base their formula price on when determining customers' contract prices. Third-party vendors give integrators a full perspective of overall market potential and the market's direction to inform future price negotiations.

Problem Statement

Broiler parts prices are in a constant state of price volatility due to external factors playing a crucial role in final parts pricing. Thus, accurately forecasting broilers prices into the future is difficult and with no consensus on the preferred forecast method. Better understanding the price interaction of broiler parts could change the way processors market individual parts. Being able to more accurately forecast broiler prices into the future would than other companies would provide the broiler company an added advantage for revenue growth and market capture. If such forecasts were public and shared among the involved parties, price discovery should become more efficient. More accurate price predictions also give broiler companies better directionality for further growth and internal strategies.

In economics, vector autoregression (VAR) models are commonly used as basis for building forecast models (Smith, Carter, & Rausser, 2017). Smith et al., utilize VAR models and "find partially identified VAR models to be a fruitful avenue for future research in price analysis" for market effects of biofuels (Smith, Carter, & Rausser, 2017). VAR model specifications require identifying the relevant variables chosen and the number of lags to use. Numerous factors play crucial roles in determining broiler prices. Some factors have an indirect relationship but still affect prices. The large market shares of chicken products the industry has in

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the foodservice category makes it extremely difficult to forecast prices, since prices are arranged by private negotiation and not reported publicly. Further processed, value-added products are extremely hard to connect back to the wholesale price of individual broiler parts due to the additional costs involved in making the changes necessary to produce the final products. This research compares VAR and single equation autoregressive (AR) models for relative forecasting accuracy. Both VAR and AR require selecting specifications of variables and lag lengths to analyze compare forecasting performance for each. Since AR models area subset of VAR models, the comparison essentially asks if the greater complexity of the VAR gives VAR an advantage over the simpler AR.

Objectives

Economic modeling approaches for the broiler industry are important and useful. The main thesis objective is to give insight into price forecasting for the broiler industry, thus allowing broiler companies to have a better understanding of how to interpret possible pricing strategies when negotiating contracts with food retail operators. Specific objectives include to: 1) Re-evaluate the VAR and AR modeling techniques used by McKenzie, Goodwin and Carreira to include updated Urner Barry wholesale parts pricing through May of 2017. A comparison using autoregressive (AR) versus vector autoregression (VAR) models will determine the superior modeling approach. 2) Determine if findings in McKenzie et al., still hold true given the changes the industry has undergone in responding to consumer demand. 3) If the findings differ, what does the new model suggest about changes in the industry? 4) Finally, determine if a specific broiler part drives all other parts prices.

Section II – Literature Review

Broiler Production and History in United States

> *Historical Background*

Over a century ago, poultry farms were found on most all rural and many urban properties. The broiler industry began in the early 1900's with individual back yard hobby farms. Broiler meat was originally considered a byproduct from chickens with eggs being the key product. A few people started to sell chickens to help supplement their income on the side. In the late 20's and early 30's individuals start to have larger flocks of birds to sell for meat consumption. During this time, we see the rise of entrepreneurs with expansion of poultry farms throughout the Midwest states. "Mrs. Wilmer Steele of Sussex County, Delaware, is often cited as the pioneer of the commercial broiler industry. In 1923, she raised a flock of 500 chicks intended to be sold for meat. Her small business was so profitable, by 1926, Mrs. Steele was able to build a broiler house with a capacity of 10,000 birds" (National Chicken Council, 2012).

Between the 1940's and 1960's the broiler industry started to slowly take form. Birds were typically sold as "New York dressed," with just the blood and feathers removed. Broiler producers at this time had no single source for obtaining resources. With businesses growing, individuals began selling their own broilers. During the 1940's individuals began to start their own hatcheries, feed mills, and processing plants; entrepreneurs came in and started buying and consolidating to have ownership of every integral part of production. In the late 1940's policy, technology, market and production changes resulted in an increase in broiler meat sales. Now, the industry still focused on both egg and meat sales. In 1942, an Illinois plant was the first to gain government approval of "on-line" evisceration to pack birds into ice-filed containers. This change led to the government considering food safety programs. In 1949, the United States

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Department of Agriculture (USDA) launched a voluntary program of grading birds to give consumers assurance of a high-quality product.

Entrepreneurs began to buy key entities for the industry to form into the 'vertical integration of today. Before this, all key broiler industry parts were owned by separate individuals, which resulted in higher costs. In 1952, the broiler industry became more commercialized, starting an economic boom for its participants. The classic meat chicken now known as the 'broiler bird' became the primary source for meat consumption. In the 1960's vertical integration became more widespread and slowly became the industry norm, strengthening the broiler industry and allowing companies to take advantage of resources not previously available. Utilizing brand names began, precipitating the vast number of chicken products are marketed under brand names today.

In the 1970's the broiler industry began the full transition into what it is today. Implementation of new technology, genetic improvement, production efficiencies, and automation allowed the industry to make the significant improvements. Technology and automation allowed the industry to begin offering consumers cut-up parts in the form of tray pack. By 1980, consumers started to change their product preferences, preferring more available cut-up and further-processed product options instead of the traditional whole or tray pack bird. Consumers wanted the bird to be broken down into more options for them to buy. It is during this time the industry gained a crucial insight about consumers -- they are willing to pay a premium for further-processed products, accelerating evolution of value-added businesses. The industry began to change and develop with technology allowing production efficiency gains to continue. Industry expansion in the 1990's, along with consumer's taste and preference changes transformed the broiler market to become even more intricate and developed.

Technological advancements allowed consumers to become increasingly aware about how and where their food was produced. In 1998, the USDA required Hazard Analysis and Critical Control Points[6] (HAACP) to be implemented within processing plants to increase food safety and quality (National Chicken Council, 2012). Over the past 15 years the broiler industry has become even more efficient, consolidated and expanded globally.

Economic Importance to the United States

The broiler industry is significant to the United States economy. In 2016 the industry provided nearly 1.2 million jobs, 68 billion dollars in wages, 313 billion dollars in economic activity and 24 billion dollars in government revenue (John Dunham & Associates, Inc., 2016). This assessment includes all job classifications that are tied to the industry in one-way or another. Sales totaled nearly 48 billion dollars in 2015. The broiler industry alone accounts for 60 percent of the 48 billion dollars (National Agricultural Statistics Service, 2016). Yearly production has increased to just surpass nearly 40 billion pounds produced in 2016 (National Chicken Council, 2017). "World meat consumption, according to OECD and FAO projections is expected to average 36.3 kg in retail weight by 2023, an increase of 2.4 kg as compared with 2013" (The Poultry Site, 2015). Approximately 72 percent of the overall meat consumption increase is estimated to come from an increase in poultry consumption.

The USDA Economic Research Service publishes a monthly report giving an outlook on the livestock, dairy, and poultry industries. In the April 2017 publication, it states "February broiler production and exports increased from last year, and higher-than-expected prices in late-March led to upward revisions for the price forecast" (Haley & Jones, 2017). Broiler exports for

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[6] HACCP is a management system where food safety is addressed through the analysis and control of products in all forms from acquiring the product until final consumption by consumer (U.S. Food & Drug Administration, 2017).

2017 are up roughly 2 percent from 2016 with the driver being exports to South Africa; which, were up nearly 25 million pounds, which passes the recent record level.

Industry Evolution and Company Structure

In the early to mid-90s, a shift in company structure occurred such that individual contract production farms expanded and smaller farms slowly stopped production. The accelerated pace of vertical integration of the integrator companies led to increases in food safety and quality assurance, efficiencies, and cost reduction throughout the process. Vertical integration also resulted in a regional shift of production to the South and Midwest states. In 1995 approximately, 83 percent of farms producing poultry were in the Northeast, Appalachia, Southeast, Delta, and Corn Belt regions (Perry, Banker, & Green, 1999). Warmer parts of the country with easier access to water means lower expenses incurred by the grower. Vertical integration, larger farms and legal changes have all caused integrators to create contracts for the growers.

In the industry, today, the clear majority of individual broiler growers (over 95 percent) work with an integrator through independent contract arrangements. The contract system allows individual growers to have access to an outlet for their production outputs along with the technical guidance from experts in the industry. Contracts have since shaped how a grower enters the industry and receives compensation and provided guidance for production limitations, equipment and facilities upgrades and management responsibilities. Contracts formalize the entire production and processing interfaces and provide specific agreement parameters between the producers and the processors. In 1995 there were approximately 49,716 farms producing poultry or eggs which totaled 14.5 billion dollars -- nearly 17 percent of the total value of all livestock commodities produced (Perry, Banker, & Green, 1999).

"In 1980 the top 20 poultry companies processed 64 percent of broilers for the industry. Between 1990 and 2000, market share of the top three integrators jumped just over 5 percent from 35.47 percent to 40.50 percent. In 2000 the top 20 companies produced 86 percent of the broilers slaughtered" (WATT Poultry, 2001). In the early 2000's the following major acquisitions or agreements continued to change the industry:

> Tyson Foods Inc. acquires IBP
>
> ConAgra acquires Seaboard Corporation
>
> Pilgrim's Pride acquires WLR, Inc.
>
> Cargill acquires Agribrands
>
> JBS acquires Pilgrim's Pride
>
> Bachoco acquires OK Foods
>
> Peterson Farms & Wayne Farms sign a managerial agreement, which formed the company now known as Crystal Lake Foods, LLC.

In a 2009 interview, WATT Poultry USA asked economist Dr. Paul Aho to describe the poultry company of 2017 and how it will be different from today (Thornton, 2009).

> I think there will be two kinds of poultry companies in the future. There will be a few very large companies of the type we see developing today and also a number of smaller players that may be very different from today's poultry companies. There will be three or four national companies that market coast to coast with a product line in every market Those companies will take 60 percent to 70 percent of the market There may also be a couple dozen-niche players with 30 percent to 40 percent of the market Those companies could be quite different from the poultry companies we've seen up till now. Some of them may not be completely vertically integrated; some of them will be selling very specific products only to very specific markets. Some of the most unusual changes will be coming about in those surviving niche players. The traditional, vertically integrated, full-product-line companies with only one plant may be on the way out. Replacing them will be companies of the same size but with niche products.

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Today, broiler companies have shifted their focus to building longevity for the company. Some companies solely focus on producing broilers while others pursue a strategy of becoming global food providers. Product offerings now consist of a variety of portfolios. A few companies now produce other proteins (red meat) and alternative proteins (utilizing plants) as well as complementary bakery items. Having product variety allows companies to reach more consumers based on the companies' overall strategy. The multitude of different products allows companies to broaden their brand portfolio to customers. Consumers continue to drive the direction of change for producers. Today's integrators are balancing the consumer's fast-paced and life style integration approach in their product development. Consumers' ever-changing life styles shape the products that find their way into the market This constant change results in challenges processors currently face today, ranging from antibiotic use to animal welfare to nutritional labeling. These challenges have become a more prevalent topic as the industry expands globally.

Exports

In 1991, a government sponsorship between the United States and Soviet Union marked the beginning of exports for broiler leg quarters, with a vigorous trade with the Former Soviet Union, primarily Russia, continuing through the next decade. In 2001, U.S. poultry exports skyrocketed accounting for nearly 20 percent of U.S. production amounted to over 2 billion dollars (National Chicken Council, 2012). The United States is the second largest chicken meat exporter next to Brazil. The United States and Brazil accounted for approximately 76 percent of global exports of chicken by 2005. "In 2009 broiler exports went down 2 percent as Russian quotas limited access to the country's market (The Poultry Site, 2010)". As productivity in the U.S. agriculture industry continued to grow, it did so at a faster rate than domestic demand,

prompting U.S. farmers and industries to rely heavily on export markets to keep prices at a

sustainable market level (Economic Research Service, 2017).

Global exports are expected to increase nearly 4 percent in 2017 due to the expansion of

the United States and Brazil shipments (Foreign Agricultural Service, 2017). The European

Union will see their exports decline roughly 8 percent in 2017 due to highly pathogenic avian

influenza (HPAI) trade restrictions (Foreign Agricultural Service, 2017). HPAI outbreaks in

China make it difficult for producers to obtain the popular poultry genetic lines to produce

broilers there. AI has a greater susceptibility with older chickens such as layers[7] and original

genetic lines; therefore, AI outbreaks are causing China to increase their imports nearly 40

percent in 2017 (Foreign Agricultural Service, 2017).

The global broiler export market has dramatically evolved since its beginning in the early

90's due to efficiency, trade policies, population growth, relative price changes and exchange

rates. Each of these factors are constantly changing, making the export market more complex.

"U.S. broiler meat exports are projected to rise about 12 percent between 2013 and 2022" (Davis,

Harvey, Zahniser, Gale, & Liefert, 2013). Export market destinations continue to expand

globally. In 2012 the U.S. was exporting to approximately 150 countries. Technological

advancements and new trading opportunities have allowed the United States to increase export

market share. In 2017, the United States is forecasted to export approximately 16.9 percent of

broiler production or nearly 7 billion pounds (National Chicken Council, 2017). World markets,

economic growth, exchange rates, income, prices and governmental policies constantly affect the

United States and overall world trade (Economic Research Service, 2017).

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[7] Layer hens are kept for egg production. These birds are kept for approximately 2 to 3 laying cycles that consist of 60 to 65 weeks each (Clauer, 2017).

Global Influences

The industry continues to expand as producers provide more food for the ever-growing population. The exponential growth of global population means more food is needed. Chicken is one of the few proteins globally accepted regardless of religion, availability and purchase cost. A global presence for integrators means they must continually formulate new strategies. Genetic companies have started to strategically place primary genetic lines in countries outside their home bases (U.S., EU). One of the key parts of the overall pipeline is pedigree stock. Parent pedigree stock[8] is the beginning of the genetic pipeline; one female will produce approximately three million market broilers. Top broiler breeding companies have spread across different parts of the globe. This strategic move will help manage the threat of avian influenza (AI) outbreaks. Strategic placement helps to ensure the least, overall effect when a disease outbreak happens. Based on the severity of an AI outbreak, countries can enact import bans. AI results in not only trade bans but also affects production efforts. China is currently battling multiple strains of AI, resulting in increased imports (Foreign Agricultural Service, 2017).

Global broiler consumption is rising and forecasted to increase 1.6 percent year over year from 2013 to 2022 (The Poultry Site, 2014). Production of broiler meat will continue to increase; the FAO suggests all meat, including red, meat will increase to 57.7 million metric tons in 2023. Broiler production will account for nearly 28.3 million metric tons of the overall increase (WATT Global Media, 2015). Production will increase in regions of low-cost and slow in those of high-costs. There is on average enough chickens in the world for three per person at any given time (The Economist Online, 2009). Broiler meat has become a more available global protein

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[8] Pedigree stock are the primary and elite foundation, then great-grandparent, and grandparent birds. Grandparent flocks produce the final generation of breeding birds consisting of parent stock. Eggs from the parent stock hatch to become production birds for human consumption.

due to the industry's expansion. By 2020, Africa will experience a population growth of nearly

25 percent (Davis, 2015). This population growth will result in increased broiler consumption

resulting in industry growth in the region. Poultry's global presence allows it to continue to be

the top animal protein exchanged globally (Davis, 2015).

Exogenous Factors Influencing the Broiler Industry in the United States

Annual broiler production increased to just over 40 billion pounds produced in 2016

(National Chicken Council, 2017). "World per capita meat consumption, according to OECD

and FAO projections is expected to average 36.3 kg in retail weight by 2023, an increase of 2.4

kg as compared with 2013" (The Poultry Site, 2015). With this increase in overall meat

consumption, approximately 72 percent of the increase is estimated to come from broiler

consumption.

To fully understand the dynamic nature of the broiler industry, it is important to identify

relevant exogenous factors. The primary factors that have affected the industry structure,

profitability, and supply and demand include diseases, recession, and drought. Each of these

factors create different kinds of shocks which, affect the pricing of wholesale broiler parts. Each

will also cause different supply and demand shocks within the industry. The following three

sections give a brief overview of the effect each of these factors has had and delineate important

time periods when they have taken place. Each factor may cause a different price reaction.

Disease outbreaks and droughts tend to increase prices; however, with a recession prices may

well decrease due to lower disposable incomes available for value-added products. These

considerations help provide an understanding of how prices have been affected (Figures 1 and 2).

It is important to note this research focuses on technical aspects of price forecasting and not the

fundamental aspects. The above factors are fundamental but worth noting as a foundation and

understanding for price movement as a basis for the technical forecasting that comprises this thesis.

Disease Impacts

AI is a zoonotic disease to which domestic poultry are highly susceptible. AI is a naturally occurring virus in waterfowl, carried by migratory birds through their migratory pathways (CDC - Centers for Disease Control and Prevention, 2017). The virus sheds and can infect the broiler or broiler breeder and become either low pathogenic avian influenza (LPAI) or (HPAI). LPAI can cause decreases in weight gain and feed consumption. However, HPAI is much more extreme, causing mortality at 90 to 100 percent within 48 hours (CDC - Centers for Disease Control and Prevention, 2017). Once an 'outbreak' occurs, the poultry supply pipeline may be affected by quarantine, disposal or trade embargo. The resultant economic effects begin and can be serious to different degrees dependent upon whether the affected flocks are parent breeder stock or primary breeders.

At the turn of the 21st century, United States poultry exports jumped nearly 3 percent from 15.6 percent in 1999 to 18.0 percent in 2001 of total production; since that time, exports have fluctuated between 14 and 20 percent (National Chicken Council, 2017). During the beginning of 2015 there were over 150 confirmed cases of AI in backyard and commercial broiler and turkey flocks, impacting primarily the Upper Midwest and Western Corn Belt. An emergency economic impact analysis from the University of Minnesota Extension estimated approximately 309.9 million dollar impact in the Greater Minnesota area alone (Darke County Extension, 2015). Analysts estimated a ripple effect of approximately 1.8 million dollars in overall economic losses for each 1 million dollars in direct losses.

Due to the outbreaks, between January and April 2016, there was a 13 percent decline in poultry exports to partners with a trade ban as compared to the same time a year previously. Disease outbreaks cause a major impact on the global supply of poultry products. In 2017, global exports are forecasted to increase 4 percent from 2016, with most coming from Brazil due to the AI outbreaks in the United States. Thus, Brazil's total share of export volume is expected to grow by approximately 10 percent, while the United States' share of export volume is expected to grow by 4 percent (Foreign Agricultural Service, 2017).

Recession

Throughout the Great Recession, which began in December 2007 and ended in June of 2009, consumer's spending habits changed on how and where they spent discretionary income. During the tougher economic conditions consumers also ate out less; when they did eat out it was at cheaper locations (Reed & Crawford, 2014). During this period, total meat consumption dropped by approximately 9 percent; poultry accounted for nearly 6 percent of the decline (The Poultry Site, 2015). During this time, poultry companies began to alter focus on their product portfolio mix. They responded by enhancing their further processed value-added product offerings in retail and food service operations to account for volume that shifted to lower margin, lower service outlets. The recession was a hard time for consumers and integrators, and coincided with a period of high grain prices, which increased feed costs. Normally, during recessionary times there is a decrease in red meat consumption and an increase or at least maintained poultry consumption. However, during the period of high feed costs, there was a *per capita* decline of 2 pounds in annual poultry consumption. The only other time this happened was in the early 70's with the combination of the oil embargo, recession, and grain crisis (Aho, 2011).

During the Great Recession, 73 percent of consumers looked for alternative, cheaper cuts of meat (North American Meat Institute, 2010). Consumers had budget to afford protein but sought cuts they were not used to purchasing but were cheaper. The recession also led to a decline in agricultural exports and prices for U.S. produced commodities.

Drought

In addition to the negative impacts of the recession, weather-related disasters affected the poultry industry. For integrators, the exogenous costs of growing birds would typically affect the supply. Whole grains such as corn, barley, sorghum and wheat are extremely important to poultry diets. In 2009-2010 broiler production declined slightly while adjusting to rising feed costs; however, future projections point to increases in broiler production over the next few years (Economic Research Service, 2009). In the broader livestock industry, feed costs account for 50 to 60 percent of operating expenses; feed runs as much as 70 percent for broilers. Rising feed costs tighten integrators' profits. Such increase disproportionately affect other proteins, leaving poultry prices lower than red meat.

In the summer of 2012, drastic weather conditions caused the most severe drought the United States had experienced since the 1950's (Adonizio, Kook, & Royales, 2012). Drought caused corn prices to increase over 120 percent causing export prices to hit record levels. The United States is the world's largest exporter of corn. A major drop in corn production decreased global supply and raised prices.

"The government's forecast, based on consumer price index for food, estimated prices would rise 4 to 5 percent for beef in 2013 with slightly lower increases for pork, eggs, and dairy products" (Lowrey & Nixon, 2012). Bill Roegnik, National Chicken Council, told Congress in 2014 "the chicken industry is one drought away from another economic crisis due to the corn

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supply volatility" (Johnston, 2014). Crop price volatility plays a crucial role for the poultry

industry, which is why crop supply and demand play a key role in the broiler pricing strategy.

Market Structure

Food producers are now being challenged by the food retail operators to be more

efficient, reduce food costs, and create new products through innovation as a result of increasing

consumer pressure. Consumers drive the market based on their buying decisions and consumer

preferences have been changing. Consumers in the United States only spend approximately 6.4

percent of their household income on food (Gray, 2016) and in 2015; approximately 34.4 cents

of every dollar consumers spent went to foodservice establishments (Economic Research

Service, 2017). Currently the United States does not import any poultry products; this is

attributed to the comparative advantage generated by production technology (Poultry

Technology Center).

Consumption of broiler meat is on the rise globally, but is affected by the income status

of households and prices and availability of other competitive proteins. "Among low-income

household's dark meat, such as chicken leg quarters, is preferred. Consequently, the higher value

cuts and added-value items are mainly purchased by the middle and high-income groups" (The

Poultry Site, 2014). If poultry remains relatively inexpensive, its consumption will continue to

rise—particularly in developing countries. Product development for integrators has been crucial

to expanding their offerings to consumers. Since 2000, consumers have preferred products that

are value-added and further processed. Some companies have shifted to become diversified food

production companies rather than only broiler companies. A survey by National Chicken Council

revealed 65 percent of consumers bought packaged boneless skinless breasts in 2003 and 30

percent purchased bone-in chicken (Benwick, 2004).

Food Safety and Awareness

Production and processing advancements in the broiler industry have led companies to drive innovation through new product creation. In 1949, the USDA started a voluntary program of grading broiler to assure consumers of high-quality products (National Chicken Council, 2012). The first HACCP program was instituted when Pillsbury Company created products for NASA. In 1971, Pillsbury presented the HACCP concept to the FDA at a national conference. The FDA started to slowly implement parts of the HACCP program to low acid food regulations in 1974. During the 70's *Clostridium Botulinum* poisoning broke out in commercially canned food; from that outbreak FDA implemented HACCP in large food processing companies. In the mid 80's to early 90's, HACCP programs took full effect in food processing industry and governmental agencies (Surak, 2009). Since the turn of the millennium, HACCP programs have grown and are ubiquitous throughout all the food industry. "In the future, we expect to see further improvement that will allow the U.S. food processing industry to deliver safe food products to their consumers anywhere in the global market place" (Surak, 2009).

In the early 2000's, integrators realized consumers demanded more information about their food products. Label Insight performed a study, which "reported 94 percent of respondents said companies providing product information on their labels not only matters, but also impacts their buying decisions" (Business & Politics Staff, 2016). These changes have fostered the 'transparency movement'. As companies create new products, they are doing so with the focus of the food processors' end consumer, creating different products based on consumer desires.

Integrator Quality Standards

In the beginning of broiler production, processing inspection was voluntary. In 1959 federal inspection by the USDA became mandatory. In late January of 1998, USDA

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implemented and required Hazard Analysis and Critical Control Points, "HAACP", to strengthen quality control within processing plants (National Chicken Council, 2012). HAACP plans are put in place to identify critical points during processing at which physical, chemical, or microbiological hazards might be of concern. These measures were put in place to strengthen and make the food supply safer for consumers.

Most notable advancement from the broiler industry was introduction of product specifications (specs). As advancements within the industry were made around product production, it became apparent, product specification sheets were needed. Product specs outline all the ingredients, individual products, weight and size limitations, microbial testing counts, shipping information and handling directions (Amsbary, 2013). This ensures the foodservice food retail operator all products will be consistent to set the cooking time to reach the optimal cook and temperature. Product specs for all products help ensure the final product the food retail operator or consumer receives is consistent, high quality, and safe. Product specs are constantly reviewed as technology improves, processes become more efficient and food safety is evaluated. With all the products on the market, it is important to have documentation to create a standard of identity as well. Standard of identity helps to hold an integrator to accountable for which a product will be delivered upon.

Product Differentiation

At the beginning of the commercial broiler industry, only whole birds were sold, as New York dressed having only the feathers and blood removed. In 1942 a processing plant in Illinois was the first to gain governmental approval of "on-line" evisceration. As the industry began to increase technology usage to create the automated production process in place today, processors could increase line speed, product efficiencies, and complexity of packaged products. Plants now

do bone-in and boneless cuts, as well as further processed and value added. Choices consumers make are based on income, diet, health attributes, accessibility and availability within market are the driver behind these changes.

Integrators have a difficult task of growing a broiler that will have the specific physical attributes—length, width, and depth of cuts, and small or big birds. Broiler genetic research companies are working on today will not get into the broiler market for another five years. Thus, companies are constantly on the forward-looking front for what consumers will want. Since vertical integration became prominent, the broiler chicken has changed dramatically, increasing in weight and feed efficiency, making today's broiler a better value than those of the past.

Boneless, skinless, chicken breasts (BSCB) became larger over the years. In 1980 each lobe of the BSCB weight approximately 4 ounces; now they are closer to 5.25 ounces (Benwick, The Odd Thing About Chicken Breasts, 2004). To combat the increase in pack weight and thus cost to the consumer, the integrators worked to create a new cut. Perdue was the first producer to do this; they sliced the BSCB to $\frac{1}{2}$ or $\frac{5}{8}$ inch thick to create a BSCB cutlet (Benwick, 2004). Cutlets are just one of the many new offerings of value added products consumers can now purchase due to technological advancements.

Technological advancements have allowed the broiler industry to take traditional cuts of meat and cut or portion them literally into almost any desired size or shape. Design Systems Inc. (DSI) waterjet portioning system is a prime example of a machine that can take the normal breast and perfectly portion it. The DSI scans the individual breast to determine the most efficient cuts and makes each individual cut as valuable as possible (John Bean Technologies Corporation, n.d.). Advancements have allowed the industry to make products for new markets that integrators were not previously in. Today integrators have two major sectors they produce for—foodservice

and retail. Foodservice consists of: national account chains (McDonalds, Taco Bell, Sonic, Hardees and Burger King), K-12, government and convenient stores. Retail consists of companies such as: Wal-Mart, Kroger, SAM's, Costco, Aldi, Hyvee, Target, etc.

Market Make-Up; Retail and Foodservice

In the early 70's broiler companies began to truly focus on mass marketing their products using commercials and print media. Consumers became more exposed to different brands companies had to offer. Most if not all chicken at retail grocers carries a brand name from either the producer or the grocer. "Store brand products were 31 percent cheaper across product categories than their national brand counterpart" (Narula & Conroy, 2010). Consumers rely on brand names they trust and know are reliable.

The retail sector continues to grow; in 2011 the industry was valued at approximately 571 billion dollars (Elitzak, 2016). Grocery stores accounted for nearly 91 percent of the overall retail sales. Nearly 20 large food retailers made up the approximately 450 billion dollars in the industry for 2013. They account for 63 percent of U.S. grocery store sales, which is a 39.9 percent increase since 1993 (Elitzak, 2016). Over the years, the retail industry has changed and added bulk purchasing in the form of club stores to force tighter margins on producers and lower prices for consumers. Two of the market leaders, Sam's Club and Costco, both opened in 1983 with a few months separating the two events. These two companies were—and still are—on the forefront of bulk packed items for consumers.

Much like retail, the foodservice market is rapidly growing. In 2010 the approximate size of the foodservice industry was estimated at about 594 billion dollars (Elitzak, 2016). By the end of 2015, the industry closed with approximately 761 billion in sales (Carbonara, 2015). More consumers are purchasing food away from home at foodservice establishments. To help the food

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retail operators increase customer traffic to drive sales, the focus shifted to locate more food retail operators closer to consumers' homes and work places to make it easier for food retail operators to gain access (Elitzak, 2016). "Technomic's Digital Resource Library has shown chicken brands are some of the fastest-growing limited service food chains" (The Poultry Site, 2016). The driver behind this growth is business expansion, fresher product, and new, innovative menu options for restaurants.

Rotisserie Chicken – Growth in Deli Foods

Classic rotisserie chicken, a familiar dinner staple in many households, has also evolved over the years. Industry advancements have made the chicken presence within the deli and cold grab-and-go section to be more convenient and available to consumers. In 2010, approximately 600 million rotisserie chickens were sold in supermarkets, club store, and retail outlets. "An additional 200 million were sold through alternative foodservice outlets" (Benwick, 2012). The classic rotisserie chicken concept of a one-night family meal has changed with not only household size and bird size, but also with culinary preferences at the household level.

Rotisserie broiler packaging has also evolved, becoming more environmentally friendly, microwavable and oven safe, often with small handles to make carrying more convenient. Flavor offerings have expanded to include; Italian, lemon-pepper, maple, BBQ and many more. Production efficiencies have allowed the rotisserie chicken price to be affordable and comparatively very hard to bypass. "Rotisserie chicken is typically less expensive than uncooked alternatives" (Horizonweb, 2016). In 2011 Costco alone moved nearly 50 million rotisserie chickens across the scanner at the register (Benwick, 2012). Rotisserie chicken alone has market share of 43.7 percent of the total prepared chicken sales in the United States. (Statista, 2016). According to Technomic data, rotisserie chicken has appeared on 6 percent more menus in 2015

than in 2013 (Horizonweb, 2016). Growth in the market is attributed to consumer's fast paced lifestyles that have them on the go constantly. Rotisserie chicken is just one of the many examples of chicken offerings which have expanded with growth and opportunity over the years.

Next Gen Retail Store – Dry Goods Shrink, While Deli and Perimeter Expands

Retail stores today are shifting their focus on how they attract consumers. Retailers must adapt to the consumers' rise in on-line ordering that accommodates fast-paced lifestyles. Focus is moving toward expanded product offerings, smaller brick-and-mortar and more online presence (International Dairy Deli Bakery Association, 2016). Foodservice innovation will drive growth for the convenience stores (C-stores) segments. C-stores will change design and environment within stores based on customer demographics. Dollar General announced in March of 2017 a company wide effort to bring fresh produce to more stores. Efforts are to focus on challenging their competitors (Wal-Mart) to retain customer basis and attempt to attract new customers with a new company strategy (Gustafson, 2017). Consumers are shifting their purchasing habits and strategy, making more frequent trips to the store for fresh and prepared foods. "Consumer Reports estimates that prepared meals purchased from grocery stores are nearly 29 billion dollar-a-year business" (Chute Gerdeman, 2017).

Millennia's are the drivers behind this change. Younger generations want healthy, local, organic, prepared, and less processed food options when shopping. Millennia's have an 'in the moment' mentality with their fast-paced lifestyles. This is where prepared foods, the deli cold and hot grab-and-go section, and fresh sections have seen growth. Consumers are becoming more and more confident with purchasing their dry staples online and having delivered to home or ready for in-store pick up. Retailers are changing their internal landscape, by adding full-service restaurants, hot bars for food, and chef inspired meal solutions to name a few (Berry,

2015). Focus and expansion will likely allow broilers producers to expand their product offerings

and capture more market share with consumers. Costs will be a major influence on how the

industry adapts and changes to better serve the food retail operators and final consumers.

Theory and Technical Estimation Procedures

The objective of this research is to specify and estimate a model to predict the prices of

wholesale broilers parts which include; drumstick (DRUM), jumbo boneless skinless breast

tender out (BSBTO), leg quarter (LQ), thigh (THIGH), small wing (SMWING), jumbo wing

(JMWING), tender (TENDER) and whole bird without giblets weighing 2 ¼ lbs. (WOG). The

purpose of this is to generate a better understanding of parts prices interactions to allow more

insight for the industry on price forecasting. Allowing producers to better strategize when

negotiating contracts with food food retail operators.

In econometrics determining the preferred modeling approach is not a precise procedure.

For several reasons, not the least of which is the number of potential modeling techniques may

be available and appropriate to varying degrees. Building the most useful model is crucial to the

broiler industry. However, most models are complex and each comes with its own deficiencies

and challenges. Modeling the broiler industry makes this process even more complex with the

extensive amount of possible exogenous variables to choose for inclusion. Identifying the goal of

the economic model can facilitate model selection. Relying on previous investigations into

chicken price prediction (McKenzie and Goodwin), our goal is to decide between a univariate

autoregressive (AR) model for each of the eight prices and a vector autoregression (VAR) model

estimates all five equations simultaneously. Both AR and VAR models require empirical

decisions that need to be made about model structure. The number of lags to include, the sample

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period from which to base the model on and the variables to include are all major concerns when estimating both AR and VAR models.

Setting the sample size is crucial for AR and VAR models to ensure a large enough training set is available. A training set allows the model to 'understand' how the variables interact with one another. Training set builds the forecasting power of the model. A robust sample should include price ups and downs is especially important for AR and VAR models. Extreme outlier observations in the sample can cause the forecast to be less accurate and have large forecast errors. AR models were utilized in the econometrics literature prior to VAR modeling being developed. VAR models might analyze volatility better due to providing a causal and feedback relationship of the other variables nested within the model. The VAR technique utilizes nesting of AR models to potentially create a more robust model. Chris Sims introduced VAR in 1980, where he demonstrated VARs provide a flexible framework for analyzing economic time series. VAR modeling is an approach that builds on the causal and feedback relationships of the model's variables. VARs analyze the interaction between all variables that are included for analysis. VAR modeling allows more complex relationships and interactions between the all the variables included in the model.

Due to the multitude of inputs in producing poultry, it is important to know which ones to include in the models. VAR modeling techniques have been widely utilized in other research areas including oil, gas and realty. The following discussion will give an alternate look into other industries where price forecasting using VAR has been applied. Bessler et al., utilized VAR modeling to understand price interaction of corn price, poultry price and retail poultry prices. Two different time periods were analyzed: 1956 through 1968 and 1973 through 1985. Time split was determined because a few issues arose focusing on prices and wages such as:

termination of the Nixon Administration's wage and price controls preceding the first OPEC oil price shock; and restaurant industry beginning of marketing poultry. They performed shocks on the models to understand the dynamic attributes. Bessler et al., found differences between the two time periods. "Their results failed to reject their hypotheses about the differences; that the changes were demand-driven due to demand and preference changes at the retail level; and changes were due to technological changes which altered the dynamic relationships among corn and broilers prices" (Babula, Bessler, & Schluter, 1991). Findings were conclusive that industry structural changes within the corn market moving from many smaller firms to larger ones impacted the timing of shocks in the market Now corn price shocks happen sooner where "large producer-contracting processors now exhibit more price-making power (Babula, Bessler, & Schluter, 1991)." Due to vertical integration, larger processors are able to "pass rises in corn-based feed costs on to consumers in a more direct and immediate manner than in the earlier period (Babula, Bessler, & Schluter, 1991)."

Bessler et al., compared VAR modeling to the univariate ARIMA process (which can be very similar to an AR model) and found the univariate model to outperform their VAR model. This finding is important to note because a simpler modeling approach sometimes outperforms more complex models. Due to a less restricted parameter space, we would reason multivariate models should perform as well as or better than univariate models. However, it is not always the case depending on the system of equation(s) and variables included for the modeling purpose. Bessler et al., stated further research over different time periods or alternate commodities could alter findings. Choice of variables included in modeling is important. "Apparently, the instability of hog prices is not well accounted for by variables in the VAR model, since no improvement in forecasting ability is evident (Bessler & Brandt, 1984)." Nerlove, Grether, and Carvalho found

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similar results when forecasting prices for the cattle industry. Their indicators of fit strongly

supported the univariate (AR) modeling approach over the multivariate (VAR) approach.

Bessler et al., utilize the VAR modeling technique in combination with Forecast Error

Variance Decompositions (FEVD) and directed, acyclical graphs. FEVD "is the percentage of

the variance of the error made." FEVD was used to quantify the importance of each shock in

explaining the variation. Directed acyclic graphs (DAG's) provide information of causality

among variables. Bessler et al., structure their VAR model with; time trend, season binary

variables and event specific variables. Structuring in this way allows the model to react and

handle time frames when certain events happened that do not normally occur. Analysis of the

FEVDs allowed price forecasting into a longer horizon. Showing FEVDs have "important effects

on the downstream markets over the longer horizons beyond the crop cycle. Doing this gave

insight into the dynamic nature and quarterly responses of the VAR model's endogenous

variables (Babula, Bessler, & Payne, 2004). They concluded from the research that time horizons

extending beyond a single market year or crop year would allow ample time for necessary

market shocks to take effect.

McKenzie et al., promoted utilizing a VAR modeling approach as an alternative price

forecast for wholesale broiler parts to AR. VAR in combination with Forecast Error Variance

Decompositions (FEVD) modeling approach was shown to be superior to the traditional Granger

Causality approach. The forecast approach included the four main parts of the bird that are sold

wholesale. When comparing the out-of-sample forecast between Granger Causality and Sims-

Bernanke, the modeling techniques were consistent with one another. Granger Causality model

requires many observations to choose between large groups of variables and select the required

variables independent of forecast horizon. Findings resulted in the assumption that Sims-

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Bernanke FEVD model selections would lead to better forecasting models than Granger

Causality tests (McKenzie, Goodwin Jr. , & Carreira, 2007).

Alquist et al., analyzes multiple forecasting methods. Two of the model structures

analyzed are AR and VAR. Utilizing an unrestricted VAR to start provides a foundation to

building the VAR model. Unrestricted VARs utilize all variables in the equations, whereas a

restricted one might include only some variables from multiple equations. The success of the

forecasting power and accuracy is dependent on the choice of variables. Alquist et al.,

simultaneously explored the appropriate number of lags which should be included. The purpose

of the lag exploration was to determine price forecast sensitivity. For oil pricing, it was

determined that comparing lags of 12 and 24 months' lags typically produced a weaker forecast.

Forecast accuracy diminished after 6 lagged periods. There was also discussion of selecting the

proper sample period. When choosing the sample period, it is important that it is structurally

equivalent to the anticipated structure in the forecast periods. It is crucial to have enough

observations; however, it is also possible to have so many observations the forecasting power is

compromised. Kilian and Murphy concluded for the oil industry it is important to include

inventory shocks in the model as well when price forecasting. Traders base their buying and

selling off the inventory of the market, expecting to buy at a low price when inventory is high

and sell high when inventory is low. They concluded "proposing a dynamic simultaneous

equation model including oil inventories that allows the identification of all three types of

shocks" (Kilian & Murphy, 2010).

"VAR models have increasingly been used in macroeconomic research over the last

decade or so, especially in the United States" (Robinson, 1998). VAR model specification

requires identifying the proper number of variables and lags, which could lead to over-

parameterization. After comparing multiple models, Robinson found "VAR models are suited for short-term forecasting" (Robinson, 1998). Robinson found other models are highly unstable for short-term forecasting. Forecasting further out would require the use of models such incorporate an error correction mechanism. When compared with the other models analyzed; VAR had the lowest mean square error for predictions.

Pricing in the broiler industry is similar to in the oil industry. Analogous to oil pricing, broilers parts pricing is derived from the whole bird without giblets (WOG). The WOG provides a base price from which the individual parts are based and then the value from further production is added to arrive at a final cost. This research provides a better understanding of variable interactions along with determining the appropriate modeling technique for economists to forecast broilers parts prices.

Section III – Data and Methods

Regression Analysis of Time Series (RATS) software was utilized to perform all forecasts and model estimates. RATS is a comprehensive econometrics and time series analysis software package. To achieve objectives 1-4 the following techniques will be utilized:

1. *Find the best variable combination in a VAR model to identify which parts impact/drive price for other parts.*

2. Is the breast still the driver based on research by McKenzie et al.? Has the industry shifted to another part, i.e. wings since they are most preferred within food service establishments? A Diebold-Mariano test is used to compare forecast performance. After generating the forecasts from both models, the series of the differences between the two modeling methods will be analyzed.

3. *Use in-sample data to estimate models and out-of-sample observations to test comparative forecast accuracy.*

4. This allows comparing the forecasting power of each AR and VAR model estimated.

5. *Identify the best variable combinations for the AR and VAR models.*

6. A total of four different model specifications will be utilized. A) All eight parts. B) Front parts without the WOG[9]. C) Front parts with the WOG. D) Parts from the original model estimated by McKenzie et al., The front half of the bird was analyzed and not the back due to consumer preference as well as price volatility. Dark meat products are primarily exported to other countries because very little is consumed in the United States. White meat portions are highly sought by food service and retail providers. Justification behind with and without the WOG is to determine if the whole bird in its original state has any interaction with the individual parts prices.

Data

Data for this project utilized Urner Barry (UB) average monthly reported prices for wholesale chicken and chicken parts. UB is considered an unbiased reporting firm that gives pricing data for poultry, red meat, egg, and seafood related segments to the food industry. UB is regarded as a trustworthy source for buyers and sellers to obtain accurate and timely price information. Each opening day, experienced marketers at UB collect information from buyers, sellers, and brokers to report real time prices. The constant interactions with the individuals allow the UB personnel to adjust prices. It also allows them to see the potential direction the market could move. Data collected from UB includes: products being traded, products producers

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[9] Whole bird, without giblets, that includes the whole breast, two wings and two legs. The head, feet, and internal organs are removed.

are selling, bid and sell prices, and other information to make informed decisions as determined by UB. Prices reported by UB used in this study are the average monthly prices and do not represent the high or low sales or bids.

Monthly prices were collected from January 1989 through May 2017. The specific parts prices collected are: drumstick (DRUM), jumbo boneless skinless breast tender out (BSBTO), leg quarter (LQ), thigh (THIGH), small wing (SMWING), jumbo wing (JMWING), tender (TENDER) and whole bird without giblets weighing 2 ¼ lbs. (WOG)[10]. These are the main parts sold wholesale to retailers and foodservice establishments. Producers use these parts to make further processed value added products.

These eight parts are all sold on the wholesale market, which facilitates accurate price reporting. Descriptive statistics of prices of these parts are reported below in cents per pound in table 1. Table 1 contains descriptive statistics from the time period that McKenzie et al., analyzed of January 1998 plus the inclusion of additional parts. In table 2, the extended time period beginning where the data ended from McKenzie et al., running from August 2007 through May 2017 is shown. Variances are higher in period 2 except for parts BSBTO and TENDER where they are higher in period 1. Volatility is relatively higher in period 2 than in period 1. Means are higher in period 2 than in period 1[11]. BSBTO and DRUM have a higher max price in the first period, all other parts are higher in the second period. The DRUM is only higher by two thousandths of a cent. The above comparisons are magnitudinal and were not tested for statistically significant differences, as they are included for perspective.

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[10] Prior to 1998, wings were in a single category. However, in 1998 the industry began to market and price wings based on their size. Because of this, UB began tracking prices both small and jumbo wing prices.

[11] All prices analyzed are nominal.

Figures 1 and 2 plot each broiler part price for all the observations used in this study period 1998 through 2017. Prices for the Northeast region of the US were reported the data source; a US price was not available. The time periods are partitioned for the base data sued by McKenzie et al., 1998-2007 (figure 1) and the data post McKenzie et al., 2007-2017 (figure 2). In figure 1 there are three major groupings of the parts with respect to their volatility. TENDER and BSBTO exhibit the most price volatility, particularly when comparing prices from 2002 to 2004 when they almost doubled. SMWING, JMWING and WOG experience small price fluctuations. However, at the points they do display volatility is where supply shocks to the market occurred due to an AI outbreak or drought with high feed prices. THIGH, DRUM and LQ are at the bottom of the figure with the lowest prices. The THIGH, DRUM, and LQ (which are primarily exported) exhibit price increases in 2005 from the AI outbreak in 2004. The export market prices are lagged from the domestic prices due to export contracts and movement of product. Exported parts have a different selling period due to cold storage and handling regulations, which must be followed. The back half of the bird is primarily exported, integrators do very little value adding where extra costs are applied to the final product.

Table 1

	Descriptive Statistics of Monthly Average Prices (Cents/Pound) Selected Broiler Parts for the Northeast U.S. Market (January 1998 - July 2007)			
Part	Mean	Variance	Minimum	Maximum
BSBTO	149.17	843.74	105.00	255.55
LQ	26.33	71.68	13.76	48.81
SMWING	80.65	587.08	41.00	136.00
JMWING	81.16	402.04	42.63	122.00
WOG	64.05	97.05	46.59	90.00
THIGH	30.37	103.63	14.67	58.29
TENDER	145.08	1098.95	91.40	235.00
DRUM	33.90	81.06	20.42	65.29

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Table 2

Descriptive Statistics of Monthly Average Prices (Cents/Pound) Selected Broiler Parts for the Northeast U.S. Market (August 2007 - May 2017)				
Part	Mean	Variance	Minimum	Maximum
BSBTO	141.56	468.83	106.00	206.00
LQ	40.37	75.87	21.00	54.00
SMWING	139.32	933.83	75.62	196.27
JMWING	133.46	975.65	67.45	188.78
WOG	94.19	167.44	71.61	126.33
THIGH	55.48	146.96	28.00	74.00
TENDER	154.79	856.71	101.16	236.00
DRUM	48.16	130.87	21.00	65.00

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This reflects the weak demand for dark meat products meaning supply in cold storage[12] increase but not indefinitely. With demand being low and supply increasing prices for dark meat items remain relatively low.

Figure 2 uses observations from September 2007 through May 2017. This interval experienced drastic volatility: recession, drought and extreme outbreaks of AI which all affect industry pricing. During this time the part's prices began to exhibit movement independently of each other rather than as a group. The most notable event was the AI outbreak in 2014, which caused prices to increase. AI caused a supply shock domestically and in export markets due to the number of birds euthanized. In contrast to figure 1, figure 2 shows the parts starting to move away from their earlier groupings. This change is likely driven by consumer demand changes in lifestyles and preferences. Prices of the back half of the bird (LQ, THIGH and DRUM) all remain relatively grouped together with little volatility. Front half parts (TENDER, SMWING, JMWING and BSBTO) began to exhibit their own identity moving away from the previous groupings. We can see the wing markets began to take form along with the tender where their pricing shows no relation to the other parts. Previous research shows prior to September 2007, the boneless skinless breast was the main determinant of all other price shocks induced to other parts. Consumer preference shifts are likely causing changes in the market due to more interest from consumers in wing products. When an exogenous shock to the industry does occur such as the AI disease outbreak in 2014, all parts experience price fluctuation to some extent. One of the most notable observations from looking at the two figures is when there is price increases; they decrease rapidly to where they were trending before.

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[12] Survey conducted by USDA NASS that inquire about cold storage products that are located across the United States. This gives the industry a gauge of the current supply available to consumers. The understanding of the supply and demand drives the final prices.

Methods and Equations

For this project, multiple samples were selected: 1) the original time frame of January 1989 through May 2017 and 2) January of 1998 through May 2017. The first sample uses the original parts (BSBTO, WOG, LQ and WING) with additional observations. In-sample selection is from January 1989 through January of 2000 with the remaining being out-of-sample. The second sample uses additional new parts (SMWING, JMWING, TENDER, DRUM, and THIGH) and the time frame 1998 through 2017. In-sample was January of 1998 through August of 2007 with the later observations being out-of-sample. Each of the exogenous factors discussed in the literature review play a vital role in determining the most effective timeframe choice. The out-of-sample period captures the following major effects on pricing: recession from 2007-2009, extreme drought in 2012, and multiple disease outbreaks[13] most notably in 2015.A dynamic estimation method is implemented. Consider the second sample. VAR and AR models are initially estimated using observations from January 1989 through August 2007. Forecasts are made from these models for the next nine months, September 2007 through May 2008. Then September 2007 observations are added to the estimation sample and the models are re-estimated. Forecasts are made for the next nine months (October 2007 through June 2008). These iterations continue until a forecast is made for May 2017.

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[13] 2008 outbreak in China and countries in Asia, 2009 in Egypt, 2010 in Japan, 2012 in China and the United States in 2014 (World Health Organization, 2012)

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Figure 1

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Figure 2

UB Price NE U.S. Market Poultry Parts September 2007 - May 2017
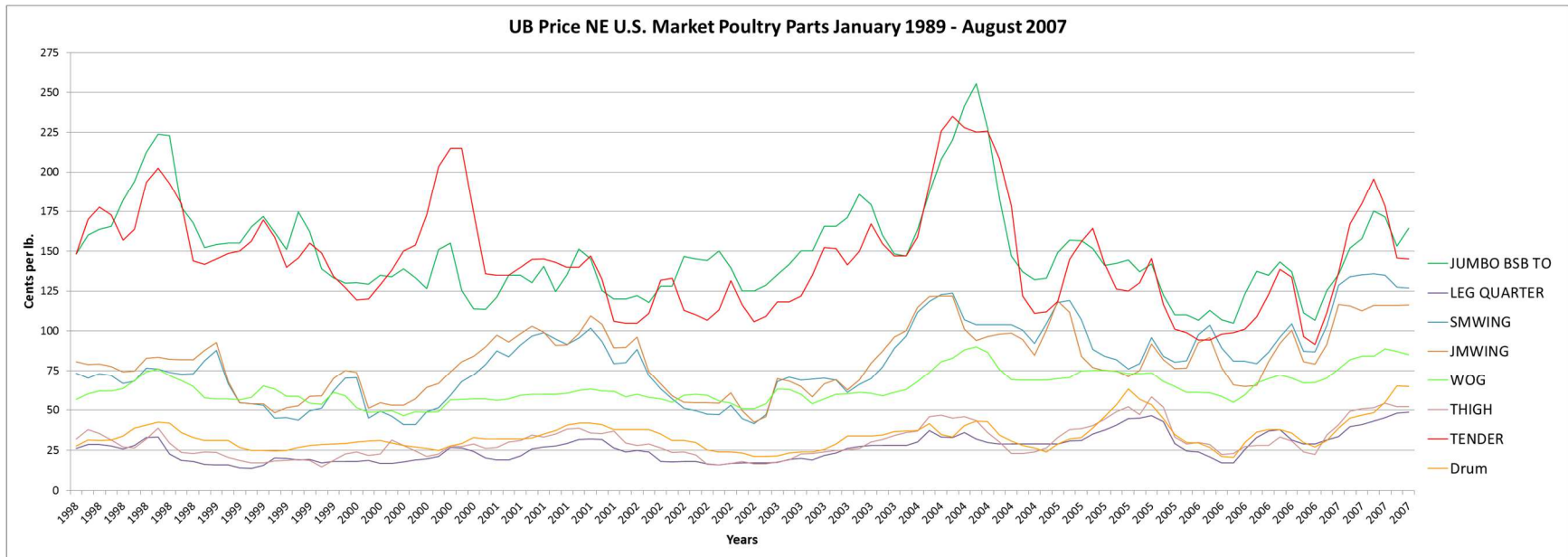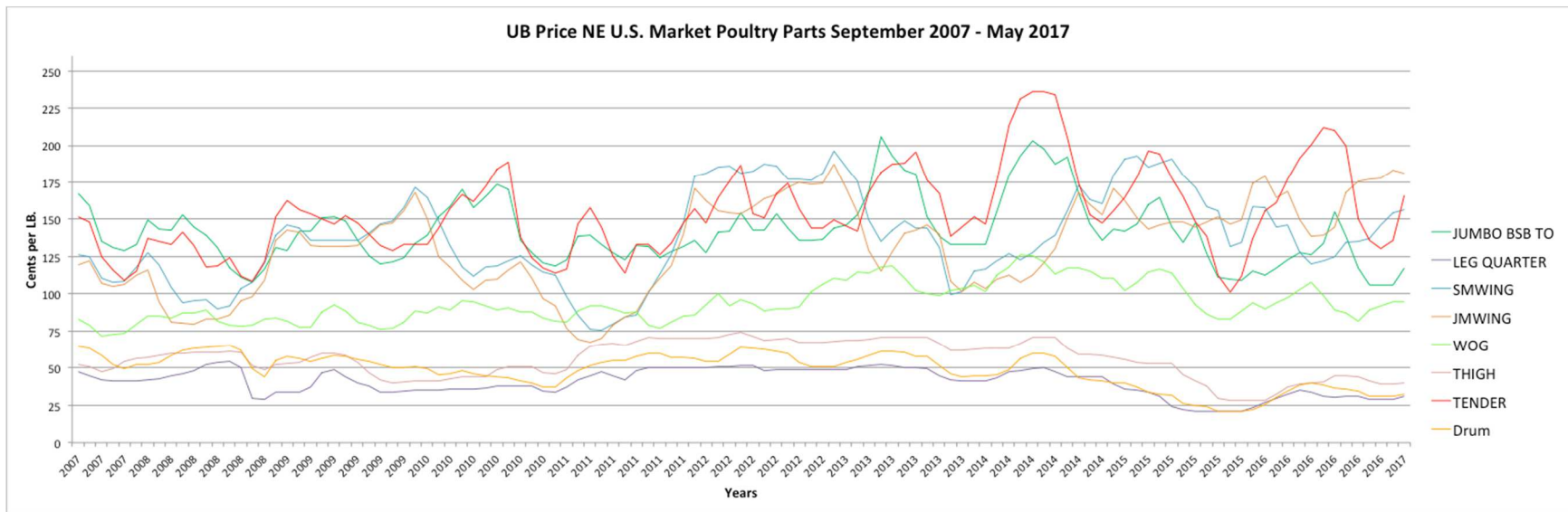
The standard VAR model for four variables was specified as:

$$(1) \quad Y_t = c + T + \sum_{k=1}^{K} \begin{bmatrix} b_{11}(k) & . & . & b_{1n}(k) \\ & . & & \\ & . & & \\ & . & & \\ b_{n1}(k) & . & . & b_{nn}(k) \end{bmatrix} Y_{t-k} + \sum_{l=1}^{11} a_l D_l + \bar{\varepsilon}_t$$

This equation was utilized as the base for all models where the number of variables was increased.

Table 3

Models Analyzed and The Wholesale Broiler Parts Included for Each[14]

Parts	Model 1	Model 2	Model 3	Model 4
SMWING	X	X	X	X
JMWING	[REDACTED]	X	X	X
WOG	X	X	X	[REDACTED]
BSBTO	X	X	X	X
LQ	X	X	[REDACTED]	[REDACTED]
TENDER	[REDACTED]	X	X	X
DRUM	[REDACTED]	X	[REDACTED]	[REDACTED]
THIGH	[REDACTED]	X	[REDACTED]	[REDACTED]
Total Number of Variables Included for Each Model	4	8	5	4

[14] Each "X" represents that part being included in the respective model.

Table 3 displays which variables are included for each model is analyzed. Each equation was adjusted accordingly to accommodate the appropriate number of variables. Lags, trend and constant all remained the same. Y_t represents a 4 x 1 vector containing WOG, BSBTO, WING and LQ prices in period t ($t = 1, \ldots,$ T), $\mathbf{c}$ is a vector 4 x 1 of constant terms, $\mathbf{T}$ is a vector 4 x 1 of trend terms, k signifies the lag order of the system, b_{ij} (k) are the parameters to be estimated in the n by n system of equations, where i refers to each of n estimating equations in the system and j refers to each coefficient associated with each i; D_l are 11 seasonal dummy variables, a_l are the parameters of the season dummy variable to be estimated and finally ε_t is a 4 x 1 vector of serially uncorrelated random errors, also known as innovations, all with constant variances.

The VAR and univariate models are used to forecast prices 1 to 9 months for out-of-sample forecasts for each variable. The below general univariate model was specified as

$$(2) \quad Y_{it} = c_i + T_i + \sum_{k=1}^{K} [b_i(k)] \, Y_{it-k} + \sum_{l=1}^{11} a_l D_l + \varepsilon_{it}$$

where Y_{it} represents each of the $i = 1$ through 8 variables (SMWING, JMWING, WOG, BSBTO, LQ, TENDER, DRUM and THIGH) and K is the lag order of 3[15]. Thus, each univariate AR (K) model is nested within the multivariate VAR (K) model which contains only K lags of the dependent (target forecast) variable along with a trend term, constant and 11 seasonal dummy variables. The univariate AR (K) models are a simple individual versions of the multivariate VAR (K) model, and both types of models are estimated using OLS. The above equations were utilized for all models and adjusted with the appropriate variables needed.

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[15] McKenzie et al., stated "Preliminary model estimations were performed on VAR systems incorporate from 1 to 12 lags for each variable. The SBIC and likelihood ratio test statistics indicated that a parsimonious VAR system with a lag order of three months was optimal. (McKenzie, Goodwin Jr. , & Carreira, 2007)"

Forecasting of the VAR and AR models were done using a dynamic modeling approach. This is a "multi-step forecasts, where forecasts computed at earlier horizons are used for the lagged dependent variable terms at later horizons For example, the forecasted value computed for time T will be used as the first-period lag value for computing the forecast at time $T + 1$, etc. (Estima, 2017)" "Steps" are used to signify in the next period forecasted, in this case months. With the dynamic forecasting approach after each reported forecast the number of observations from which to model from decreases by 1. For example if there are 300 observations the first forecast would utilize all 300. Forecasted step 2 would utilize 299 observations and so on thus you have a decreasing sample size with the more forecasts ahead.

Forecasting performance of all models was then evaluated using the Diebold Mariano tests (DM) based on both the Mean Square Error (MSE) and Mean Absolute Error (MAE) loss functions. The null hypothesis of the DM test is that forecasts from a VAR model are no different than those from an AR specification; H_0: VAR forecasts $\approx$ AR forecasts. Two alternate hypotheses are considered: (1) VAR forecasts are preferred to AR forecasts (H_{A1}: VAR forecasts $\succ$ AR forecasts), and (2) vice versa is, (H_{A2}: VAR forecasts $\prec$ AR forecasts). Forecast performance is also documented with respect to Mean Error (ME), MAE, Root Mean Square Error (RMSE) and Theil's U Statistic (Theil's U) which can be expressed as:

$$(3) \quad U = \sqrt{\frac{\sum_{t=1}^{n-1} \left(\frac{F_{t+1} - Y_{t+1}}{Y_t}\right)^2}{\sum_{t=1}^{n-1} \left(\frac{F_{t+1} - Y_{t+1}}{Y_t}\right)^2}}$$

Where U is the Theil's U-statistic, F is the forecasted value of Y and Y is the actual observation. Theil's U is "a ratio of the RMS error to the RMS error of the "naïve" forecast of no change in the dependent variable" (Estima, 2017). A unit free measurement ranging from zero to infinity,

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with unit value being equivalent to a random walk forecast. Overall forecasting accuracy improves with lower ME, MAE, RMSE and Theil's U values.

Section IV – Results, Summary, Conclusion and Implications

Results

To recap, the dependent variables in the estimated models consisted of the main wholesale chicken parts prices that are published by UB. Wholesale parts are: jumbo boneless skinless breast tender out (BSBTO), leg quarter (LQ), small wing (SMWING), jumbo wing (JMWING), whole bird without giblets (WOG), thigh (THIGH), tender (TENDER), and drumstick (DRUM). The most important wholesale parts for the broiler industry are BSBTO, SMWING, JMWING and TENDER. These are all the white meat portions preferred in the United States.

By 1998, all parts listed were being tracked by UB, some parts were tracked long before. Tests for unit roots were performed within RATS utilizing the Augmented Dickey-Fuller test of null hypothesis of existence of a unit root. Unit roots were detected in some variables and not in others. Sims, Stock, and Watson in 1990 "recommend against differencing to transform models to stationary form when it appears likely that the data is integrated. VAR analysis is used to understand the interrelationship between the variables; not the individual parameters" (Sims, Stock, & Watson, 1990). Unit roots were not corrected for in this research. Each unit root test result is presented in the appendix following each model. Each of the models is a comparison of VAR versus AR modeling.

Baseline - Model 1

Model 1 estimates the original McKenzie et al., model VAR comparison with AR utilizing BSBTO, WOG, WING, and LQ. The purpose was to utilize updated data from August

2007 through May 2017 to see if there were substantial changes in parameter values. The broiler industry has changed in several ways since the McKenzie et al., model was estimated. The in-sample data remained the same from January of 1989 through January of 2000. The forecast period data extended from August 2007 through May of 2017. Results of this estimation are shown in Table 1A in the appendix. Forecast statistics are most notably different for WOG and BSBTO from the model estimated by McKenzie et al. WOG in the model estimated by McKenzie et al., had all 9 steps supporting the VAR model. In the new baseline model, the support for modeling is split with steps 1 through 4 having neither model preferred over the other and steps 5 through 9 supporting AR modeling. BSBTO in McKenzie et al., had mixed support of VAR and AR between the model choices with AR being slightly preferred. The new baseline model has all steps supportive of using AR. LQ also exhibited mixed support between VAR and AR however, with the later data the AR model is preferred. For all the 9 steps AR, has support at the one percent level of significance. Overall, for all variables presented, AR support is preferred over VAR modeling 23 times and 13 times neither model is preferred over the other, with no support for VAR. The WING, however, is unchanged from previous research with neither model approach being preferred over the other. When looking at the MAE and RMSE for LQ, the errors are smaller than those of BSBTO and WING for all 9 steps other. WOG has small errors as well through step 5.

Alternative Models - Models 2, 3 and 4

Models 2, 3 and 4 utilize the same observations for the sample period. The alternative models are estimated to understand the price volatility of the white meat portions of the bird which drive overall pricing. White meat portions are also the parts that exhibit the most market volatility; dark meat parts are relatively unchanged in price.

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Model 2

Model 2 is an analysis utilizing all parts currently reported by UB data. Results are shown in Table 2A. It is intriguing that the forecast test results fully support AR modeling for all parts except for two steps when forecasting JMWING, steps 8 and 9, when neither model is preferred. Results overwhelmingly support AR and exhibit a statistical significance of one percent. BSBTO, SMWING, THIGH and DRUM each have all 9 steps supporting AR modeling with a one percent statistical significance. LQ, WOG and TENDER have one or two steps that are statistically significant at five percent with all others at the one percent level. JMWING is the only variable that has mixed results at the one, five and ten percent statistical significance interval and two steps that are inconclusive between either model choice. In the original model estimated by McKenzie et al., BSBTO had mixed support for VAR and AR modeling where now it has full support for AR modeling. In the original model by McKenzie et al., LQ had some support for AR modeling at ten percent statistical significance, but now fully supports AR modeling with many steps statistically significant at the one percent level. In the original model by McKenzie et al., WOG had full support for VAR modeling; however, that has now shifted to full support AR modeling at the one percent significance level. It is important to note that model 2 includes 4 additional parts not considered in the original model by McKenzie et al., which could have influenced the changed results. Out of 72 steps, only 2 support neither model choice over the other; 70 steps support AR modeling. The MAE and MSE for LQ, WOG, THIGH and DRUM each have small errors through step 4. Other parts have relative high errors past step 2.

Models 3 and 4

Models 3 and 4 take the approach of looking at the front half or the white meat portions of the bird. The difference between the two is the inclusion of WOG; model 3 has WOG

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included and model 4 does not. Results from model 3 are presented in table 3A results for model 4 are presented in table 4A. When looking at the most notably intriguing results indicate the inclusion of WOG lend more support for AR modeling than for VAR modeling. However, when the WOG is not included, a number of the variables exhibit mixed support and in some cases, support the null hypothesis that neither model is preferred over the other. BSBTO has the same results in both models 3 and 4. SMWING in model 3 has more steps that have a higher statistical significance than in model 4; both support AR modeling for SMWING. JMWING is interesting in that model, 3 all statistically significant support is for the null hypothesis that neither model is preferred over the other. However, in model 4 there are two instances (steps 8 and 9) where VAR modeling is preferred at the five and one percent statistical significance, respectively. These are the only two steps that show any support for VAR modeling. The WOG, included in model 3 only, has significant support for AR modeling. TENDER in model 3 lends support for AR modeling with a high statistical significance. Nonetheless, in model 4, steps 1 and 2 and steps 7 through 9 support the null hypothesis while steps 3 through 6 support AR modeling with a five and 10 percent statistical significance, respectively. For model 3 the MAE and MSE are relatively small for WOG through step 3, then become larger; all other parts have large ME and MSE after step 1. For model 4 past step 1 for all parts the errors are large.

Summary, Conclusions and Implications

Broiler prices exhibit considerable volatility due to the exogenous factors that determine the prices of parts. Pricing in the broiler industry is reported by third party vendors who gather numerous observations on variables ranging from: cold storage volumes, current and forward contract price negotiations, overall supply and demand and many other measures from the industry. From this information, third parties such as Urner Barry can develop a live pricing

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sheet for processors to utilize as a base when negotiating new contracts with customers. Economists find the pricing of broiler parts to be more complex due to the vertical integration and all the exogenous factors that play a role in pricing. Therefore, it is important to understand the industry and analyze the most appropriate modeling technique to utilize between VAR and AR to determine the superior modeling approach. Outside factors such as recessionary times, heavy drought periods and extreme outbreaks of AI cause substantial supply and demand shocks to the industry. For example, the drought in 2012 caused a supply shock to chicken wings. In December 2012 chicken prices were up 6 percent, which was more than triple, the increase of overall food prices. The drought resulted in a decrease in the number of chickens produced due to high corn and soybean meal prices. Such factors make modeling complex when attempting to specify models to predict broiler price level over time. This decrease in production resulted in a 1 percent decline in the number of chicken wings consumed for a Super Bowl weekend. National Chicken Council expected approximately 1.23 billion chicken wings would be consumed on that weekend alone (Linn, 2013).

The United States is forecasted to grow with a 2 percent production increase and 4 percent growth in exports (Foreign Agricultural Service, 2017). April 2017 Livestock, Dairy and Poultry Outlook report predicts increasing prices for most chicken parts. Higher prices are expected for 2017, which is most likely showing an increase and strengthening in consumer demand. A constant increase in the total agricultural exports outpacing imports is creating a trade surplus for the U.S. agricultural industry.

The broiler industry continually changes due to changing consumers' tastes and preferences and technological innovation. United States consumers distinctly prefer white meat parts for consumption while dark meat is primarily exported with no value added. Prior to 2007,

groupings of parts are based on essentially consumer preference for BSBTO, TENDER and

SMWING, JMWING and then WOG, THIGH, LQ and DRUM. Post 2007, each of these parts

began to take on their own identity in the market place. Products today have a significant amount

of extra value added that the initial wholesale price only represents a small portion of final

product cost. Innovation, consumer's lifestyle changes, varying processors' market share are all

reasons the broiler industry is changing at a rapid rate. Technological advancements have

allowed the industry to increase in production efficiency, food safety, and product quality.

All the change in the industry makes it imperative to understand the market make-up, pricing and

variable interaction between broiler parts. This research was performed to give more insight into

understanding pricing in the broiler industry. To do this, econometric modeling approaches were

examined using VAR and AR techniques. Monthly average part price data were gathered from

January 1998 through May of 2017.

Forecasting results from the models support simpler AR modeling techniques over VAR

models. This is especially apparent when trying to utilize all the current wholesale parts that are

sold as represented in model 2. Compared to the original model estimated by McKenzie et al.,

more results favor AR than VAR modeling. The WING is the only part that showed no change

from the original model to the base line model. Estimated models for the other parts strongly

support the hypothesis that the structure of the industry has changed dramatically since research

by McKenzie et al., McKenzie et al., determined from Directed Acyclical Graphs using Sims-

Bernanke FEVD results that from the original model each BSBTO, WING and LQ shocks

directly affect WOG pricing; meaning WOG was best suited for VAR modeling approach.

However, each of the models presented, especially the comparison of models 3 and 4, which are

both models using data from 1989 through 2017, show support for AR modeling techniques, not

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only for WOG but all other parts as well. The MSE and MAE for each of the models across all parts remain relatively small through step 3, after that they tend to become quite large. Forecasting through step 3 (3 months out) is the most suitable; past that, the accuracy weakens dramatically.

Forecasting broiler parts prices employing more accurate forecasting models can help to more efficiently purchase inputs and select products based on pricing. This can have a substantial positive impact on the broiler industry with competitive advantage, cost savings and more market captures, allowing poultry companies increase revenue and give directionality for further growth within their company. This research was purely technical and a theoretical. Outside exogenous factors listed in the literature review help give a foundational understanding on price shocks that are observed in figures 1 and 2. Broiler production requires a multitude of inputs particularly for producing feed production. Feed accounts for approximately 65 percent of the cost to produce a bird (Goodwin, Jr. & Cappas, 2015). Drought, recession and disease outbreak cause exogenous shocks to pricing as well as supply and demand shifters. Other major costs include: heating (propane or natural gas), electricity and water. Research presented ignores the impact of many supply and demand shifters. Models incorporating mitted supply and demand shifters should provide even more accurate forecasts.

This research gives direction for the industry to focus each part rather than the parts as a whole for pricing. That is, under conditions now present in the broiler meat market, it appears more accurate forecast results can be obtained by modeling individual parts independently of other parts rather than being inter-related with all broiler parts can have forecast results.

The broiler industry has changed dramatically since the early 2000's. Prior to further processed value-added products, broiler wholesale prices represented a significant portion of the

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agreed upon contract price. Value-added products have since grown in market share and are now

demanded by consumers. However, value-added products now have a large portion of extra costs

added to them. For the broiler industry, this means that the initial wholesale costs of the whole

bird before parts are individually priced no longer represent a large portion of the costs. Each

individual wholesale part is now broken down significantly further to create even more products.

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Appendix

Table 1A – Baseline Model 1 – Diebold Mariano Test Parameter Estimates VAR (3^{16}) vs. AR (3) Out-of-Sample Forecasts
January 2000 – May 2017

| | VAR (3) Estimation Jan. 00 - May 17 | | | | AR (3) Estimation Jan. 00 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | | | | | | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series WING														
1	209	1.16	6.41	8.04	0.84	0.72	6.33	8.05	0.84	0.47	0.79	0.53	0.21	FTR H_0
2	208	2.75	11.36	13.99	0.88	1.62	11.20	13.96	0.87	0.57	0.77	0.43	0.23	FTR H_0
3	207	4.35	14.76	17.98	0.88	2.52	14.43	17.86	0.88	0.63	0.87	0.37	0.13	FTR H_0
4	206	5.62	17.20	20.90	0.87	3.27	16.76	20.80	0.87	0.61	0.89	0.39	0.11	FTR H_0
5	205	6.69	19.06	23.31	0.86	3.95	18.78	23.22	0.86	0.60	0.77	0.40	0.23	FTR H_0
6	204	7.67	20.37	25.25	0.85	4.64	20.44	25.11	0.84	0.63	0.46	0.37	0.54	FTR H_0
7	203	8.52	21.85	26.91	0.83	5.29	22.20	26.73	0.83	0.65	0.23	0.35	0.77	FTR H_0
8	202	9.21	23.27	28.52	0.82	5.88	23.62	28.22	0.81	0.72	0.24	0.28	0.76	FTR H_0
9	201	9.79	24.40	30.02	0.81	6.41	24.54	29.58	0.80	0.79	0.41	0.21	0.59	FTR H_0
Forecast Statistics for Series WOG														
1	209	0.73	2.89	3.77	0.89	0.56	2.94	3.80	0.89	0.42	0.31	0.58	0.69	FTR H_0
2	208	1.61	4.91	6.20	0.90	1.27	4.98	6.29	0.91	0.36	0.36	0.64	0.64	FTR H_0
3	207	2.40	6.16	7.74	0.88	1.91	6.14	7.78	0.88	0.46	0.55	0.54	0.45	FTR H_0
4	206	3.06	6.94	8.82	0.87	2.43	6.73	8.76	0.87	0.58	0.81	0.42	0.19	FTR H_0
5	205	3.67	7.41	9.60	0.88	2.90	7.06	9.35	0.86	0.76	0.92	0.24	0.08	VAR < AR*
6	204	4.27	7.67	10.13	0.89	3.38	7.18	9.69	0.85	0.88	0.97	0.12	0.03	VAR < AR**
7	203	4.79	7.94	10.55	0.89	3.81	7.47	10.13	0.86	0.87	0.97	0.13	0.03	VAR < AR**
8	202	5.26	8.20	10.85	0.91	4.20	7.87	10.49	0.88	0.83	0.90	0.17	0.10	VAR < AR*
9	201	5.69	8.35	11.05	0.93	4.58	8.08	10.69	0.90	0.82	0.83	0.18	0.17	VAR < AR*

[16] 3 signifies the month lag parameter

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Table 1A Cont. – Baseline Model 1 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
January 2000 – May 2017

| | | | | | | | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | VAR (3) Estimation Jan. 00 - May 17 | | | | | AR (3) Estimation Jan. 00 - May 17 | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series BSBTO														
1	209	1.37	8.19	10.55	0.87	1.10	7.92	10.18	0.84	0.99	0.96	0.01	0.04	VAR < AR**
2	208	2.95	12.01	16.23	0.82	2.20	11.59	15.60	0.78	1.00	0.96	0.00	0.04	VAR < AR**
3	207	4.63	15.06	20.43	0.80	3.33	14.12	19.46	0.77	1.00	1.00	0.00	0.00	VAR < AR***
4	206	6.07	17.48	23.42	0.79	4.34	16.28	22.16	0.75	1.00	1.00	0.00	0.00	VAR < AR***
5	205	7.30	18.54	25.13	0.78	5.25	17.58	23.82	0.74	1.00	0.99	0.00	0.01	VAR < AR***
6	204	8.41	19.03	25.91	0.77	6.12	18.23	24.69	0.73	1.00	0.98	0.00	0.02	VAR < AR**
7	203	9.35	19.48	26.16	0.78	6.91	18.60	25.09	0.75	1.00	0.99	0.00	0.01	VAR < AR**
8	202	10.21	19.63	26.22	0.81	7.70	18.92	25.34	0.78	0.99	0.96	0.01	0.04	VAR < AR**
9	201	10.84	20.06	26.56	0.85	8.31	19.37	25.86	0.83	0.97	0.96	0.03	0.04	VAR < AR**
Forecast Statistics for Series LQ														
1	209	0.30	1.98	2.85	0.94	0.20	1.82	2.71	0.90	0.99	1.00	0.01	0.00	VAR < AR***
2	208	0.68	3.75	5.01	0.99	0.46	3.47	4.72	0.93	0.99	1.00	0.01	0.00	VAR < AR***
3	207	1.02	4.98	6.39	0.99	0.72	4.64	5.99	0.93	0.99	0.99	0.01	0.01	VAR < AR***
4	206	1.28	5.92	7.43	0.98	0.91	5.48	6.95	0.92	1.00	1.00	0.00	0.00	VAR < AR***
5	205	1.52	6.50	8.21	0.98	1.09	6.02	7.65	0.91	1.00	1.00	0.00	0.00	VAR < AR***
6	204	1.77	6.92	8.80	0.98	1.27	6.43	8.19	0.91	1.00	1.00	0.00	0.00	VAR < AR***
7	203	2.00	7.18	9.18	0.99	1.43	6.71	8.58	0.92	1.00	0.99	0.00	0.01	VAR < AR***
8	202	2.23	7.35	9.45	1.00	1.58	6.83	8.82	0.94	1.00	1.00	0.00	0.00	VAR < AR***
9	201	2.43	7.52	9.69	1.02	1.73	6.96	8.98	0.95	1.00	1.00	0.00	0.00	VAR < AR***

Note:* Indicatesstatistical significance at α = 10%; ** Indicates statistical significance at α = 5%;
    *** Indicates statistical significance at α = 1%

Table 1B – Unit Root Results Presented By RATS – Baseline Model 1

Results of Augmented Dickey-Fuller Test of Null Hypothesis of
Existence of a Unit-Root Given by RATS
Model 1 - Estimation January 2000 - May 2017

Variable	Model Specification Selected	Test Statistic	Critical Value ($\alpha = 1\%$)	Critical Value ($\alpha = 5\%$)	Critical Value ($\alpha = 10\%$)	AIC Lag	Test Conclusion
WOG	With Intercept	-0.775	-3.452	-2.871	-2.572	13	Unit Root
WING	With Intercept	0.185	-3.453	-2.871	-2.572	24	Unit Root
BSBTO	With Intercept	-2.503	-3.453	-2.871	-2.572	24	Unit Root
LQ	With Intercept	-2.160	-3.452	-2.870	-2.571	7	Unit Root

Table 2A – Model 2 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

		VAR (3) Estimation August 07 - May 17				AR (3) Estimation August 07 - May 17				D-M p-Value of Test of $H0$: VAR (3) = AR(3)				Concl.: Data Supports
										VAR > AR		VAR < AR		
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	
Forecast Statistics for Series BSBTO														
1	118	0.343	8.920	10.897	0.958	-0.312	6.959	8.725	0.767	1.000	1.000	0.000	0.000	VAR < AR***
2	117	-0.184	14.650	17.896	0.982	-0.696	10.215	12.729	0.699	1.000	1.000	0.000	0.000	VAR < AR***
3	116	-0.647	17.903	22.579	0.966	-1.001	11.863	14.945	0.639	1.000	1.000	0.000	0.000	VAR < AR***
4	115	-0.900	20.703	26.360	0.960	-1.262	13.603	16.751	0.610	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-1.187	23.031	28.953	0.955	-1.570	14.488	17.876	0.590	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-1.403	24.705	30.088	0.952	-1.764	15.185	18.654	0.590	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-1.585	25.606	30.223	0.963	-1.899	15.792	19.308	0.615	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-1.699	26.064	30.260	1.000	-2.047	16.289	20.079	0.663	1.000	1.000	0.000	0.000	VAR < AR***
9	110	-1.584	25.560	30.051	1.050	-2.083	16.645	20.577	0.719	1.000	1.000	0.000	0.000	VAR < AR***
Forecast Statistics for Series LQ														
1	118	-0.682	2.504	3.400	1.138	-0.554	1.955	2.890	0.967	1.000	1.000	0.000	0.000	VAR < AR***
2	117	-1.773	4.673	6.082	1.230	-1.337	3.639	5.017	1.015	1.000	1.000	0.000	0.000	VAR < AR***
3	116	-2.709	5.933	7.691	1.234	-2.041	4.664	6.307	1.012	1.000	1.000	0.000	0.000	VAR < AR***
4	115	-3.555	6.713	8.771	1.219	-2.700	5.400	7.336	1.019	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-4.280	7.291	9.603	1.209	-3.313	6.074	8.183	1.030	1.000	0.999	0.000	0.001	VAR < AR***
6	113	-4.843	7.829	10.258	1.206	-3.873	6.697	8.927	1.050	0.999	0.998	0.001	0.002	VAR < AR***
7	112	-5.257	8.113	10.614	1.210	-4.387	7.218	9.540	1.088	0.998	0.990	0.002	0.010	VAR < AR***
8	111	-5.490	8.221	10.843	1.222	-4.856	7.581	10.056	1.133	0.986	0.953	0.014	0.047	VAR < AR**
9	110	-5.722	8.578	11.062	1.233	-5.318	7.829	10.489	1.169	0.960	0.975	0.040	0.025	VAR < AR**

Table 2A Cont. – Model 2 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | VAR (3) Estimation August 07 - May 17 | | | | AR (3) Estimation August 07 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | | | | | | | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series SMWING														
1	118	-0.379	7.109	8.950	0.877	-0.213	6.141	7.865	0.771	0.999	0.999	0.001	0.001	VAR < AR***
2	117	-0.716	12.710	15.966	0.920	-0.502	11.116	13.895	0.800	0.998	0.994	0.002	0.006	VAR < AR***
3	116	-1.208	16.998	21.343	0.944	-0.844	14.575	18.338	0.811	1.000	0.998	0.000	0.002	VAR < AR***
4	115	-1.953	21.332	26.317	0.973	-1.254	17.343	22.236	0.822	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-2.877	25.151	30.377	0.991	-1.686	20.456	25.505	0.832	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-3.563	27.605	33.249	0.988	-1.916	22.984	27.887	0.829	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-4.068	29.606	35.138	0.958	-2.061	25.343	29.731	0.811	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-4.548	31.242	36.530	0.920	-2.311	27.390	31.542	0.795	1.000	0.998	0.000	0.002	VAR < AR***
9	110	-4.632	32.655	37.807	0.891	-2.474	28.891	33.282	0.784	0.999	0.998	0.001	0.002	VAR < AR***
Forecast Statistics for Series JMWING														
1	118	1.160	6.734	8.757	0.831	0.517	6.011	7.806	0.740	0.990	0.977	0.010	0.023	VAR < AR**
2	117	2.389	12.049	15.814	0.899	1.175	10.612	13.926	0.791	0.974	0.977	0.026	0.023	VAR < AR**
3	116	3.036	16.217	20.952	0.933	1.740	14.397	18.318	0.816	0.988	0.976	0.012	0.024	VAR < AR**
4	115	3.200	20.020	25.080	0.946	2.322	17.493	21.958	0.828	0.997	0.993	0.003	0.007	VAR < AR***
5	114	3.058	22.219	27.661	0.937	2.746	19.623	24.217	0.820	0.998	0.989	0.002	0.011	VAR < AR**
6	113	3.148	23.797	29.277	0.924	3.224	21.120	25.814	0.814	0.996	0.991	0.004	0.009	VAR < AR***
7	112	3.456	24.232	30.133	0.894	3.760	22.600	27.184	0.806	0.984	0.911	0.016	0.089	VAR < AR*
8	111	3.744	24.590	30.655	0.859	4.164	24.148	28.657	0.803	0.923	0.636	0.077	0.364	FTR H_0
9	110	4.379	25.707	31.375	0.832	4.639	25.501	30.054	0.797	0.834	0.564	0.166	0.436	FTR H_0

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Table 2A Cont. – Model 2 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | VAR (3) Estimation August 07 - May 17 | | | | AR (3) Estimation August 07 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | | | | | | | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series WOG														
1	118	-0.042	3.477	4.442	0.918	-0.100	3.166	3.934	0.813	0.983	0.968	0.017	0.032	VAR < AR**
2	117	-0.525	5.902	7.507	0.970	-0.240	5.021	6.298	0.814	0.998	0.996	0.002	0.004	VAR < AR***
3	116	-0.985	7.295	9.437	0.951	-0.346	6.204	7.712	0.777	1.000	0.996	0.000	0.004	VAR < AR***
4	115	-1.335	8.181	10.574	0.946	-0.437	6.711	8.532	0.763	1.000	0.999	0.000	0.001	VAR < AR***
5	114	-1.653	9.020	11.531	0.968	-0.528	6.700	8.945	0.751	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-1.895	9.904	12.477	1.019	-0.610	7.019	9.286	0.758	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-2.079	10.285	13.071	1.030	-0.708	7.406	9.766	0.770	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-2.202	10.583	13.374	1.052	-0.873	7.922	10.231	0.805	1.000	1.000	0.000	0.000	VAR < AR***
9	110	-2.188	10.685	13.362	1.074	-0.988	8.266	10.579	0.850	1.000	1.000	0.000	0.000	VAR < AR***
Forecast Statistics for Series THIGH														
1	118	0.020	2.523	3.392	1.139	-0.260	1.907	2.690	0.903	0.978	0.999	0.022	0.001	VAR < AR***
2	117	-0.376	4.896	6.309	1.212	-0.611	3.764	4.947	0.950	0.983	0.999	0.017	0.001	VAR < AR***
3	116	-1.022	6.701	8.255	1.204	-0.947	5.260	6.614	0.965	0.999	1.000	0.001	0.000	VAR < AR***
4	115	-1.828	8.017	9.910	1.235	-1.380	6.328	7.932	0.989	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-2.598	9.021	11.389	1.271	-1.830	7.070	9.096	1.015	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-3.263	9.947	12.606	1.292	-2.309	7.714	10.195	1.045	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-3.827	10.595	13.574	1.299	-2.769	8.219	11.198	1.071	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-4.239	11.245	14.376	1.294	-3.189	8.867	12.206	1.098	1.000	1.000	0.000	0.000	VAR < AR***
9	110	-4.622	11.821	15.006	1.284	-3.637	9.470	13.098	1.121	1.000	1.000	0.000	0.000	VAR < AR***

Table 2A Cont. – Model 2 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | VAR (3) Estimation August 07 - May 17 | | | | AR (3) Estimation August 07 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | | | | | | | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series TENDER														
1	118	0.449	10.274	13.431	0.892	1.431	9.156	11.383	0.756	0.986	0.974	0.014	0.026	VAR < AR**
2	117	0.219	18.102	23.950	0.942	3.401	15.312	18.093	0.711	0.989	0.988	0.011	0.012	VAR < AR**
3	116	-0.042	23.776	30.593	0.935	5.477	17.373	22.292	0.681	0.999	1.000	0.001	0.000	VAR < AR***
4	115	0.418	26.397	33.755	0.892	7.373	18.608	24.405	0.645	1.000	1.000	0.000	0.000	VAR < AR***
5	114	1.559	28.590	36.355	0.878	8.707	19.416	25.608	0.618	1.000	1.000	0.000	0.000	VAR < AR***
6	113	3.252	30.208	37.825	0.884	9.841	19.796	26.198	0.612	1.000	1.000	0.000	0.000	VAR < AR***
7	112	5.016	29.779	37.618	0.900	10.819	20.280	26.418	0.632	1.000	1.000	0.000	0.000	VAR < AR***
8	111	6.594	29.038	36.413	0.921	11.537	20.857	26.600	0.673	1.000	1.000	0.000	0.000	VAR < AR***
9	110	8.328	28.812	35.062	0.943	12.344	21.267	26.829	0.722	1.000	1.000	0.000	0.000	VAR < AR***
Forecast Statistics for Series DRUM														
1	118	-0.607	2.399	3.111	0.971	-0.501	2.079	2.776	0.867	0.988	0.996	0.012	0.004	VAR < AR***
2	117	-1.790	5.009	6.317	1.135	-1.247	4.080	5.192	0.933	0.999	1.000	0.001	0.000	VAR < AR***
3	116	-2.957	6.674	8.379	1.160	-2.003	5.366	6.707	0.928	1.000	1.000	0.000	0.000	VAR < AR***
4	115	-4.076	7.970	9.851	1.160	-2.804	6.201	7.908	0.931	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-5.019	8.977	11.110	1.172	-3.547	6.909	9.023	0.952	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-5.718	9.883	12.167	1.200	-4.215	7.498	10.119	0.998	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-6.275	10.572	13.024	1.244	-4.889	8.279	11.127	1.063	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-6.678	11.171	13.660	1.296	-5.516	8.864	12.046	1.143	0.998	1.000	0.002	0.000	VAR < AR***
9	110	-7.139	11.735	14.151	1.346	-6.175	9.425	12.765	1.214	0.994	1.000	0.006	0.000	VAR < AR***

Note:* Indicatesstatistical significance at α = 10%; ** Indicates statistical significance at α = 5%;
*** Indicates statistical significance at α = 1%

Table 2B – Unit Root Results Presented By RATS – Model 2

Results of Augmented Dickey-Fuller Test of Null Hypothesis of
Existence of a Unit-Root Given by RATS
Model 2 - Estimation August 2007 - May 17

Variable	Model Specification Selected	Test Statistic	Critical Value ($\alpha = 1\%$)	Critical Value ($\alpha = 5\%$)	Critical Value ($\alpha = 10\%$)	AIC Lag	Test Conclusion
JBSBTO	With Intercept	-4.237	-3.465	-2.877	-2.575	16	Significant at $\alpha = 1\%$
JMWING	With Intercept	0.089	-3.467	-2.877	-2.575	24	Unit Root
SMWING	With Intercept	-0.779	-3.467	-2.877	-2.575	24	Unit Root
TENDER	With Intercept	-2.621	-3.467	-2.877	-2.575	24	Significant at $\alpha = 10\%$
WOG	With Intercept	-1.824	-3.455	-2.872	-2.572	24	Unit Root
LQ	With Intercept	-2.914	-3.452	-2.870	-2.571	6	Significant at $\alpha = 5\%$
THIGH	With Intercept	-2.322	-3.463	-2.876	-2.574	3	Unit Root
DRUM	With Intercept	-1.800	-3.467	-2.877	-2.575	23	Unit Root

Table 3A – Model 3 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | | | | | | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | VAR (3) Estimation August 07 - May 2017 | | | | AR (3) August 07 - May 17 | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series BSBTO														
1	118	-0.285	8.171	9.872	0.868	-0.312	6.959	8.725	0.767	1.000	1.000	0.000	0.000	VAR < AR***
2	117	-1.016	12.754	15.650	0.859	-0.696	10.215	12.729	0.699	1.000	1.000	0.000	0.000	VAR < AR***
3	116	-1.288	15.169	19.592	0.838	-1.001	11.863	14.945	0.639	1.000	1.000	0.000	0.000	VAR < AR***
4	115	-1.253	17.496	22.564	0.822	-1.262	13.603	16.751	0.610	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-1.189	18.743	24.378	0.804	-1.570	14.488	17.876	0.590	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-0.960	20.339	25.015	0.792	-1.764	15.185	18.654	0.590	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-0.622	20.833	24.625	0.785	-1.899	15.792	19.308	0.615	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-0.306	20.578	24.176	0.799	-2.047	16.289	20.079	0.663	1.000	1.000	0.000	0.000	VAR < AR***
9	110	0.077	20.000	23.513	0.822	-2.083	16.645	20.577	0.719	0.999	1.000	0.001	0.000	VAR < AR***
Forecast Statistics for Series SMWING														
1	118	-0.491	6.490	8.363	0.819	-0.213	6.141	7.865	0.771	0.976	0.918	0.024	0.082	VAR < AR**
2	117	-0.942	11.708	14.753	0.850	-0.502	11.116	13.895	0.800	0.975	0.895	0.025	0.105	VAR < AR*
3	116	-1.350	15.724	19.794	0.875	-0.844	14.575	18.338	0.811	0.995	0.967	0.005	0.033	VAR < AR**
4	115	-1.862	19.970	24.507	0.906	-1.254	17.343	22.236	0.822	1.000	1.000	0.000	0.000	VAR < AR***
5	114	-2.527	23.525	28.351	0.925	-1.686	20.456	25.505	0.832	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-3.027	26.344	31.114	0.925	-1.916	22.984	27.887	0.829	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-3.446	28.463	33.006	0.900	-2.061	25.343	29.731	0.811	1.000	0.999	0.000	0.001	VAR < AR***
8	111	-4.050	30.084	34.251	0.863	-2.311	27.390	31.542	0.795	0.996	0.997	0.004	0.003	VAR < AR***
9	110	-4.341	31.194	35.421	0.835	-2.474	28.891	33.282	0.784	0.982	0.991	0.018	0.009	VAR < AR***

Table 3A Cont. – Model 3 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | VAR (3) Estimation August 07 - May 2017 | | | | AR (3) August 07 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | Concl.: Data |
| | | | | | | | | | | VAR > AR | | VAR < AR | | |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series JMWING														
1	118	0.674	6.145	7.992	0.758	0.517	6.011	7.806	0.740	0.765	0.674	0.235	0.326	FTR H_0
2	117	1.516	10.885	13.964	0.794	1.175	10.612	13.926	0.791	0.531	0.691	0.469	0.309	FTR H_0
3	116	2.253	14.426	18.456	0.822	1.740	14.397	18.318	0.816	0.582	0.516	0.418	0.484	FTR H_0
4	115	2.854	18.186	22.597	0.852	2.322	17.493	21.958	0.828	0.796	0.788	0.204	0.212	FTR H_0
5	114	3.108	20.624	25.198	0.854	2.746	19.623	24.217	0.820	0.871	0.859	0.129	0.141	FTR H_0
6	113	3.369	21.933	26.819	0.846	3.224	21.120	25.814	0.814	0.862	0.815	0.138	0.185	FTR H_0
7	112	3.700	22.729	27.815	0.825	3.760	22.600	27.184	0.806	0.751	0.557	0.249	0.443	FTR H_0
8	111	3.860	23.280	28.460	0.798	4.164	24.148	28.657	0.803	0.417	0.168	0.583	0.832	FTR H_0
9	110	4.304	23.933	29.274	0.777	4.639	25.501	30.054	0.797	0.201	0.046	0.799	0.954	FTR H_0
Forecast Statistics for Series WOG														
1	118	-0.410	3.396	4.255	0.880	-0.100	3.166	3.934	0.813	0.981	0.955	0.019	0.045	VAR < AR**
2	117	-1.048	5.739	7.206	0.931	-0.240	5.021	6.298	0.814	0.997	0.996	0.003	0.004	VAR < AR***
3	116	-1.519	7.022	9.144	0.921	-0.346	6.204	7.712	0.777	0.999	0.986	0.001	0.014	VAR < AR**
4	115	-1.831	7.889	10.351	0.926	-0.437	6.711	8.532	0.763	1.000	0.997	0.000	0.003	VAR < AR***
5	114	-2.033	8.656	11.184	0.938	-0.528	6.700	8.945	0.751	1.000	1.000	0.000	0.000	VAR < AR***
6	113	-2.095	9.190	11.897	0.971	-0.610	7.019	9.286	0.758	1.000	1.000	0.000	0.000	VAR < AR***
7	112	-2.079	9.416	12.358	0.974	-0.708	7.406	9.766	0.770	1.000	1.000	0.000	0.000	VAR < AR***
8	111	-2.079	9.773	12.678	0.998	-0.873	7.922	10.231	0.805	1.000	1.000	0.000	0.000	VAR < AR***
9	110	-1.992	10.043	12.765	1.026	-0.988	8.266	10.579	0.850	1.000	1.000	0.000	0.000	VAR < AR***

Table 3A Cont. – Model 3 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts August 2007 – May 2017

										D-M p-Value of Test of $H0$: VAR (3) = AR(3)				
	VAR (3) Estimation August 07 - May 2017					AR (3) August 07 - May 17				VAR > AR		VAR < AR		Concl.: Data
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series TENDER														
1	118	0.260	9.414	11.962	0.794	1.431	9.156	11.383	0.756	0.917	0.723	0.083	0.277	FTR H_0
2	117	-0.038	16.502	20.315	0.799	3.401	15.312	18.093	0.711	0.985	0.894	0.015	0.106	FTR H_0
3	116	-0.176	21.562	26.610	0.813	5.477	17.373	22.292	0.681	0.999	1.000	0.001	0.000	VAR < AR***
4	115	0.335	23.896	30.597	0.808	7.373	18.608	24.405	0.645	1.000	1.000	0.000	0.000	VAR < AR***
5	114	1.385	25.174	33.072	0.799	8.707	19.416	25.608	0.618	1.000	1.000	0.000	0.000	VAR < AR***
6	113	3.037	26.395	33.933	0.793	9.841	19.796	26.198	0.612	1.000	1.000	0.000	0.000	VAR < AR***
7	112	4.939	26.005	33.410	0.799	10.819	20.280	26.418	0.632	1.000	0.999	0.000	0.001	VAR < AR***
8	111	6.758	25.592	32.393	0.820	11.537	20.857	26.600	0.673	0.998	0.995	0.002	0.005	VAR < AR***
9	110	8.709	25.392	31.595	0.850	12.344	21.267	26.829	0.722	0.996	0.995	0.004	0.005	VAR < AR***

Note:* Indicatesstatistical significance at α = 10%; ** Indicates statistical significance at α = 5%;

*** Indicates statistical significance at α = 1%

Table 3B – Unit Root Results Presented By RATS – Model 3

Results of Augmented Dickey-Fuller Test of Null Hypothesis of
Existence of a Unit-Root Given by RATS
Model 3 - Estimation August 2007 - May 2017

Variable	Model Specification Selected	Test Statistic	Critical Value ($\alpha = 1\%$)	Critical Value ($\alpha = 5\%$)	Critical Value ($\alpha = 10\%$)	AIC Lag	Test Conclusion
JBSBTO	With Intercept	-4.237	-3.465	-2.877	-2.575	16	Significant at $\alpha = 1\%$
JMWING	With Intercept	0.089	-3.467	-2.877	-2.575	24	Unit Root
SMWING	With Intercept	-0.779	-3.467	-2.877	-2.575	24	Unit Root
TENDER	With Intercept	-2.621	-3.467	-2.877	-2.575	24	Significant at $\alpha = 10\%$
WOG	With Intercept	-1.824	-3.455	-2.872	-2.572	24	Unit Root

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Table 4A – Model 4 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

										VAR > AR		VAR < AR		Concl.: Data
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series BSBTO														
1	118	-0.766	7.644	9.348	0.822	-0.312	6.959	8.725	0.767	0.999	1.000	0.001	0.000	VAR < AR***
2	117	-1.971	11.591	14.192	0.779	-0.696	10.215	12.729	0.699	1.000	1.000	0.000	0.000	VAR < AR***
3	116	-2.770	13.615	17.049	0.729	-1.001	11.863	14.945	0.639	1.000	1.000	0.000	0.000	VAR < AR***
4	115	-3.213	15.176	19.014	0.693	-1.262	13.603	16.751	0.610	0.999	0.997	0.001	0.003	VAR < AR***
5	114	-3.575	16.019	20.175	0.666	-1.570	14.488	17.876	0.590	0.998	0.996	0.002	0.004	VAR < AR***
6	113	-3.715	16.843	20.872	0.661	-1.764	15.185	18.654	0.590	0.998	0.998	0.002	0.002	VAR < AR***
7	112	-3.717	17.459	21.292	0.678	-1.899	15.792	19.308	0.615	0.997	0.998	0.003	0.002	VAR < AR***
8	111	-3.666	18.036	21.873	0.723	-2.047	16.289	20.079	0.663	0.996	0.999	0.004	0.001	VAR < AR***
9	110	-3.489	18.206	22.075	0.772	-2.083	16.645	20.577	0.719	0.993	0.997	0.008	0.003	VAR < AR***
Forecast Statistics for Series SMWING														
1	118	-0.668	6.448	8.233	0.807	-0.213	6.141	7.865	0.771	0.972	0.948	0.028	0.052	VAR < AR*
2	117	-1.307	11.491	14.373	0.828	-0.502	11.116	13.895	0.800	0.919	0.859	0.081	0.141	VAR < AR*
3	116	-2.061	15.301	19.181	0.848	-0.844	14.575	18.338	0.811	0.978	0.951	0.022	0.049	VAR < AR**
4	115	-3.011	19.002	23.659	0.875	-1.254	17.343	22.236	0.822	0.996	0.999	0.004	0.001	VAR < AR***
5	114	-4.100	22.171	27.352	0.892	-1.686	20.456	25.505	0.832	0.998	0.997	0.002	0.003	VAR < AR***
6	113	-4.936	25.177	30.168	0.897	-1.916	22.984	27.887	0.829	0.999	0.999	0.001	0.001	VAR < AR***
7	112	-5.620	27.612	32.165	0.877	-2.061	25.343	29.731	0.811	0.999	0.999	0.001	0.001	VAR < AR***
8	111	-6.349	29.305	33.614	0.847	-2.311	27.390	31.542	0.795	0.994	0.992	0.006	0.008	VAR < AR***
9	110	-6.737	30.540	34.830	0.821	-2.474	28.891	33.282	0.784	0.965	0.979	0.035	0.021	VAR < AR**

Column group headers:
- VAR (3) Estimation August 07 - May 2017 (columns: ME, MAE, RMSE, Theil U)
- AR (3) August 07 - May 17 (columns: ME, MAE, RMSE, Theil U)
- D-M p-Value of Test of H0: VAR (3) = AR(3) — VAR > AR (MSE, MAE); VAR < AR (MSE, MAE)

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Table 4A Cont. – Model 4 – Diebold Mariano Test Parameter Estimates VAR (3) vs. AR (3) Out-of-Sample Forecasts
August 2007 – May 2017

| | | VAR (3) Estimation August 07 - May 2017 | | | | AR (3) August 07 - May 17 | | | | D-M p-Value of Test of $H0$: VAR (3) = AR(3) | | | | |
| | | | | | | | | | | VAR > AR | | VAR < AR | | Concl.: Data |
Step	N	ME	MAE	RMSE	Theil U	ME	MAE	RMSE	Theil U	MSE	MAE	MSE	MAE	Supports
Forecast Statistics for Series JMWING														
1	118	0.614	6.069	8.032	0.762	0.517	6.011	7.806	0.740	0.867	0.603	0.133	0.397	FTR H_0
2	117	1.418	10.900	13.990	0.795	1.175	10.612	13.926	0.791	0.562	0.744	0.438	0.256	FTR H_0
3	116	1.890	14.588	18.223	0.812	1.740	14.397	18.318	0.816	0.433	0.634	0.567	0.366	FTR H_0
4	115	2.073	18.076	21.823	0.823	2.322	17.493	21.958	0.828	0.418	0.807	0.582	0.193	FTR H_0
5	114	1.919	20.112	23.941	0.811	2.746	19.623	24.217	0.820	0.349	0.751	0.651	0.249	FTR H_0
6	113	1.847	21.098	25.342	0.799	3.224	21.120	25.814	0.814	0.254	0.487	0.746	0.513	FTR H_0
7	112	1.896	21.943	26.423	0.784	3.760	22.600	27.184	0.806	0.133	0.166	0.867	0.834	FTR H_0
8	111	1.845	22.917	27.290	0.765	4.164	24.148	28.657	0.803	0.016	0.029	0.984	0.971	VAR > AR**
9	110	2.119	23.452	28.138	0.746	4.639	25.501	30.054	0.797	0.002	0.002	0.998	0.998	VAR > AR***
Forecast Statistics for Series TENDER														
1	118	-0.117	9.071	11.630	0.772	1.431	9.156	11.383	0.756	0.737	0.416	0.263	0.584	FTR H_0
2	117	-0.896	15.826	19.259	0.757	3.401	15.312	18.093	0.711	0.893	0.727	0.107	0.273	FTR H_0
3	116	-1.666	20.226	24.514	0.749	5.477	17.373	22.292	0.681	0.962	0.994	0.038	0.006	VAR < AR**
4	115	-1.790	21.818	27.163	0.718	7.373	18.608	24.405	0.645	0.966	0.992	0.034	0.008	VAR < AR**
5	114	-1.273	21.533	28.416	0.686	8.707	19.416	25.608	0.618	0.952	0.923	0.048	0.077	VAR < AR**
6	113	-0.004	21.654	28.592	0.668	9.841	19.796	26.198	0.612	0.911	0.874	0.089	0.126	FTR H_0
7	112	1.614	21.760	28.025	0.670	10.819	20.280	26.418	0.632	0.810	0.816	0.190	0.184	FTR H_0
8	111	3.250	22.333	27.750	0.702	11.537	20.857	26.600	0.673	0.738	0.822	0.262	0.178	FTR H_0
9	110	5.066	22.559	27.873	0.750	12.344	21.267	26.829	0.722	0.750	0.816	0.250	0.184	FTR H_0

Note: * Indicates statistical significance at α = 10%; ** Indicates statistical significance at α = 5%;
*** Indicates statistical significance at α = 1%

Table 4B – Unit Root Results Presented By RATS – Model 4

Results of Augmented Dickey-Fuller Test of Null Hypothesis of
Existence of a Unit-Root Given by RATS
Model 4 - Estimation August 2007 - May 2017

Variable	Model Specification Selected	Test Statistic	Critical Value ($\alpha = 1\%$)	Critical Value ($\alpha = 5\%$)	Critical Value ($\alpha = 10\%$)	AIC Lag	Test Conclusion
JBSBTO	With Intercept	-4.608	-3.462	-2.875	-2.574	16	Significant at $\alpha = 1\%$
JMWING	With Intercept	0.061	-3.463	-2.875	-2.574	24	Unit Root
SMWING	With Intercept	-0.590	-3.463	-2.875	-2.574	24	Unit Root
TENDER	With Intercept	-2.672	-3.463	-2.875	-2.574	24	Significant at $\alpha = 10\%$

EXHIBIT 18

WATTPoultry
.com

US per capita meat use in pounds and household median income
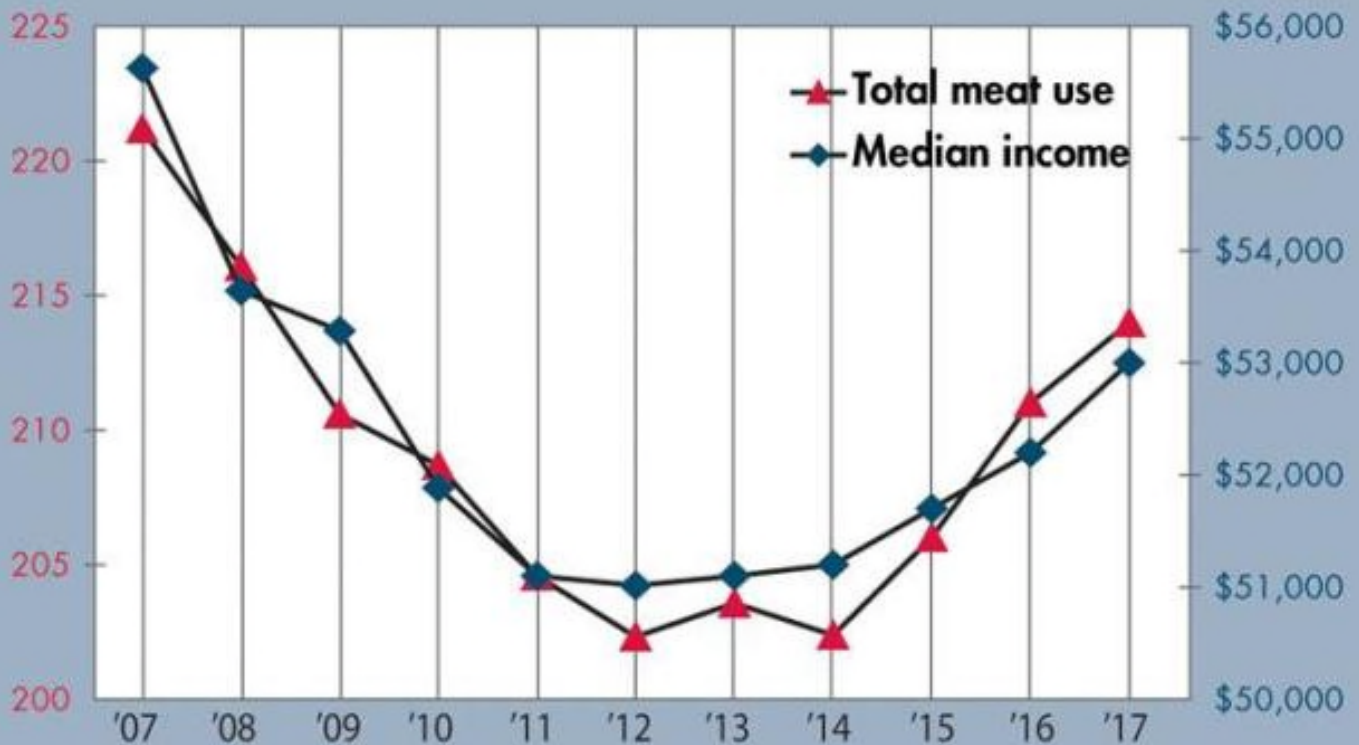
By 2015, the production and domestic consumption of chicken, beef and pork can all be expected to be increasing robustly.

By Paul Aho
on April 14, 2014

POULTRY PERSPECTIVE

The great meat recession

During the meat recession, US per capita red meat and poultry consumption dropped nearly 20 pounds or 10 percent.

The great recession in the U.S. started in December 2007 and officially ended in June 2009. However, it left such damage in its wake that hard times lingered for millions of people long after the recession officially ended. If 2009 was too early to call the great recession over, when did it really end? Perhaps it ended when the involuntary drop in the consumption of meat associated with the recession finally ran its course.

A period of falling per capita meat consumption could be called a meat recession. When meat consumption is falling, it is almost sure to be a period of deteriorating economic conditions. On the other hand, rising meat consumption is generally a sign of an improving real economy. In contrast to the official end of the economic recession in the U.S. economy in 2009, the meat recession ended in 2012. During the meat recession, U.S. per capita red meat and poultry consumption dropped nearly 20 pounds or 10 percent. It was the biggest such recession since the 1930s.

Meat consumption's link to median income

Over the same period, U.S. median income dropped $5,000 per household. The link between meat use and median income is unsurprising. With less money to spend, Americans ate less meat.

What is median income and why use it? Median income is the income in the middle. In the case of the U.S. with 120 million households, the median household income would be the income of that one single household which happens to be 60 million down from the richest household and 60 million up from the poorest household. Median is a better number to use than average because average income is distorted by billionaires.

Meat consumption more closely rises and falls with median income than average income.

To be sure, the recent drop in meat consumption had more than one cause. High grain prices increased the cost and ultimately the retail price of meat thereby reducing consumption. In addition, the success of U.S. meat exports also played a role in reducing the amount of domestic consumption. Nevertheless, when all is said and done, income remains the most important variable.

Meat consumption now on the way up

Household income appears to have reached a bottom in 2012, the last yearly number available. Indications are that median income showed little movement either up or down between 2012 and 2014. A more substantial increase is projected beginning in 2015.

Similarly, overall meat consumption leveled off since 2012 and is preparing for a period of rising consumption. By 2015, the production and domestic consumption of chicken, beef and pork can all be expected to be increasing robustly. Lower grain prices will help reinforce this upward movement in the next few years.

Paul Aho, Ph.D., is owner of Poultry Perspective and economist and consultant. To contact Aho, email paulaho@paulaho.com.

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EXHIBIT 19

The New York Times

U.S. May Free Up More Land for Corn Crops

Jim Heitman at his farm Friday in Elsberry, Mo., Because of flooding, he says, he has planted only 50 acres of corn this year compared with 600 last year.
Dan Gill for The New York Times

By David Streitfeld

June 21, 2008

CHICAGO   Signs are growing that the government may allow farmers to plant crops on millions of acres of conservation land, while a chorus of voices is also pleading with Washington to cut requirements for ethanol production.

The Midwest floods have washed out an estimated four million acres of prime farmland, crimping this year's harvest as the world desperately needs more grain. With corn prices setting records and soybean prices not far behind, the Bush administration is under intense pressure to do what it can to bolster the food supply.

Senator Charles E. Grassley, Republican of Iowa and one of Capitol Hill's main voices on farm policy, on Friday urged the Agriculture Department to release tens of thousands of farmers from contracts under which they had promised to set aside huge tracts as natural habitat.

"This is an extraordinary request," Mr. Grassley said in a telephone interview as he toured his devastated state. "I would not make it if the situation in the Midwest were not so dire."

In disasters, the Environmental Protection Agency can roll back requirements for ethanol production, which could free up a large amount of corn for animal feed. Mr. Grassley, a strong ethanol backer, rejected that proposition, but in recent days many industries that depend on corn have urged the government to act.

A quarter of the United States corn crop is used for biofuels rather than animal or human food, and the percentage is rising. What this has done to the price of gasoline is debated by ethanol's critics and defenders, but it has certainly benefited farmers, who have not seen such demand for their corn crop in decades.

On the losing side of the equation have been cattle, hog and chicken producers, as well as consumers. The government's latest projection, released Friday, is that food prices this year will rise as much as 5.5 percent. Some products, including cereals and eggs, are expected to rise about 10 percent.

An Agriculture Department spokesman said Friday that the Grassley proposal would be considered. This week, the agriculture secretary, Ed Schafer, said his department would consider "everything possible" to aid farmers.

In the last couple of days, corn fell from its recent highs as traders grew convinced the government would release conservation land. Corn closed Friday at $7.21 a bushel, still an extraordinary price by historical standards.

The idea of easing ethanol mandates, while it would also lower the price of corn, is contentious. "There are different forces at work in the administration that are basically duking it out over how this should come out," said Brent Erickson, executive vice president of the Biotechnology Industry Organization, a Washington group that follows the

issue.

Keith Collins, the former Agriculture Department chief economist, will release a study on Monday saying that as much as half of the sharp increase in corn prices over the last few years is due to the demands of ethanol production.

Kirk Siegle, fearing flooding, removed corn Monday from a bin on his farm in Oakville, Iowa.
Scott Olson/Getty Images

That view diverges sharply from the view of Mr. Collins' former boss, Mr. Schafer, who said at a Rome conference that only a tiny percentage of the increase in world food prices was due to American ethanol production.

"We've seen a tremendous range of unintended consequences" from the requirement that increasing amounts of ethanol be blended into gasoline, Mr. Collins said.

The economist, who was hired by the Kraft food company to prepare his report, said he would be surprised if the Agriculture Department did not open up some conservation lands. He would not speculate about a change in the ethanol mandates.

The White House will be forced to confront the ethanol issue next month. States are allowed to asked for waivers of the mandate for corn ethanol on the ground that it is harming the economy or the environment.

In April, Gov. Rick Perry of Texas did just that, saying the "misguided" mandate was devastating the livestock industry in Texas. He asked for a large decrease in ethanol requirements to free up corn for use as animal feed.

The comment period for the waiver ends on Monday; the E.P.A. administrator has until July 24 to make a decision.

President Bush has been a strong supporter of alternative fuels, including ethanol. But Keith B. Hennessey, Mr. Bush's chief economics adviser, said in an interview last week, "We have pushed renewable fuels to the point where we are getting counter-pressure saying we are going too far".

About 34 million acres are enrolled in the government's biggest conservation program, known as the Conservation Reserve Program. Farmers enroll their land for as long as a decade and cannot take it out without paying severe penalties.

Last month, the Agriculture Department took the unprecedented step of saying that some conservation land could be used for hay and grazing after the nesting season ends for grass-nesting birds. Farmers would pay only a $75 fee.

As of Friday, more than half a million acres had been signed up for the modification.

Environmental and hunting groups generally went along with that shift, but were quick to decry Mr. Grassley's latest proposal.

"Clearly there is elevated pressure every day to take land out of the program, but it would be completely devastating to wildlife," said Dave Nomsen, vice president of governmental affairs for Pheasants Forever, an advocacy group.

A better idea, Mr. Nomsen said, would be to take the millions of flooded acres and put them into conservation programs.

Sheryl Gay Stolberg contributed reporting from Washington.

EXHIBIT 20

Effects of grain and oilseed prices on the costs of US poultry production

M. Donohue* and D. L. Cunningham†[1]

*Agri Stats Inc., 6510 Mutual Drive, Fort Wayne, IN 46825; and †Department of Poultry Science, The University of Georgia, Athens 30602

Primary Audience: Plant Managers, Complex Managers, Nutritionists, Researchers

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SUMMARY

In 2002, the US government encouraged the production of ethanol and other biofuels through a combination of tax benefits and direct subsidies. Most of the ethanol produced in the United States comes from corn, the most abundant crop available. In 2002, 11% of available US corn was used for ethanol production. By 2008, approximately 30% of the US corn crop was used for ethanol production. The increased demand for corn supplies as a result of the diversion of significant amounts of corn for biofuel production in the United States, combined with increased world demands for feed grains, have resulted in unprecedented feed prices for livestock and poultry. Feed ingredient costs as a percentage of live production costs have increased from 51.8% in 2001 to 68.7% in 2008. Live production costs for broilers increased from $0.25 per pound of live weight in September 2006 to $0.45 in 2008. Similarly, live production costs for turkey meat increased from $0.35 per pound in 2006 to $0.58 in 2008, whereas the live production costs for a dozen eggs increased from $0.34 to $0.56. The increased costs of feed ingredients in the United States have resulted in $9.36 billion in cumulative additional costs to the poultry industries since 2006. Despite increases in land planted to corn and soybeans, the demand for feed grains has outpaced the supply. These factors will likely continue to put pressure on poultry producers in the United States as they seek to regain profitability.

Key words: grain price, feed cost, production cost

DESCRIPTION OF PROBLEM

Poultry and egg producers around the world are faced with unprecedented increases in feed ingredient prices and, as a result, some of the highest feed manufacturing prices ever experienced. These increased feed prices are a result of several factors that have pushed total production costs for poultry meat and eggs to record levels. Feed efficiencies and feed purchasing programs have become critically important for poultry companies as managers respond to the challenges of operating in this difficult environment. The continued demand for grain in the future suggests that costs are unlikely to diminish significantly in coming years. In many cases, the increased costs of production have eliminated company profitability for US poultry producers. This report will focus on the impact that rising feed ingredient prices have had on the poultry industry in the United States since 2006.

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[1]Corresponding author: dcungham@uga.edu
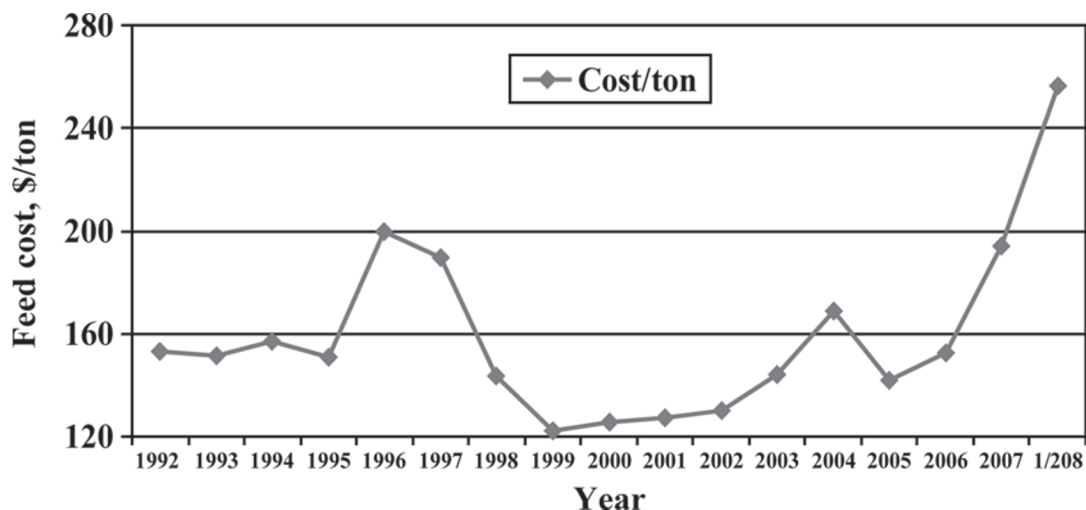
Figure 1. Feed cost per ton for the US broiler industry.

MATERIALS AND METHODS

This study was carried out to determine the effects of unprecedented increases in grain prices during the period from October 2006 to October 2008 on the costs of poultry production in the United States. To achieve these goals, data relative to feed and production costs for this time period were compiled and summarized from Agri Stats Inc. reports. Agri Stats is a privately owned statistical research and analysis firm serving agribusiness companies in the United States as well as internationally [1]. The purpose of the company is to provide proprietary management reports based on weekly and monthly data collection from participating clients to improve the profitability of poultry companies in the United States and around the world. Agri Stats clients include many of the major broiler-, turkey-, and egg-producing companies. The results of this study are based on data collected weekly and monthly from 160 broiler producer complexes, 51 turkey producer complexes, and 63 layer operations in the United States during the 2006 to 2008 period. These poultry complexes produced 9.0 billion broilers, 187 million turkeys, and 137 million layers, representing approximately 98% of the US poultry industry.

The data for this study were summarized across complexes and are presented as means on a monthly basis in tabular and graphic format. Statistical analysis of the data was not conducted because of the very large sampling base used and the obvious practical significance of the results.

RESULTS AND DISCUSSION

A History of Feed Costs

Feed costs in the poultry industry rise and fall in line with supply and demand for the ingredients that make up every ton of feed. Approximately 60% of the average US poultry diet is corn, with another 25% of the diet made from soybean meal [2]. Historically, availability of these 2 important ingredients has depended primarily on US harvests of these crops. Crop harvests in any given year depend largely on the acres planted, combined with the weather conditions experienced in the various production regions for that year. A poorer than expected harvest reduces the amount of corn or soybean meal available for that crop year and increases concerns about the availability of these ingredients in future years. Both cash and futures market prices then reflect both abundant and less than average real and anticipated production levels and real and anticipated feed costs.

Prime examples of the typical effect of supply and demand shortfalls for corn and soybean crops on feed prices occurred during the 1995 to 1997 and 2003 to 2004 periods (Figure 1). During 1996, broiler feed prices rose from $151 to

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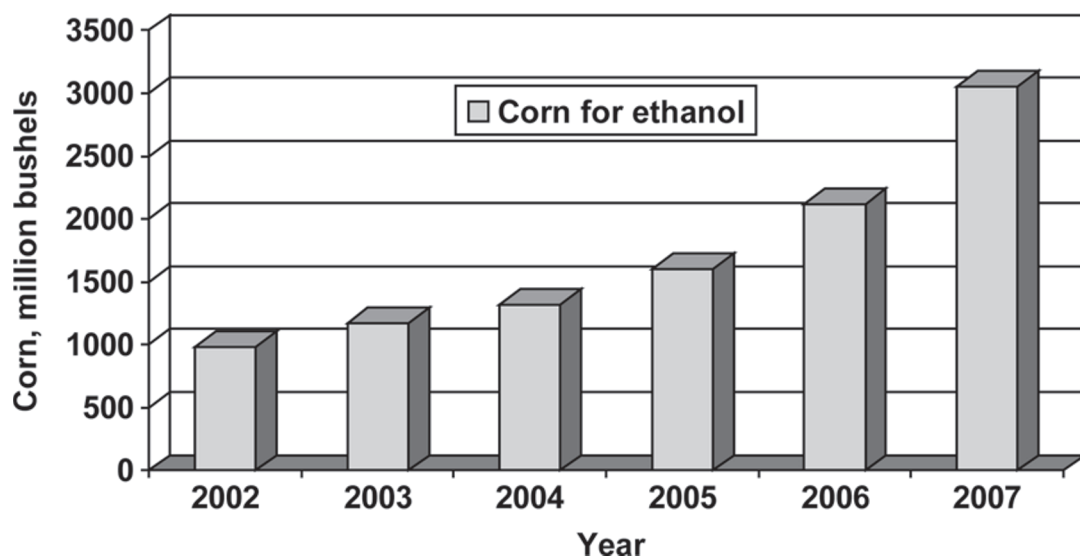
Figure 2. Corn use for ethanol production in the United States from 2002 to 2007.

$199 per ton. In 2004, broiler feed prices rose from $142 to $170 per ton. Under normal conditions, an abundant crop in the year following a poor harvest year would reduce feed costs to more normal levels. This would in turn encourage poultry producers to increase production via increased chick placements, heavier BW, or both. Larger grain crops did follow the poor harvest years of 1997 and 2004, and producers increased production in the following years as concerns about supplies and feed prices diminished. Although US farmers produced record grain crops in 2007, demand for corn (i.e., ethanol) and concerns about grain availability resulted in soaring feed prices rather than declining prices.

There is a common perception that high feed prices are good for poultry processors. This is true in years when higher costs are met with cutbacks in production. Under these conditions, decreasing supplies result in increased costs for the consumer. This was the case in 2004, when demand for poultry meat also increased because of several additional factors: 1) the discovery of several cases of mad cow disease in US cattle herds, reducing the demand for beef; 2) an outbreak of highly pathogenic avian influenza in British Columbia, requiring the depopulation of all poultry in the area and necessitating a short-term increase in broiler meat imports from the United States; and 3) a demand for high-protein

diets from American consumers, which increased the demand for poultry meat and eggs.

While feed prices increased close to $50 per ton from 2002 to 2004, the increased demand for poultry products allowed poultry producers to pass on the increased costs to consumers. However, when these special demand circumstances disappeared, product prices fell. Simultaneously, feed costs fell as the 2004 US grain harvest returned to normal levels.

A Rise in Volatility of Grain Markets

In 2002, the US government, in an effort to increase the production of domestically produced energy, encouraged the production of ethanol and other biofuels. This was accomplished through a combination of tax benefits and direct subsidies to biofuel processors. The majority of ethanol produced in the United States is made from corn, the most abundant crop available.

Ethanol processing plants have been in existence in the United States for decades, but the costs of production and the lack of economic value of ethanol previously kept production at small but stable levels. Through subsidies, tax incentives, and fuel mixing mandates, the US government developed the Renewable Fuel Mandate to encourage investment in new ethanol plants. This program succeeded beyond ex-

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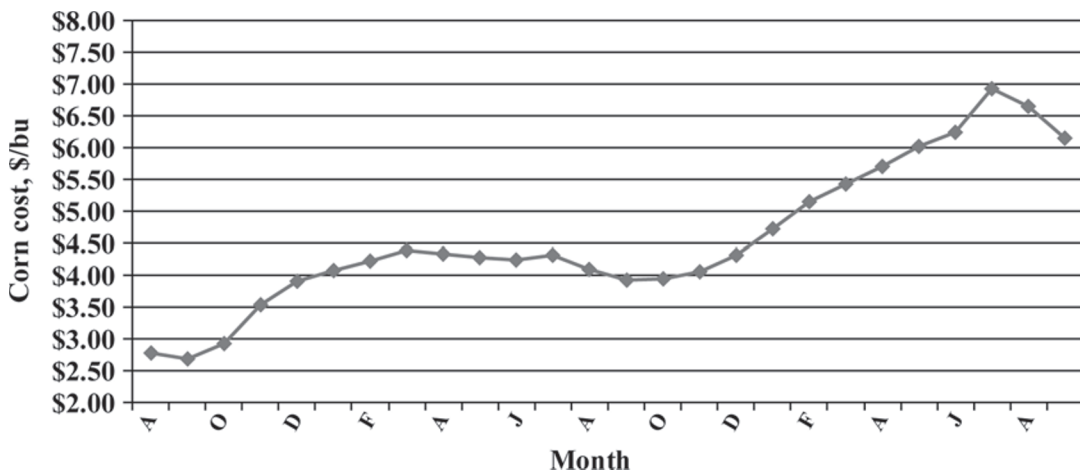
Figure 3. Actual integrator corn cost per bushel, August 2006 to October 2008. A = August; O = October; D = December; F = February; A = April; J = July.

pectations as ethanol production levels increased substantially, fueling additional demand for corn (Figure 2). In 2002, before the Renewable Fuel Mandate was established, 996 million bushels of corn were used to make ethanol. By 2007, more than 3.2 billion bushels of US corn were used in the production of ethanol, an increase of 221% over a 5-yr period [3].

In 2002, 11% of available US corn was used in the production of ethanol. For 2008, approximately 30% of US corn (4 billion bushels) was used for ethanol production. The most recent US Farm Bill dictates that by the year 2015, the ethanol industry will require 6.6 billion bushels of corn to meet the production goal of 15 billion gallons of ethanol from noncellulosic-based ingredients.

The problems associated with increased demand for corn for ethanol production were exacerbated by a 2006 US corn and soybean harvest below historical trend lines. Given the increased demand for products such as ethanol and biodiesel, abundant harvests have become more critical from a supply-side perspective. Increased US harvests are needed to meet increased demands for corn and soybeans. Increased harvest levels
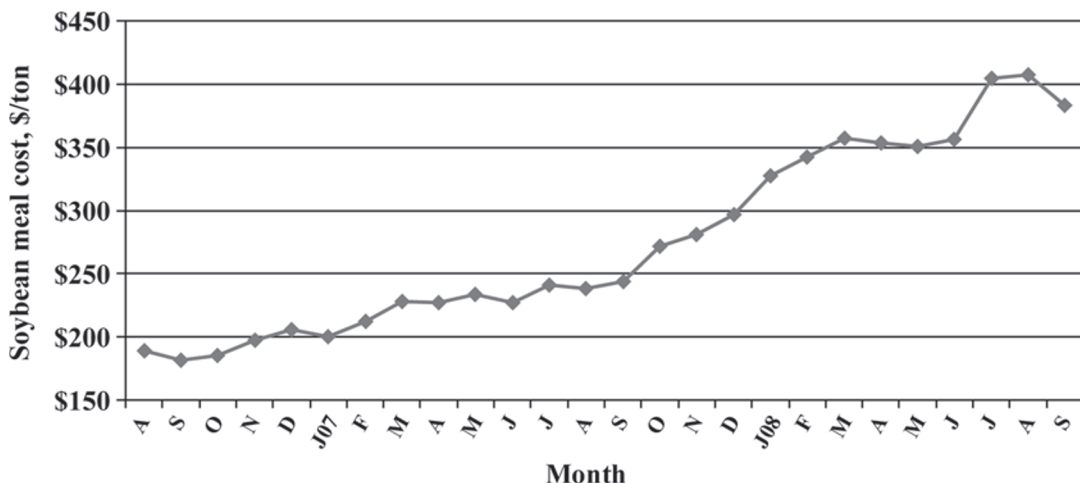
Figure 4. Actual integrator soybean meal cost per ton, August 2006 to October 2008. A = August; S = September; O = October; N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July.

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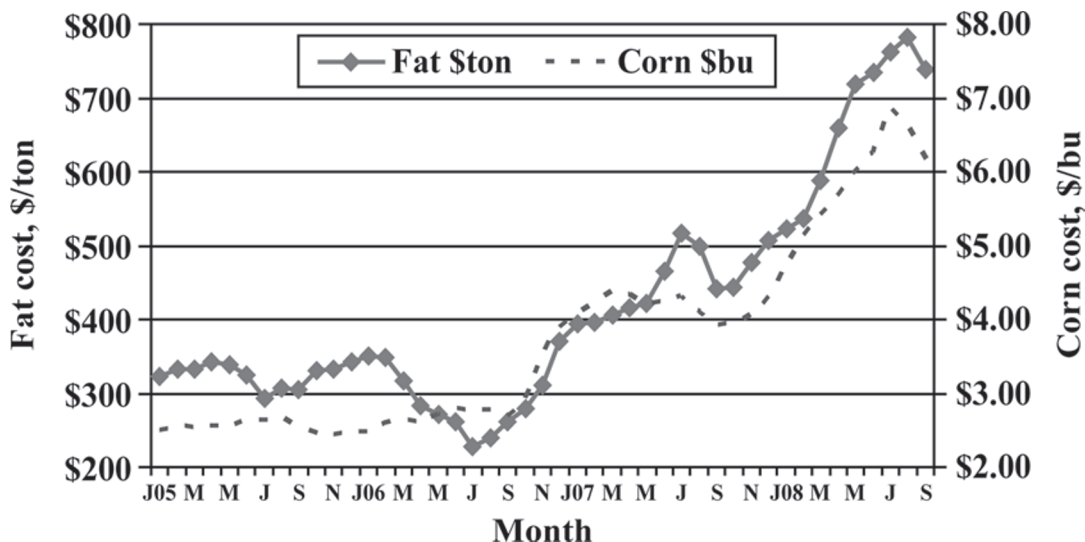
Figure 5. Fat cost per ton and corn cost per bushel, January 2005 to September 2008. M = March; M = May; J = July; S = September; N = November.

may come from a combination of additional acreage planted, increased yields, or both. The 2006 harvest fell short of expectations as corn production fell by 5.2%, to 10.535 billion bushels, from 2005 levels, and soybean production was only 3,188 billion bushels [4]. This set the stage for the increase in the costs of animal feeds beginning in late 2006. In October of 2006, the average price of corn fed to chickens was $2.60 per bushel and soybean meal was $170 per ton

(Figures 3 and 4). By October of 2007 corn had increased to $4.20 per bushel (61%) and soybean meal had increased to $260 per ton (53%).

Responding to higher price levels and soaring demand for corn for ethanol, US farmers increased the acreage planted to corn by 19.5% in 2007, to 93.6 million acres [4]. At the same time, soybean acreage decreased by 15.8%, to 63.6 million acres. Markets for corn and soybean meal stabilized throughout the summer of 2007,
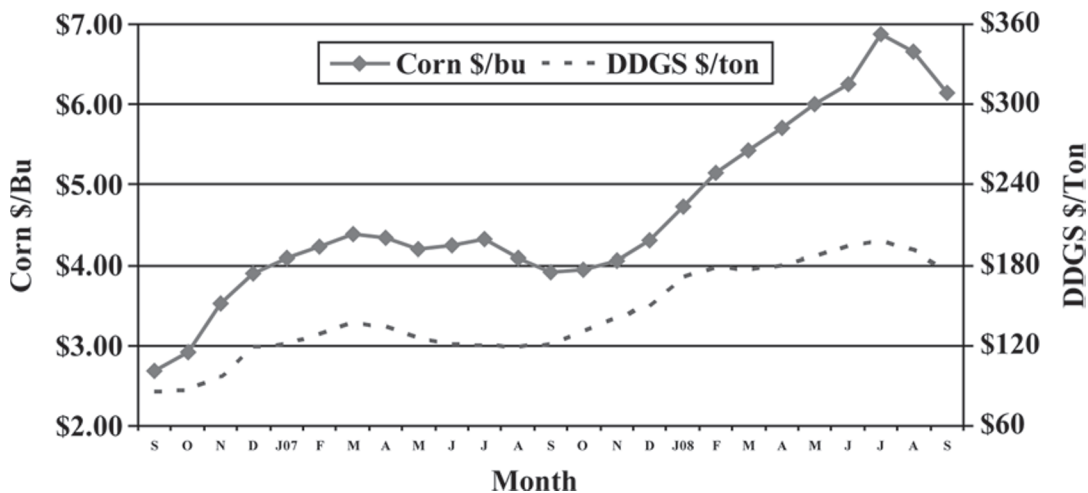
Figure 6. Corn cost per bushel compared with distillers dried grain plus solubles (DDGS) cost per ton, September 2006 to September 2008. S = September; O = October; N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July; A = August.

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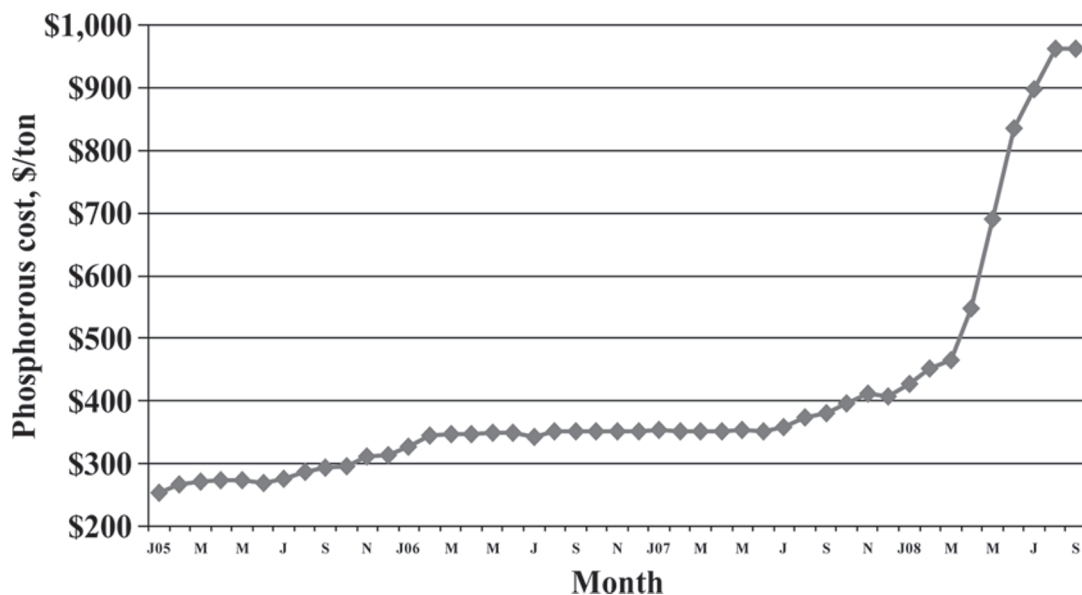
Figure 7. An 18% phosphorous cost per ton, all companies, January 2005 to September 2008. M = March; M = May; J = July; S = September; N = November.

and US chicken producers were able to pass on the increased grain costs to the consumer.

The 2007 US grain harvest was a historic record for both corn and soybeans and, as the industry entered the fall, futures prices for grain fell for a brief period. However, in December 2007 and January 2008, the rapid rise in the cost of corn and soybean meal resumed as corn demand for ethanol production continued to expand and as the value of the US dollar declined. These circumstances caused an expansion in the volumes of US corn and soybeans exported to other parts of the world [4]. Corn exports increased from 1.9 billion bushels in 2003 to 2.4 billion bushels in 2007, whereas soybean exports increased from 887 million bushels to 1.11 million bushels during the same period.

The USDA forecasts for grain and oilseed supply and demand predicted that corn carryout from the 2007 to 2008 crop year would be down but manageable. The prediction for soybeans was that demand would be greater than the supply and that carryout levels would be at particularly perilous levels. As a result, both corn and soybean meal prices rose because of concerns about carryout levels. By May of 2008, corn prices on the futures markets had approached $6.00 per bushel and soybean meal was $320 per ton.

In early June of 2008, heavy rains hit the major corn- and soybean-producing areas of the US Midwest. Reports carried warnings of damage to croplands across the area. Worldwide commodity prices spiked as demand for oil surged, lifting oil prices to more than $140 per barrel. Investors were encouraged to speculate in corn and soybean futures, gambling that the effects of the heavy rains would severely damage the size of the US corn crop. Corn futures for delivery in May 2009 crested at $8.00 per bushel and nearer term soybean meal futures surpassed $450 per ton.

Effects of Corn and Soybean Prices on Feed Costs

A typical US broiler diet is composed of 60% corn and 25% soybean meal. Based on this ratio, which holds true in high-price or low-price environments, every $0.10 per bushel increase in corn adds $0.001 in feed ingredient expenses per pound of live weight produced. Similarly, ever $10.00 in soybean meal costs adds another $.001 in feed ingredient expenses per live pound produced. Actual ingredient prices incurred by feed mills or integrators for each flock of chickens vary based on several factors: 1) distance of the feed mill relative to grain-producing locations,
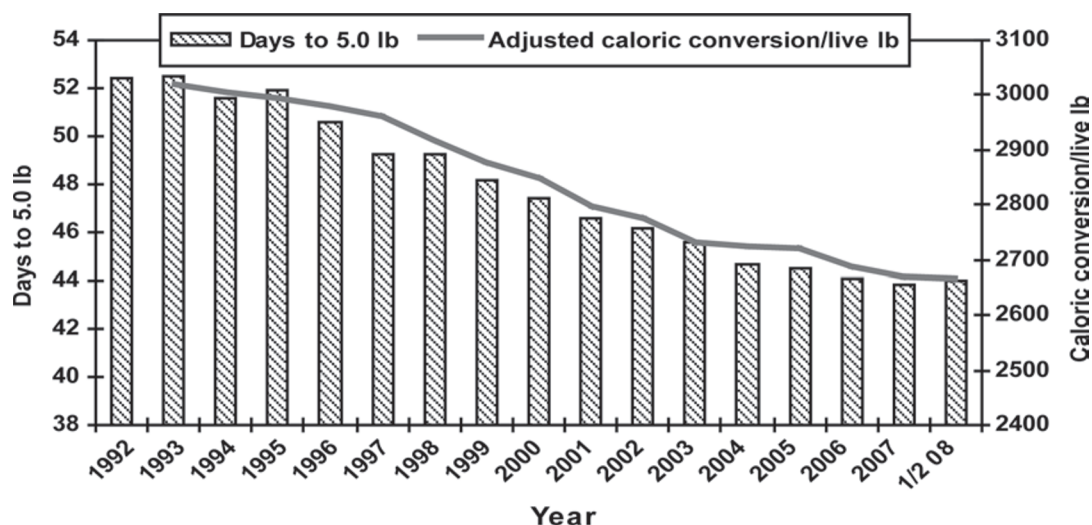
Figure 8. Days and calories conversion to 5.0 lb of live weight.

2) the number of rail cars that can be received at the feed mill, and 3) futures positions. By June and July of 2008, the actual cost (Figure 3) of corn fed to chickens reached the $7.00 per bushel level and soybean meal purchased by companies (Figure 4) was more than $400 per ton. These prices represented the highest levels ever experienced in the history of the poultry industry. Corn and soybean prices retreated slightly from the highs experienced in the June to July 2008 period but still remained at unprecedented levels into October 2008.

The Use of Alternative Ingredients

Poultry nutritionists traditionally use smaller quantities of other ingredients, including animal proteins (meat and bone meal, poultry meals, and feather meal), as part of the protein requirement in poultry diets. In addition, animal and vegetable fats are also used to supplement grains in the diet to meet energy requirements. The remainder of the average ration used in the chicken industry includes sources for phosphorous, calcium, sodium, essential amino acids, trace minerals, vitamins, and standard medications.

The increased demand for corn and soybean meal experienced from October 2006 to October 2008 increased the prices for alternative ingredients as well. The increased demand for poultry fat to be used in biofuels has resulted in price increases outpacing the price increases for corn

(Figure 5). When corn is used for ethanol production, one of the by-products of the distillation process is distillers dried grain plus solubles (**DDGS**). The DDGS can be used in poultry and other livestock diets as a protein source. Prices of DDGS (Figure 6) have also increased, but not as rapidly as competing protein meals because of nutritional and feed mill limitations of its use in poultry diets.

Increases in phosphorous costs were particularly dramatic as fertilizer demands increased, with more planted acreage of corn and oilseeds crops. The dual demand for phosphorous for feed and fertilizer use increased prices from $250 per ton to more than $800 per ton in 2008 (Figure 7). A traditional broiler diet includes 10 lb of supplemental phosphorous per ton of feed produced. The increase in phosphorous costs from 2006 to 2008 added $3.50 per ton in ingredient expenses for US broiler producers.

The impact of higher feed ingredient prices on the costs and profitability of the poultry industries in the United States is real and considerable, and it is unlikely that the effects will moderate in coming years. To this point, consumers have not seen the impact of higher production costs as industry production volumes have surpassed market demand, resulting in an oversupply of product for current markets. As a result, profits have suffered and most companies have lost money in this difficult environment.

Table 1. Components of US live production costs as a percentage of total production

Item	2001, %	2007, %	August 2008, %
Chick cost	16.2	13.4	10.9
Grower cost	19.9	17.0	11.8
Feed ingredient	51.8	59.1	68.7
Mill and delivery	4.3	4.3	3.4
Vaccine and medicine	0.3	0.2	0.2
Live haul	5.2	4.4	3.5
Other	2.3	1.7	1.5

Effects of Feed Conversion Efficiencies on Broiler Costs

The growth of the broiler industry over the last 50 yr has been largely associated with annual incremental improvements in FCR (Figure 8). In 1950, it took 16 lb of feed to raise a 4-lb broiler, a FCR of 4:1. In 2008, it takes 11.3 lb of feed to raise a 5.8 lb broiler, a FCR of 1.95:1. Currently, turkey and hog FCR are approximately 2.5:1, 28% higher than broiler ratios. Cattle convert feed to BW at a ratio of 4:1, 105% higher than broilers, whereas commercial layers convert feed at a ratio of 3.25 lb of feed per dozen eggs produced.

Annual improvements in FCR from genetic and nutritional improvements and from gains in poultry husbandry programs have averaged 1 to 2 points (0.5 to 1.0%) per year since 1950. Much of this gain is associated with faster growth rate to target BW. The less time birds are in production houses, the larger percentage of their total feed consumption will be used for muscle development as opposed to body maintenance. An annual improvement of 1% in feed conversion reduces the corn requirements for the poultry

Table 2. Effect of feed ingredient cost on various production costs

| Feed ingredient cost/lb, $	Total cost/live lb, $	Live cost/evis lb,[1] $	Processing cost/lb, $	Processed costs/lb,[2] $	S, G, and A + int exp and frt,[3] $	RTC cost of prod,[4] $
0.13	0.25	0.34	0.23	0.57	0.08	0.65
0.14	0.26	0.35	0.23	0.58	0.08	0.66
0.15	0.27	0.37	0.23	0.60	0.08	0.68
0.16	0.28	0.38	0.23	0.61	0.08	0.69
0.17	0.29	0.39	0.23	0.63	0.08	0.70
0.18	0.30	0.41	0.23	0.64	0.08	0.72
0.19	0.31	0.42	0.23	0.65	0.08	0.73
0.20	0.32	0.44	0.23	0.67	0.08	0.75
0.21	0.33	0.45	0.23	0.68	0.08	0.76
0.22	0.34	0.46	0.23	0.69	0.08	0.77
0.23	0.35	0.48	0.23	0.71	0.08	0.79
0.24	0.36	0.49	0.23	0.72	0.08	0.80
0.25	0.37	0.50	0.23	0.73	0.08	0.81
0.26	0.38	0.52	0.23	0.75	0.08	0.83
0.27	0.39	0.53	0.23	0.76	0.08	0.84
0.28	0.40	0.54	0.23	0.78	0.08	0.85
0.29	0.41	0.56	0.23	0.79	0.08	0.87
0.30	0.42	0.57	0.23	0.80	0.08	0.88
0.31	0.43	0.59	0.23	0.82	0.08	0.90
0.32	0.44	0.60	0.23	0.83	0.08	0.91
0.33	0.45	0.61	0.23	0.84	0.08	0.92

[1]Evisceration (evis) yield = 73.5% of live weight.

[2]Live cost per eviscerated pound plus processing cost per pound.

[3]Selling (S), general (G), and administrative (A) costs plus interest expenses (int exp) and freight (frt) costs.

[4]Cost per processed pound plus S, G, and A and interest and freight costs. RTC = ready-to-cook; prod = production.
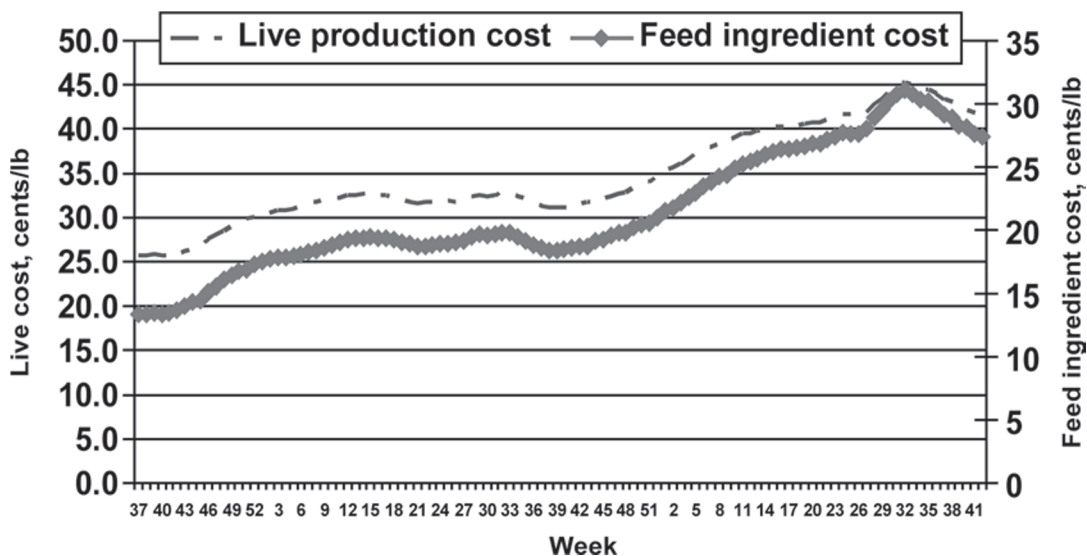
Figure 9. Live production cost and broiler feed ingredient cost, September 2006 to October 2008.

industry by 5.3 million bushels and the soybean meal requirements by 61,304 tons for comparable production levels. Even with increases in production, improved feed conversions lessen the impact of the chicken industry on corn and soybean meal demand.

Net Effect of Higher Grain Prices on Production Costs

Broiler Costs. Feed costs represent the most significant component of live production costs.

Table 1 summarizes the components of live production costs for broilers on a percentage basis for 2001, 2007, and 2008. As shown, the contribution of the feed component of total costs for broiler production increased from 51.8% in 2001 to 68.7% in 2008. This is in contrast to most other component costs, which have actually declined as a percentage of overall costs.

Although corn and soybean meal prices have retreated some from the highs in midsummer of 2008, costs of broiler production for 2008 were
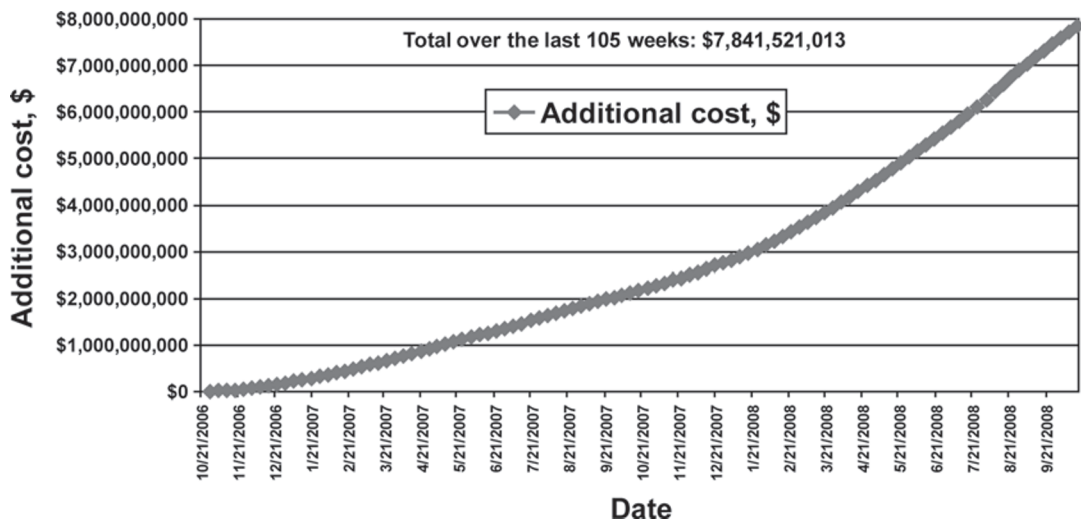
Figure 10. Cumulative additional cost to the broiler industry in feed ingredient costs, October 2006 to October 2008.

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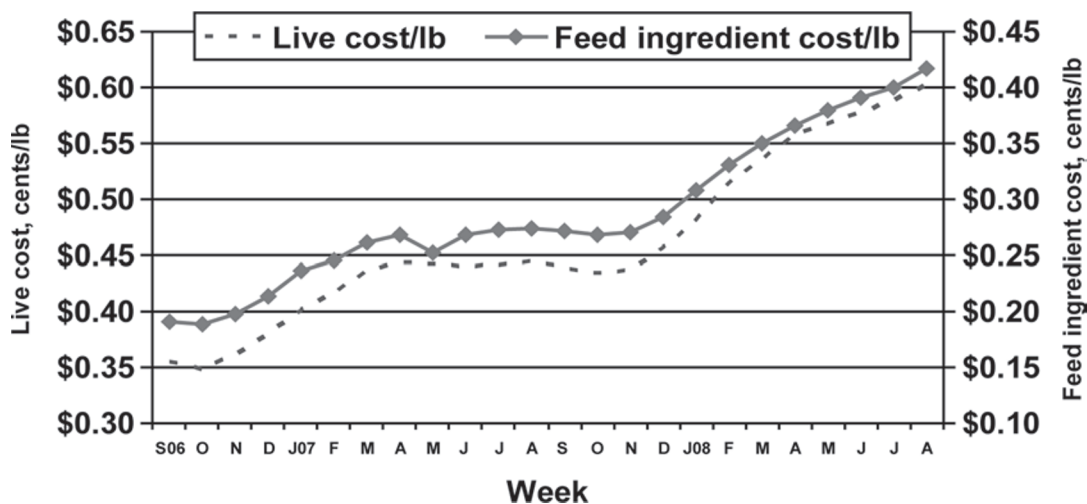
Figure 11. Live cost and turkey feed cost per pound, September 2006 to August 2008. O = October; N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July; A = August; S = September.

the highest in poultry production history. Live production costs for broilers exceeded $0.45 per lb during the height of grain price increases, $0.20 per lb higher than costs in September 2006 (Figure 9). The increased costs of feed ingredients during this 2-yr period increased the feed ingredient component of live production costs from $0.13 per live pound to $0.31 per live pound. These numbers represent an 80% increase in live production cost and a 138% increase in feed component costs from the 2006 levels. The

impact of increases in feed ingredient costs on various broiler production costs are summarized in Table 2. As would be expected, increased feed ingredient costs increased other costs associated with processing ready-to-cook broiler meat. The cumulative effect of the increased feed costs to the broiler industry exceeded $7.8 billion by September 2008 (Figure 10).

Turkey Costs. The feed ingredient issues that affect the broiler industry also affect the turkey and table egg industries. Although the turkey and
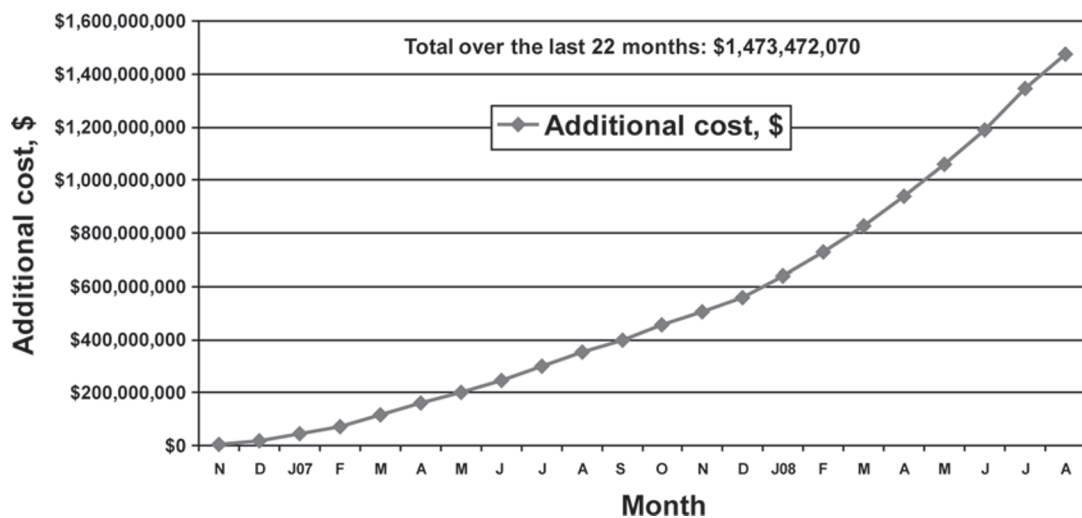
Figure 12. Cumulative additional costs to the turkey industry in feed ingredient costs, October 2006 to August 2008. N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July; A = August; S = September; O = October.

Table 3. Effect of feed ingredient cost on various production costs of turkey meat

Feed ingredient cost/lb, $	Total cost/live lb, $	Live cost/evis lb,[1] $	Processing cost/lb, $	Processed costs/lb,[2] $	S, G, and A + int exp and frt,[3] S	RTC cost of prod,[4] S
0.36	0.54	0.70	0.20	0.90	0.08	0.98
0.37	0.55	0.71	0.20	0.91	0.08	0.99
0.38	0.56	0.72	0.20	0.92	0.08	1.00
0.39	0.57	0.74	0.20	0.94	0.08	1.02
0.40	0.58	0.75	0.20	0.95	0.08	1.03
0.41	0.59	0.76	0.20	0.96	0.08	1.04
0.42	0.60	0.78	0.20	0.98	0.08	1.06
0.43	0.61	0.79	0.20	0.99	0.08	1.07
0.44	0.62	0.80	0.20	1.00	0.08	1.08
0.45	0.63	0.81	0.20	1.01	0.08	1.09
0.46	0.64	0.83	0.20	1.03	0.08	1.11
0.47	0.65	0.84	0.20	1.04	0.08	1.12
0.48	0.66	0.85	0.20	1.05	0.08	1.13
0.49	0.67	0.87	0.20	1.07	0.08	1.15
0.50	0.68	0.88	0.20	1.08	0.08	1.16
0.51	0.69	0.89	0.20	1.09	0.08	1.17
0.52	0.70	0.90	0.20	1.10	0.08	1.18
0.53	0.71	0.92	0.20	1.12	0.08	1.20
0.54	0.72	0.93	0.20	1.13	0.08	1.21
0.55	0.73	0.94	0.20	1.14	0.08	1.22
0.56	0.74	0.96	0.20	1.16	0.08	1.24

[1]Evisceration (evis) yield = 77.4% of live weight.

[2]Live cost per eviscerated pound plus processing cost per pound.

[3]Selling (S), general (G), and administrative (A) costs plus interest expenses (int exp) and freight (frt) costs.

[4]Cost per processed pound plus S, G, and A and interest and freight costs. RTC = ready-to-cook; prod = production.

table egg industries are not as large as the broiler industry, the impact of higher feed ingredient costs on the respective production costs is no less dramatic. From October of 2006, turkey live production costs increased from $0.35 to $0.58 per lb in 2008, and the feed ingredient expenses portion of the total costs increased from $0.19 to $0.39 per lb of live weight (Figure 11). Table 3
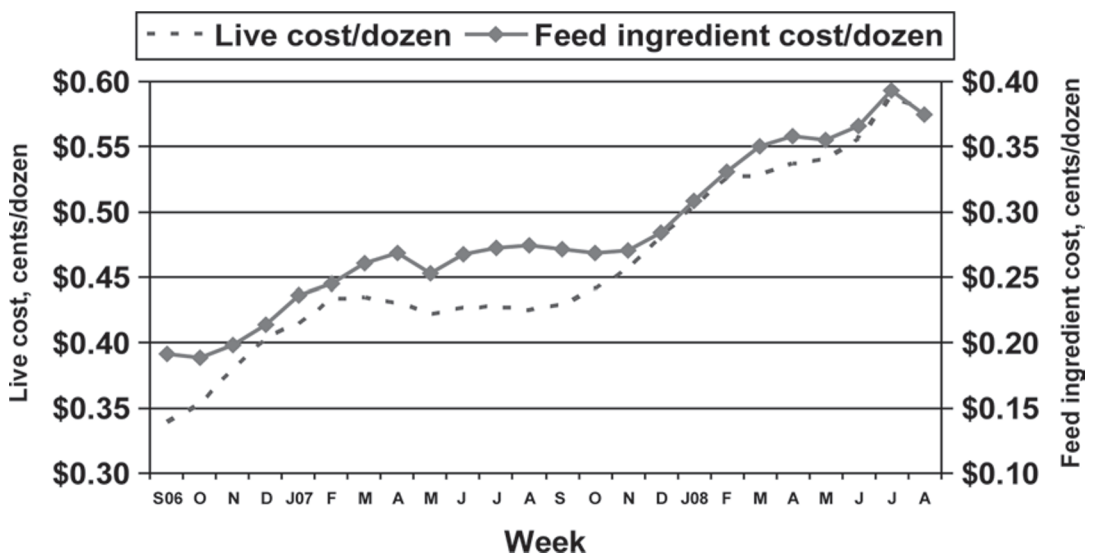
Figure 13. Total cost and feed cost per dozen eggs, September 2006 to August 2008. O = October; N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July; A = August; S = September.

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Table 4. Effect of feed ingredient cost on various production costs of commercial eggs

Feed ingredient cost/dozen, $	Production cost/dozen, $	Processing cost/dozen, $	Total cost/dozen,[1] $	S, G, and A + int exp and frt/dozen,[2] $	Breakeven cost/dozen, $
0.17	0.37	0.15	0.51	0.08	0.59
0.18	0.37	0.15	0.52	0.08	0.60
0.19	0.38	0.15	0.53	0.08	0.61
0.20	0.39	0.15	0.54	0.08	0.62
0.21	0.40	0.15	0.55	0.08	0.63
0.22	0.41	0.15	0.56	0.08	0.64
0.23	0.42	0.15	0.57	0.08	0.65
0.24	0.43	0.15	0.58	0.08	0.66
0.25	0.44	0.15	0.59	0.08	0.67
0.26	0.45	0.15	0.60	0.08	0.68
0.27	0.46	0.15	0.61	0.08	0.69
0.28	0.47	0.15	0.62	0.08	0.70
0.29	0.48	0.15	0.63	0.08	0.71
0.30	0.49	0.15	0.64	0.08	0.72
0.31	0.50	0.15	0.65	0.08	0.73
0.32	0.51	0.15	0.66	0.08	0.74
0.33	0.52	0.15	0.67	0.08	0.75
0.24	0.53	0.15	0.68	0.08	0.76
0.35	0.54	0.15	0.69	0.08	0.77
0.36	0.55	0.15	0.70	0.08	0.78
0.37	0.56	0.15	0.71	0.08	0.79

[1]Production costs per dozen produced plus processing cost per dozen.

[2]Selling (S), general (G), and administrative (A) costs plus interest expenses (int exp) and freight (frt) costs.

details the changes in feed ingredient expenses observed during this period and the effect on the various costs for turkey meat production. Similar to broiler production, increasing feed ingredient costs resulted in increased processing cost for turkeys. The monthly effect of higher feed costs on the US turkey industry surpassed $130 million in June of 2008, and the cumulative effect from October 2006 through June 2008 was $1.19 billion (Figure 12).
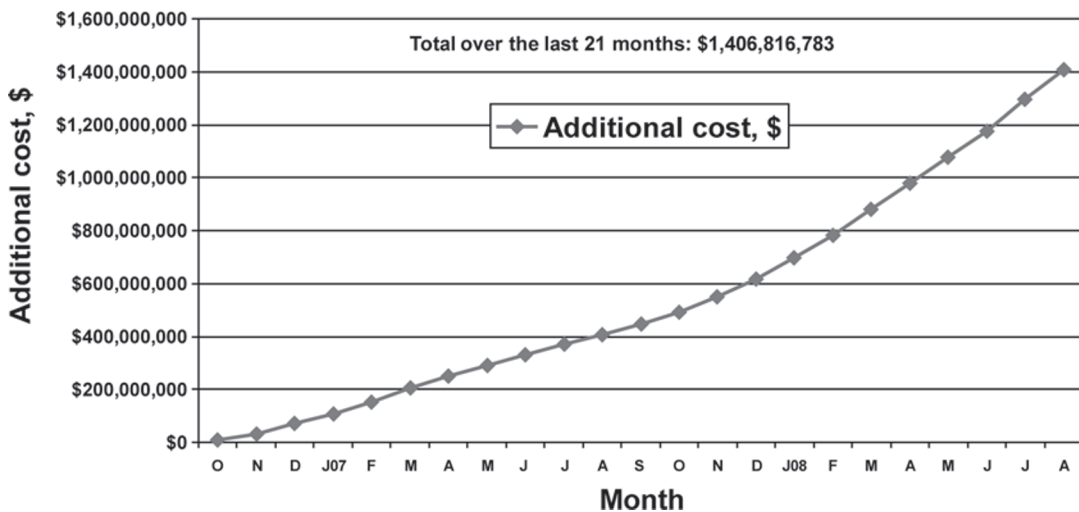
Figure 14. Cumulative additional cost to the egg industry in feed ingredient costs, October 2006 to August 2008. O = October; N = November; D = December; F = February; M = March; A = April; M = May; J = June; J = July; A = August; S = September.

Table Egg Costs. The table egg industry experienced a 64% increase in total production costs, rising from $0.34 per dozen in September 2006 to $0.56 per dozen in June 2008 (Figure 13). The feed ingredient component of egg production costs rose from $0.19 to $0.37 per dozen over the same period. Table 4 details the impact of increasing feed ingredient expenses on the total costs of commercial egg production. Increasing feed costs resulted in increased production and processing costs across the board. By June 2008, the monthly effect of higher feed costs surpassed the $100 million level, and the cumulative effect from October 2006 through June 2008 was $1.17 billion (Figure 14).

CONCLUSIONS AND APPLICATIONS

1. The increase in demand for corn and oilseeds for ethanol and biofuel production has been an important contributor to increased feed ingredient costs for the US poultry industries.

2. The increased costs of feed ingredients resulted in $9.36 billion in total cumulative costs to the poultry industries in the United States from October 2006 to October 2008.

3. Given the projected demand for ethanol under the US Renewable Fuel Mandate, demand for corn is likely to increase in future years. These factors will continue to pressure poultry producers as they seek to regain profitability in difficult market conditions.

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EXHIBIT 21

NEWS

Flooding will send food prices soaring

By **ASSOCIATED PRESS** |
PUBLISHED: June 23, 2008 at 12:00 a.m. | UPDATED: August 29, 2017 at 1:18 a.m.

NEW YORK – Raging Midwest floodwaters that swallowed crops and sent corn and soybean prices soaring are about to give consumers more grief at the grocery store.

In the latest bout of food inflation, beef, pork, poultry and even eggs, cheese and milk are expected to get more expensive as livestock owners go out of business or are forced to slaughter more cattle, hogs, turkeys and chickens to cope with rocketing costs for corn-based animal feed.

The floods engulfed an estimated 2 million or more acres of corn and soybean fields in Iowa, Indiana, Illinois and other key growing states, sending world grain prices skyward on fears of a substantially smaller corn crop. The government will give a partial idea of how many corn acres were lost before the end of the month, but experts say the trickle-down effect could be more dramatic later this year, affecting everything from Thanksgiving turkeys to Christmas hams.

Rod Brenneman, president and chief executive of Seaboard Foods, a pork supplier in Shawnee Mission, Kan. that produces 4 million hogs a year, said high corn costs are already forcing producers in his industry to cut back on the number of animals they raise.

"There's definitely liquidation of livestock happening," and that will cause meat prices to rise later this year and into 2009, said Brenneman, who is also the vice chairman of the American Meat Institute.

Brenneman's cost for feeding a single hog has shot up $30 in the past year because of record-high prices for corn and soybeans, the main ingredients in animal feed. Passing that increase on to consumers would tack an extra 15 cents per pound onto a pork chop.

It's a similar story for U.S. beef producers, who spend a whopping 60 percent to 70 percent of their production costs on animal feed and are seeing that number rise daily as corn prices hover near an unprecedented $8 a bushel, up from about $4 a year ago.

"This is not sustainable. The cattle industry is going to have to get smaller," said James Herring, president and CEO of Amarillo, Texas-based Friona Industries, which buys 20 million bushels of corn each year to feed 550,000 cattle.

Corn's prices were already rising before the floods, driven up 80 percent over the past year as developing countries like China and India scramble for grains to feed people and livestock. U.S. production of ethanol, an alternative fuel that can be made with corn, has also pushed prices higher, prompting livestock owners to lobby Washington to roll back ethanol mandates.

Before the floods, corn farmers were enjoying record profits selling the grain to feed animals and for use in cereals and as a sweetener in soda and candy. But a sharply smaller corn crop could wipe out those gains.

In Iowa, the No. 1 U.S. corn grower, floods inundated about 9 percent of corn crops, representing about 1.2 million acres.

In Indiana, another 9 percent of corn and soybean crops were flooded, potentially costing farmers up to $840 million, Indiana Agriculture Director Andy Miller said.

Floodwaters also tossed farm equipment, sprayed cornfields with debris and silt, and sucked away large chunks of topsoil. For livestock owners, the damage may be felt long after the corn grows back.

Even before the floods, Tyson Foods was complaining that high grain prices would drive up its costs by $600 million this year. The world's largest poultry company has already raised its prices over the past year, and expects to keep raising them, CEO Dick Bond said in May.

Higher feed prices will eventually filter through to the cost of milk, cheese and yogurt, too, since 65 percent to 75 percent of a dairy farmers' production costs are for feed, said Chris Galen, a spokesman for the National Milk Producers Federation.

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New content coming to Netflix in January 2021

By the t.e.a.

tea.

Here are some shows or movies coming to Netflix to make it even better.

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EXHIBIT 22

Midwest floods may send gas up 15%

Soaring corn prices could increase the price of ethanol, driving up demand for oil and sending gas prices even higher. Some think it's time for Congress to act.

By David Goldman, CNNMoney.com staff writer
Last Updated: June 13, 2008: 4:37 PM EDT

NEW YORK (CNNMoney.com) -- Continued flooding in Iowa and Illinois - the nation's top two corn-growing states - is inciting fears that the cost of the high-priced crop could soar even further, driving up ethanol and gas prices, too.

Days of heavy rain across the Midwest Corn Belt region have wreaked havoc on the crop, sending front-month prices to $7.08 a bushel on the Chicago Board of Trade Friday. Corn futures have risen for seven straight trading sessions.

Since ethanol - a mandated ingredient in U.S. gasoline - is produced domestically with corn, rising crop prices could send already-record gasoline prices even higher.

"The floods in the Midwest will have a major impact on ethanol," said Phil Flynn, senior market analyst at Alaron Trading in Chicago.

Gasoline in the United States is comprised of only about 6% to 10% ethanol, as mandated by federal and state governments. But Flynn believes gas prices could jump 10% or 15% if corn were to hit $10 a bushel and crude oil maintains its current high level.

With the national average of gasoline at a record $4.07 a gallon, according to AAA, a 15% increase would translate into an additional 61 cents.

"Crude oil is still the predominant factor why gas prices are high, but don't think that 6% to 10% isn't going to matter," Flynn said.

But others disagree, saying ethanol has not historically kept pace with corn prices.

"Ethanol has historically been more closely tied to the price of gasoline than corn," said Geoff Cooper, director of research at ethanol trade group Renewable Fuels Association. "The value of the product is its ability to displace gasoline, not on the cost of its input."

Congress' ethanol quandary

But as Congress continues to search for a way to relieve Americans' pain at the pump, members may look to change their ethanol policies if gas prices spike another 50 or 60 cents.

"Congress is going to have a hard time justifying mandating the use of ethanol in gasoline if we lose one-third of the corn crop," Flynn said.

But simply relaxing ethanol mandates may not be enough. According to the latest short-term energy report released by the U.S. Energy Information Administration, use of ethanol has reduced U.S. oil demand by 440,000 barrels a day.

If the nation consumes less ethanol, crude oil usage - and prices - could rise as well.

"For every drop of ethanol that we're not using, we'll be using (more oil-based) gasoline," noted Flynn.

Flynn argued that the market should determine ethanol's price, saying the root of the problem was Congress' rushing the use of ethanol in the first place.

"The problem with ethanol is that it was driven by the government and not by market forces," Flynn said. "Ethanol would have come on naturally had the government not acted."

Reducing the ethanol tariff

Another potential solution that is gathering support in Congress is reducing or eliminating the foreign ethanol tariff. The import tariff of 54 cents a gallon on ethanol keeps the price of imported ethanol high in an effort to support domestic farmers.

Much of imported ethanol is made from sugar cane, which is cheaper to produce than domestic corn-based ethanol.

Energy industry experts say lifting the tariff entirely will likely lower gas prices by 10 cents a gallon, but legislation that proposed canceling the tax found little support in Congress. As a result, Sens. Dianne Feinstein, D-Calif., and Judd Gregg, R-N.H., recently introduced a compromise bill to reduce the tariff to 45 cents.

"The need for inexpensive and cleaner-burning fuels continues to grow, and yet U.S. refiners are forced to pay a 54-cent tariff on ethanol imported from Brazil and other foreign sources," Feinstein said on the Senate floor last week. "This makes no sense, given the record oil prices and the limited supplies of domestic ethanol."

Gregg noted that ethanol cannot be transported through pipelines, which makes the domestic product hard to come by in some states. As a result, many non-midwestern states are forced to use foreign ethanol and pay the tariff at the pump.

"States outside the Midwest, especially ... coastal states, are at a huge disadvantage when it comes to accessing domestically produced ethanol due to shipping challenges," said Gregg on the floor. "Imported ethanol from Brazil and other friendly nations can be provided to these coastal states more easily and at a lower cost." ▪

First Published: June 13, 2008: 12:22 PM EDT

Find this article at:
https://money.cnn.com/2008/06/13/news/economy/corn_ethanol

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EXHIBIT 68

LOSS LEADER PRICING AND RAIN CHECK POLICY

JAMES D. HESS AND EITAN GERSTNER

North Carolina State University
Georgetown University

Loss leader pricing and rain check policies are common in retail markets, yet research on these topics is surprisingly scarce. In this paper, we study the effects of leader pricing and rain check policy on stores' profits and market outcomes. Suppose stores can accurately predict demand. Might they still run out of stock? We investigate whether such a result is plausible when stores can offer rain checks. The paper also helps resolve an issue that has recently attracted much attention: Should the FTC repeal its rule prohibiting stock outs of advertised sale items?

(Pricing; Loss Leaders; Rain Checks; Featuring)

1. Introduction

Leader pricing is a pricing strategy in which retailers set very low prices, sometimes below cost, for some products to lure customers into stores. The idea is that while customers are in the store to get this good (the leader product), they buy other goods that generate higher profits. This phenomenon is also referred to as "featuring" (Nelson and Hilke 1986). When a featured brand is sold at a loss, stores try to avoid selling large quantities of the loss leader product and want to sell other goods with larger markups. As a result, some stores limit purchases of leader items to one per customer, while others run out of the leader products and offer rain checks to frustrated customers. A rain check is a promise to provide the items at the reduced price sometime in the future.

In this paper, we study the effects of leader pricing and rain check policy on stores' profits and market outcomes. Suppose stores can accurately predict demand. Might they still run out of stock? We investigate whether such a result is plausible when stores can offer rain checks.

Other research on leader pricing and rain check policy is scarce. In one empirical study, Hendon (1976) found that stock outs of sale items were common in his sample of three interstate chain stores. We have conducted a short empirical investigation in two general merchandise stores and also found that stock outs occurred more often for products on sale than for similar products not on sale. In this study, 35 frequently purchased products were preselected for each store. When the two stores advertised sales on similar products, 35 sale items with substantial discounts were selected for each store. We compared the percentages of stock outs for each group in each store one day before the end of the sale. The sales lasted three days. Table 1 shows the percentages of

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TABLE 1

Stock Out Percentages by Store and Product Group

Store	35 Advertised Sale Items	35 Non-sale Items
1	22.9	8.6
2	37.1	5.7

stock outs for sale and nonsale products. As can be seen, the percentages of stock outs for sale items are significantly higher (at the 5% level).

It is hard to explain these results as inventory misjudgements: Why should errors be more frequent for featured items? Furthermore, these stock outs occurred despite a 1971 ruling of the Federal Trade Commission that makes it illegal for stores to advertise sale items not available in sufficient quantities. The stores cannot comply with the law simply by offering rain checks in such circumstances; they must carry sufficient inventories to satisfy customers.

In a recent article in the *Wall Street Journal* (Saddler 1985), it was reported that the FTC is considering repeal of the rule that "requires stores to have enough stock on hand so that the last shopper on the last day of the sale can purchase every time. More than 3000 people have written to the agency in recent months about the proposal; most opposed repeal."

The issue of concern to the retailers and to the FTC is that the rule imposes an inventory burden on retailers that is eventually passed on to consumers. Repealing the rule and allowing stores to offer rain checks to compensate consumers for inventory mistakes could be plausible. The point we make in this paper is that the FTC is ignoring a different aspect of leader pricing and rain checks; the opportunity of using rain checks can actually induce retailers to run out of stock deliberately even when they can accurately predict demand. We investigate a fully informed model of profit-maximizing firms that consciously plan on running out of stock of advertised goods and offering rain checks to those customers who do not find the goods on the shelf. Rain checks are offered to induce customers to come to the store a second time and buy other products. This behavior imposes inefficiencies on the economy.

Leader pricing is not the only reason for "price deals" by stores. Other possibilities are:

(a) Price differentiation: Stores might find it profitable to price discriminate between well-informed and ill-informed consumers (Salop 1977, Shilony 1977 and Varian 1980), or between consumers with high and low transaction costs (Narasimhan 1984, Gerstner and Holthausen 1986, Gerstner and Hess 1987a), or between consumers with high and low willingness to pay (Conlisk et al. 1984, Sobel 1984 and Lazear 1986).

(b) Forward buying: Price dealing can help stores increase profits by inducing consumers to purchase for future consumption (Salop and Stiglitz 1982 and Jeuland and Narasimhan 1985).

(c) Peak load pricing: By offering different prices in different periods, sellers profitably motivate consumers to spread their buying across time periods (Gerstner 1986).

(d) Introductory offers of new products: Effective market penetration can be achieved when sellers offer new products at a special low price (Bass 1980, Jeuland 1981, Jeuland and Dolan 1982 and Kalish 1983).

Most of these papers examine sales strategies by assuming that the retailer sells only one product. Therefore they do not consider multiproduct marketing strategies that rely on substitutability or complementarity relationships that exist in shopping. In this paper we consider complementarity; shoppers who visit a store to buy one product also buy complementary products to reduce the number of future shopping trips or to

satisfy urgent needs. In another paper (Gerstner and Hess 1987b) we consider substitutability; when visiting a store consumers are exposed to substitute brands and they may choose to buy these rather than the brand originally on their shopping list.

Interesting questions that are not addressed in our paper are the following: Why do retailers usually feature a relatively small subset of their products? And, why are only particular brands featured and others not? Limited advertising budgets or industry traditions are possible reasons. Different explanations are offered in Holton (1957, p. 20) and Nagle and Novak (1985). First, buyers can more easily remember prices of frequently purchased items. Therefore these items are more likely to be featured. Second, featuring might be a way of price differentiation; stores are more likely to feature brands that are more frequently purchased by price sensitive customers. Nagle and Novak tested these two hypotheses and found them to be supported by the evidence.

Finally, leader pricing can be interpreted as a "bundling strategy" in which stores bundle impulse goods with leader products. Bundling might be used to sort consumers into groups among which a monopolist can profitably price discriminate (Stigler 1963, Adams and Yellen 1976). In this paper, the bundling is a device designed to compete for customers. The purpose is to bring customers to the store with the low-priced leader product, for once they are in the store, the cost of going to another store gives the seller monopoly power over impulse goods.

2. The Model

Consumer Behavior

We will construct a two-period model with N identical consumers. Stores sell a selection of "impulse goods" (products bought on sight without price comparisons across stores)[1] and only one shopping good as a leader product. Each consumer visits only one store in each period (because of high transaction costs) and is willing to spend R dollars on impulse goods each visit but buys only one unit of the leader product either in period 1 or period 2. When the customer finds the leader product on the shelf in period 1, the product has a current reservation value of V to the consumer. If, however, the customer does not find it, the customer gets a rain check and the value is reduced to $\beta V - T$. Here T is the transaction cost to customers of using a rain check (for example, spending time at the service desk, remembering to bring it back to the store, etc.) and β is the discount factor common to sellers and buyers, $0 < \beta < 1$. A rain check guarantees that a frustrated customer will get one unit of the leader product at the current price when the customer visits the same store again in the second period.

Consumers are informed about the leader price and rain check policy and rational by assumption. They compare stores' policies concerning the leader products and each period choose the store that provides them with the highest utility. We simplify notation by distinguishing only between a representative store and all other stores. Small letters describe the behavior of the representative store, and capital letters describe the common behavior of each of the other stores. Let x be the number of customers who visit the representative store in period 1, let q be the quantity of leader product sold in period 1, and let p be the leader product price. The equivalent magnitudes for all other stores are X, Q, and P, respectively.

The number of rain check offers by the representative store is $x - q$, and the fraction of customers who will not find the leader product on the shelf and will use rain checks is

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[1] Impulse buying is an important aspect of buyer behavior, and it has been investigated in numerous studies. (See, for example, Stern 1962, Cox 1964, Kollat and Willett 1967, D'Antoni and Shenson 1973.) A most recent large-scale study by Point-of-Purchase Advertising Institution, Inc. shows that roughly 60 percent of all products bought in supermarkets are unplanned purchases (*Marketing News*, March 27, 1987). A high incidence of unplanned buying also occurs in drugstores and in general merchandise stores (Prasad 1975).

$$\alpha = (x - q)/x = 1 - q/x. \tag{1}$$

The transaction cost of frustrated customers, T, is likely to increase with the proportion of customers seeking rain checks because of longer lines at the service counter. For simplicity, assume that T is proportional to α, $T = t\alpha$, $t > 0$, and that all consumers take advantage of rain check offers (consumer heterogeneity will be considered in §6). That is, we assume all consumers have the same transaction costs and that t is not so high that the surplus, $\beta V - \beta p - t\alpha$, obtained when using a rain check is negative. This requires

$$t \le \beta(V - p)/\alpha. \tag{2}$$

Noting that α is the probability of a stock outage, the consumer's expected surplus from buying the leader product at the representative store equals

$$u = (1 - \alpha)(V - p) + \alpha[\beta(V - p) - t\alpha]. \tag{3}$$

Figure 1 shows three different indifference curves: u_0, u^*, and u_1 derived from (3) when varying p and α. Expression (3) and the indifference curves imply the following: (a) indifference curves closer to the origin represent higher utility; (b) if the probability
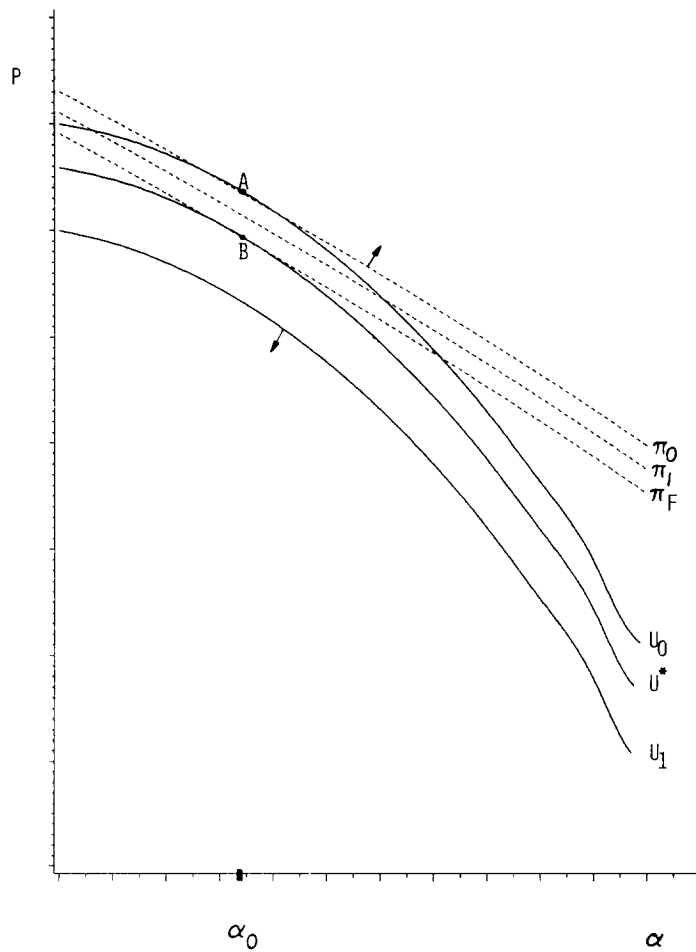
FIGURE 1

of stock out is increased, the price of the leader product must be lowered to keep utility constant; (c) larger price decreases are required as the probability approaches one.

Seller Behavior

There are n profit-maximizing stores in the market. The representative store chooses a price for the impulse good, a price for the leader product, and the fraction of customers who receive rain checks to maximize the present value of profits. Following in the Bertrand (1882) tradition, the store with the best offer attracts *all* consumers.[2] Stores compete by giving better and better offers until they reach a point where the leader product is so inexpensive that leader pricing and rain checks are no longer profitable.

The pricing of impulse goods is straightforward. Consumers decide to buy these products while at the store and do not visit other stores, so each store has complete monopoly power with respect to these goods. The store extracts all consumer surplus from each customer: each customer will spend R dollars and obtain zero surplus from the impulse goods.

Pricing of leader products is more competitive. Consumers compare expected surplus obtained from the leader product (see equation (3)) before selecting a store in the first period. To attract customers, the representative store must offer consumers nonnegative expected surplus, and this surplus cannot be below the expected surplus, U, offered by other stores. Specifically, if $u < U$, no customers visit the representative store in the first period, whereas when $u > U$, all N consumers visit the representative store in the first period. Finally, if $u = U$, N/n consumers visit the store. Therefore, the demand at the representative store is

$$x = \begin{cases} 0 & \text{if} & u < U, \\ N/n & \text{if} & u = U, \\ N & \text{if} & u > U. \end{cases} \tag{4}$$

The profit function of the representative store can now be specified. Start by calculating the store's revenue. When x customers visit the store in the first period, each customer contributes R dollars to revenue by purchasing impulse goods. Of these customers, $(1 - \alpha)x$ also finds the leader product on the shelf and each purchase contributes p dollars. Therefore, the first-period revenue is $Rx + (1 - \alpha)xp$. What is the present value of the second-period revenue? Since αx customers receive rain checks, they come back to the store in the second period for the leader product. Their contribution to revenue's present value, including purchase of impulse goods, is $\beta(R + p)\alpha x$. Some customers shop at the store in the second period without a rain check and just buy the impulse good; these are the consumers who found the leader product on the shelf and had no need for a rain check. There are $(1 - \alpha)x$ customers who purchased the leader product from the representative store in the first period and $(n - 1)(1 - A)X$ consumers who purchased the leader product from other stores in the first period (A is the probability of stock outages at other stores). Since they have already purchased the leader product, these consumers choose a store randomly in the second period and, on average, $[(1 - \alpha)x + (n - 1)(1 - A)X]/n$ customers visit the representative store, each one contributing βR dollars to the present value of revenue.

Considering costs, a store incurs a constant marginal cost, C, to supply the leader product, and the costs of supplying impulse goods and handling rain checks are as-

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[2] In the Bertrand oligopoly model firms choose prices rather than quantities, and the firm with the lowest price attracts all the customers for the homogeneous product. The Bertrand equilibrium outcome is competitive in that price equals marginal cost.

sumed for simplicity to be zero. Some leader products are provided in the first period at a unit cost of C and some are provided in the second period at a present value cost of βC. Combining the revenue and cost, the present value of profits is

$$\pi(p, \alpha, x) = x\{R + p(1 - \alpha) + \beta(R + p)\alpha\}$$

$$+ \beta R[(1 - \alpha)x + (n - 1)(1 - A)X]/n - (1 - \alpha)Cx - \alpha\beta Cx. \quad (5)$$

Figure 1 shows three different iso-profit curves π_0, π_1, and π_F derived from (5) when p and α are varied. Expression (5) and the iso-profit curves imply the following: (a) iso-profit curves farther from the origin represent higher profits; (b) if the probability of stock out is increased, the price of the leader product must be decreased to keep the profit constant; (c) for $p < C$, larger price decreases are required as the probability approaches one.

3. The Symmetric Bertrand-Nash Equilibrium

The symmetric Bertrand-Nash equilibrium is defined as a set of values (p^*, P^*, α^*, A^*) that satisfy the following conditions. The values (p^*, α^*) maximize the representative store's profits subject to demand (4), given (P^*, A^*). In equilibrium the magnitudes satisfy the symmetry conditions

$$p^* = P^*, \qquad \alpha^* = A^*. \quad (6)$$

To find the symmetric Nash equilibrium, imagine that all other stores offer a leader price and rain check policy (P, A). This offer provides consumers with expected surplus U. The representative store would contemplate a leader price and rain check policy combination (p, α) that provides consumers with a slightly higher surplus $u_0 = U + \epsilon$. Under the Nash assumption that other sellers leave their prices and rain check policies unchanged, this will attract *all* N consumers to the representative store, increasing its profits. What combination (p_0, α_0) maximizes the representative store's profit for the given u_0? Since the representative store obtains all consumers when u_0 is offered, we substitute $x = N$ and $X = 0$ in the profit expression (5). This gives

$$\pi(p, \alpha) = RN + pN(1 - \alpha) + \beta(R + p)N\alpha + \beta R(1 - \alpha)N/n - (1 - \alpha)CN - \alpha\beta CN. \quad (7)$$

To find the optimal combination (p_0, α_0), first use the surplus formula (3) to solve for p as a function of α. Second, substitute p into the profit formula (7) and maximize the profit function with respect to α. This gives[3]

$$\alpha_0 = [\beta R(n - 1)/n - (1 - \beta)(V - C)]/(2t). \quad (8)$$

Finally, substitute α_0 back into p to get

$$p_0 = V - [u_0 + t\alpha_0^2]/[1 - \alpha_0 + \beta\alpha_0]. \quad (9)$$

The combination (p_0, α_0) is illustrated by the tangency between iso-profit π_0 and the indifference curve u_0 in Figure 1 at point A. It is interesting to note from (8) and (9) that only p_0 depends on u_0. Therefore, the most profitable way the deviant store could offer customer higher utility would be by reducing price, leaving α_0 unchanged.

The combination (p_0, α_0) is not the market equilibrium. The other stores lose all their customers to this offer. To regain customers, these stores will offer expected surplus slightly higher than u_0. One can imagine stores successively undercutting each other in frustrating attempts to build a larger market share. (During this process α_0 remains constant.) When will the process stop?

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[3] Second order conditions are satisfied as long as $t > 0$. A necessary and sufficient condition for α_0 to be in the interval [0, 1] is

$$C + \frac{\beta}{1 - \beta} \frac{n - 1}{n} R - \frac{2}{1 - \beta} t \le V \le C + \frac{\beta}{1 - \beta} \frac{n - 1}{n} R.$$

TABLE 2

Parameter Values

$t = 2.895$, $R = 3$, $V = 15$, $\beta = 0.9$, $C = 10$, $N = 100$, $n = 10$

Solution Values

$\alpha^* = A^* = 0.33$, $p^* = P^* = 5.97$, $x^* = X^* = 10$, $\pi^* = 18$, $u^* = 8.41$

The process of price cutting will stop and an equilibrium will be reached before loss leader pricing and rain checks become unprofitable. A deviant store can always choose not to use leader pricing. If all other stores continue to use leader pricing with rain checks, all N consumers visit the other stores in the first period. Of these, $(1 - \alpha_0)N$ find the leader product on the shelf. Since these consumers choose a store randomly in the second period, on average the deviant store expects $(1 - \alpha_0)N/n$ second-period customers and can guarantee profit of $(1 - \alpha_0)(N/n)\beta R$ by not selling the leader product. Equilibrium will be reached when the profit obtained under leader pricing and rain checks equals this profit floor,

$$\pi(p, \alpha_0) = \pi_F \equiv (1 - \alpha_0)(N/n)\beta R. \tag{10}$$

In Figure 1 the iso-profit curve that takes on the value of the profit floor is labelled π_F. The equilibrium price can be obtained by substituting $\pi(p, \alpha)$ from (5) into (10), solving for p using the symmetry conditions (6):

$$p_0^* = C - R \frac{1 + \alpha_0\beta}{1 + \alpha_0\beta - \alpha_0}. \tag{11}$$

At this point, a substantial part of monopoly profits from selling impulse goods is wiped out by the leader product being sold at a loss, so stores are indifferent between using leader pricing and selling only impulse goods in the second period. The leader product is sold below its unit cost and the markdown is larger than R when $\alpha_0 > 0$. (Recall that the cost of producing impulse goods is assumed to be zero and, therefore, R is the profit per customer per period from selling impulse goods.)

The unique symmetric Bertrand-Nash equilibrium has now been derived:

$$\alpha^* = A^* = \alpha_0, \qquad p^* = P^* = p_0^*, \qquad x^* = X^* = N/n. \tag{12}$$

Substituting (12) in (5) and (3) gives the equilibrium profits earned by each store and the equilibrium surplus provided to the typical consumer:

$$\pi^* = (1 - \alpha^*)\beta RN/n, \tag{13}$$

$$u^* = V + R - C + \alpha^*\beta R/n + t\alpha^{*2}. \tag{14}$$

The equilibrium is illustrated in Figure 1 at point B where the iso-profit curve π_F is tangent to the indifference curve u^*. The representative store cannot increase profit by using leader pricing without rain checks[4] or by selling only impulse goods in the second period. The price war resulting from the rain check policy has increased the surplus other stores provide customers. These other strategies would reduce customer satisfaction and the representative store would lose all its customers in the first period. Furthermore, if the transaction cost of using rain checks is not too high, the store cannot increase profit by offering the leader product only in the second period (see Appendix).

Table 2 provides a numerical example of a symmetric Bertrand-Nash equilibrium with stock outages and rain checks. The proportion of stock outages in this example

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[4] When the representative store uses leader pricing without rain checks, $\alpha = 0$. Setting $\alpha = \alpha^*$, however, would yield higher profit since α^* maximizes the store's profit.

resembles the actual proportions in our sample (see Table 1) and the leader product is sold at 40 percent below costs.

4. The Effect of a Law Eliminating Rain Checks

As shown, leader pricing together with rain check policy gives stores incentives to run out of stock. In this model stock outs occur for no other reason, such as unanticipated demand. What is the effect of a law that prohibits stores from offering rain checks? We will compare the equilibrium and welfare resulting when leader pricing is used with rain check policy to the equilibrium and welfare resulting when leader pricing is used but rain checks are not allowed. Two types of inefficiencies could prevail: inefficiency resulting from sale of loss leaders and inefficiency resulting from stock outages. If V is smaller than C, consumers would not buy the leader product at cost, so the industry would be inefficient when the leader is sold. Yet, stores may sell the leader product below cost to attract impulsive customers. Another inefficiency can be attributed only to stock outages, not to cross subsidization of the leader product by the impulse good. Because we want to concentrate on the inefficiency created by stock outs, it will be assumed that $V > C$.

First, let's calculate the total welfare under a law that forbids rain checks. In this case, stores face a legal constraint $\alpha = 0$. Substituting this in surplus (3) and profit (5) yields

$$u = V - p, \tag{15}$$

$$\pi = (R + p)x + \beta Rx - Cx. \tag{16}$$

The representative store maximizes (16) subject to (15) and demand (4), given U. What is the equilibrium?

When all other stores sell the leader product at P, they provide consumers with surplus U. The representative store can lower its price slightly below P, provide consumers with surplus higher than U, and gain all N consumers. Successive price cutting by all stores would take place until first period profits, $(R + p)x - Cx$, are driven to zero. Sales of impulse goods guarantee that the second-period expected profit is βRx; this will not be eroded by price competition, since stores can always shut down in the first period if the leader price drops too low. Using the symmetry condition (6), equilibrium profit equals

$$\pi^{**} = \beta R(N/n). \tag{17}$$

The equilibrium price is determined by setting first-period profits to zero:

$$p^{**} = C - R. \tag{18}$$

The surplus obtained by each consumer is

$$u^{**} = V - p^{**} = V + R - C. \tag{19}$$

By summing all profits and utilities, the total welfare in the economy is obtained:

$$W^{**} = Nu^{**} + n\pi^{**} = N(V - C + R) + \beta R(N/n)n$$

$$= N[V + (1 + \beta)R - C]. \tag{20}$$

Now consider repeal of the law prohibiting rain checks. What is the total welfare when rain check policy α can be adjusted by stores? From the previous section, we know that stock outages can occur. Sum the profits and utilities given in (13) and (14) to obtain

$$W^* = Nu^* + n\pi^* = W^{**} - \alpha^*[(1 - \beta)V + t\alpha^*]N. \tag{21}$$

$W^{**} - W^*$ measures the relative inefficiency of an economy with and without a law prohibiting stock outs and rain checks.

Comparing the equilibria with and without such a law, the following results are evident:

(A) The price of the leader product is lower when rain checks can be used. (Compare (11) with (18).)

(B) Stores earn lower profits when rain checks can be used. (Compare (13) with (17).)

(C) Consumers obtain higher surplus when rain checks can be used. (Compare (14) and (19).)

(D) The total welfare in the economy is higher with a law that eliminates rain checks. (Compare (20) and (21).)

The results are surprising. The explanation is as follows. Consider first result (A). When the law to eliminate rain checks is in effect, leader pricing is used only to increase first-period sales of impulse products, but when rain checks can be used, stores combine rain checks with leader pricing to gain both first- and second-period sales of impulse goods. Each store has an incentive to lower the leader price further to augment these second-period sales. Therefore, the leader product price is lower without the law.

Now examine result (B). When rain checks may not be used, every store can guarantee the expected profits given in (17) by selling only impulse goods in the second period. Allowing stores to use rain checks opens new marketing opportunities. By offering rain checks, a representative store can dramatically increase from $1/n$ to 1, the probability that a first-period customer will return to the store in period two, so the store anticipates greater profits from offering rain checks to some consumers.[5] To attract customers to the store in the first place, the price of the leader product is reduced. However, this is not the equilibrium outcome. Since all the stores will use this opportunity, profits will be driven below the profit level that would result under the law prohibiting rain checks. The situation is similar to the prisoner's dilemma (Luce and Raiffa 1957, Axelrod 1984). The rain check policy is profitable to the representative store as long as the other stores are not using this strategy. This behavior, however, is myopic; when all stores adopt rain checks, they all lose profits. Stores are better off with the law that eliminates rain checks.

Next consider result (C). Since rain checks enhance competition, consumers can buy the leader product at a lower price. The price decrease must be large enough to compensate for transaction costs incurred when using the rain checks, since the seller must induce the customers to its store. Therefore, consumers are better off with a law that allows rain checks and stock outages.

Finally, result (D) says the economy is more efficient with a law eliminating rain checks. Rain checks do not increase total sales[6] but do introduce transaction costs. The last term in (21) reflects net costs to society of delayed consumption and transaction costs associated with rain checks.[7]

We conclude that laws that limit the scope of "competitive" marketing practices can be economically efficient. How can a law preventing voluntary competitive behavior by firms and individuals be beneficial? An essential ingredient in the model developed here is that the number of customers who buy the product is not increased by the marketing strategy of rain checks and loss leaders. The entrepreneur who first offers rainchecks gains customers from other stores, not expanding the size of the market. Because the policy imposes costs on the customers, it is not efficient. If the total number of customers depends on the offers made by the firms (for example, due to consumer hetero-

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[5] In reality, not all customers use rain checks. Consumer heterogeneity is discussed in §6.

[6] Note that in our model the rain checks do not increase sales of impulse products in the market. They only help divert sales from one store to another.

[7] If stores had positive costs of processing rain checks, the last term in (21) would include these costs, but α^* would be smaller.

geneity), the results could be less determinate, as is the case for monopolistic price discrimination (Chiang and Spatt 1982, Varian 1985, and Gerstner and Hess 1987).

5. Sensitivity Analysis

This model of retail marketing leads to some sharp testable hypotheses. Table 3 shows how small increases in the parameters of the economy affect leader pricing, rain check policy and efficiency. The responses of α^* and p^* to parameter changes can be obtained from expressions (8) and (11). The inefficiency created by stock outages is studied by comparing (20) and (21). The results have an intuitive appeal as explained below.

Increased Competition

Column 1 shows how an increase in the number of competitors affects leader pricing and rain check policy. Without a rain check, the probability that a given customer will visit the store in period two is $1/n$. This probability approaches zero when n increases. The store can improve this probability to 1.0 by giving a rain check to the customer. Therefore, when the number of rivals is larger, rain checks are more productive, so α^* increases. Since α^* is larger, the leader price p^* falls to compensate customers for more frequent stock outages and to keep profits from rising above the equilibrium level (10). Surprisingly, greater competition for a fixed number of customers increases the inefficiency of the industry. To prevent loss of customers in the more competitive situation, stock outs are more prevalent, imposing greater transaction costs on the consumers.

Increased Cost

When the cost of the leader product increases, rain checks are more attractive to the store because the cost of the leader product can be delayed: α^* increases when C increases. The impact of a cost increase on price is ambiguous. On the one hand, the increase in stock outages forces price down to compensate customers, but on the other hand, the price must reflect the increased cost of the leader product if profit levels are to be maintained. More frequent stock outs cause greater inefficiencies.

Increased Willingness-to-Pay

When the amount spent on the impulse goods, R, increases, leader pricing and rain checks both are more profitable to stores because of the higher returns from each customer who visits the store. When R increases, p^* is reduced to draw customers to the store and α^* is raised to induce them to return. In the case of larger R, the more frequent stock outages add to inefficiency.

When consumers value the leader product more, any delay in its consumption is more costly. Therefore, α^* decreases when V increases. The decrease in stock outages

TABLE 3

	Store Parameters				Consumer Parameters	
	No Firms	Cost	Demand Values		Transact. Cost	Discount Rate
	n	C	R	V	t	β
p^*	$-$	?	$-$	$+$	$-$	$-$
α^*	$+$	$+$	$+$	$-$	$-$	$+$
$W^{**} - W^*$	$+$	$+$	$+$	$-$	$-$	?

improves customer satisfaction so the leader price can be raised. The reduction in stock outages mitigates the inefficiency of the economy.

Increased Transaction Costs

Transaction costs, t, affects p^* and α^* in a way similar to that of V. Rain checks are less attractive when the transaction cost of using them increases, so α^* decreases when t increases. The leader price can then be increased without loss of customers.

Increased Discount Rate

An increase in the common discount factor β has a similar effect to that of increased value of impulse goods because consumer willingness to purchase the leader product in the second period increases and the seller is more willing to postpone sales. Again, leader pricing and rain checks are more attractive. An increase in β, however, has an indeterminate effect on efficiency because it makes delayed consumption less detrimental, even though the increased stock outs increase the incidence of delays.

6. Consumer Heterogeneity

In the analysis above, it was assumed that all consumers take advantage of loss leader pricing and rain check policy. In this section we will relax these assumptions. In reality, not all consumers take advantage of loss leaders and rain checks. Research shows that there are different segments among shoppers (Gabor and Granger 1961, Brown 1968, William et al. 1978). Some buyers choose a store based more on its location and services than on its price. Other buyers compare stores' pricing policies more carefully and choose a store accordingly. To model consumer heterogeneity, we will assume that a fraction μ of the N customers do not respond to loss leader pricing and/or rain checks. These customers, called the nonresponsive segment, choose stores randomly. The assumption that consumers in the nonresponsive segment choose stores randomly might look restrictive. However, the results obtained below would still be valid under circumstances in which nonresponsive customers select stores based on location or services, but no store has a location or service advantage; all stores obtain the same share of nonresponsive customers. The following cases will be considered:

(a) The nonresponsive segment responds neither to advertised loss leader pricing nor to rain check offers.

(b) The nonresponsive segment does not respond to advertised loss leader pricing but will use rain checks.

To study these cases we will assume that the other parameters, V, R, β, are still the same for all consumers.

Case (a): *Heterogeneity in response to both loss leader pricing and rain check use.* Suppose that all the consumers in the nonresponsive segment have the same high cost of time. As a result, they do not become informed about the leader price and rain check policy and choose a store randomly. Furthermore, these customers buy the leader product only if it is available at the store in the first period. If the product is out of stock, they do not take the time to get a rain check and choose a store randomly again in the second period (condition (2) does not hold for these customers).

To find the Bertrand-Nash equilibrium for this case, it is useful to note that any store that is not using loss leader pricing and rain checks can guarantee a profit of

$$\pi_F = \mu(R + V - C + \beta R)N/n + (1 - \mu)(1 - A)\beta RN/n. \tag{22}$$

To see this, notice that when leader pricing and rain checks are used by other stores but not by a deviant store, only the nonresponsive consumers visit the deviant store in the first period, $\mu N/n$ on the average. Since these consumers do not learn the price before

choosing a store, each is willing to pay the reservation value V for the leader product, and R for the impulse products. In the second period, the deviant store expects not only the $\mu N/n$ nonresponsive customers but also its fair share $(1 - \mu)(1 - A)N/n$ of the responsive consumers who found the leader product on the shelf (and did not need a rain check). Each of these customers buys impulse goods at value R. Therefore each store is guaranteed the profit floor (22).

The representative store can choose to use loss leader pricing and rain checks. Its profit function is then given by

$$\hat{\pi}(p, \alpha, x) = (1 - \mu)\pi(p, \alpha, x) + \mu[R + \beta R + (1 - \alpha)(p - C)]N/n. \qquad (23)$$

To see this, note that the profit from the responsive segment is obtained by multiplying $\pi(p, \alpha, x)$ from equation (5) by the proportion $1 - \mu$; the response of these consumers to loss leader pricing and rain checks remains the same. The profit from the nonresponsive segment is computed as follows: there are $\mu N/n$ nonresponsive customers who visit the store at random in the first period. Of these $(1 - \alpha)\mu N/n$ also find the product on the shelf and purchase it at a price p. The first-period expected revenue from the nonresponsive segment is $\mu RN/n + \mu(1 - \alpha)pN/n$. In the second period the nonresponsive customers choose a store for the impulse good only, so revenue is $\mu \beta RN/n$. The expected cost of selling the leader product to these customers is $\mu(1 - \alpha)CN/n$. The combined profit function of the representative store is given by (23).

When all the other stores use loss leader pricing and rain checks, the representative store can also use this strategy but gain all the responsive customers by offering them a utility slightly higher than that offered by the other stores. The combination of (p, α) that maximizes the store's profit is obtained by substituting $x = N$ in the profit function (23) and maximizing with respect to p and α.

A symmetric equilibrium with significant stock outages (similar to the one derived for the case of homogeneous consumers) would exist if the segment of responsive consumers is large relative to the nonresponsive segment. In this case the stores compete for responsive consumers, offering (p, α) combinations with higher and higher expected surplus. The process stops and equilibrium is reached when the profit obtained under loss leader pricing and rain checks just equals the profit floor (22). Table 4 provides a numerical example for the symmetric Bertrand-Nash equilibrium, using the same parameter values as in the example of Table 2 but with various values of μ.

The following results can be observed from the numerical example:

(E) As the proportion of nonresponsive customers, μ, increases, the equilibrium price of the leader product, p^*, increases.

(F) As the proportion of nonresponsive customers, μ, increases, the probability of a stock outage, α, first increases and then decreases.

It can be shown that these results hold in general.

Result (E) is clear. As the size of the nonresponsive segment increases, fewer con-

TABLE 4

Parameter Values

	$t = 2.895$,	$R = 3$,	$I = 15$,	$\beta = 0.9$,	$C = 10$,	$N = 100$,	$n = 10$			
					$\mu =$					
	0 0	0.1	0.2	0.3	0.4	0 5	0.6	0.7	0.8	0.9	1.0
p^*	6.0	6.0	6.1	6 3	6.4	6.8	7.0	7.5	8.5	10.9	15.0
α^*	0.333	0.337	0.342	0.347	0 352	0.358	0.363	0.359	0.315	0.098	0.000
π^*	18.0	26 8	35.6	44.5	53.3	62.1	71.1	80.1	89.3	98.7	107
u^*	8 41	8 33	8 23	8 09	7 93	7.70	7.38	6.88	6.00	4.25	0.0

sumers compare prices before choosing a store. Therefore the stores can increase their profits by raising the price of the leader product.

To understand result (F), recall that the nonresponsive segment will not use rain checks, but it does take advantage of the leader product if it is available. Loss leader pricing does not influence these customers; they choose a store at random. Therefore, when the leader product is sold at a significant loss, stores prefer not to sell the leader product to the nonresponsive consumers. Since the store cannot distinguish responsive from nonresponsive customers, the only way the store can discourage sales to the nonresponsive segment is to increase stock outs. As the size of the nonresponsive segment continues to increase, however, the price of the leader product increases, so selling the leader product to all customers becomes more and more profitable. To attract responsive customers and to induce the nonresponsive customers to buy the leader product, stock outages must decrease. Therefore, α^* increases for small values of μ and decreases for larger values of μ.

Case (b): *Heterogeneity in response to loss leader pricing only.* The analysis of this case is not much different from that of Case (a). Consumers in the nonresponsive segment still choose stores randomly in the first period, but they will use rain checks when they do not find the leader product on the shelf. Therefore, the profit floor and the profit function under leader pricing and rain checks must be revised.

If loss leader pricing is used by other stores but not by a deviant store, only nonresponsive consumers visit the store in the first period, $\mu N/n$ on average. These uninformed customers are willing to buy the leader product if it is available and will accept a rain check if it is out of stock. In either case they will spend R on the impulse goods. In the second period, responsive and nonresponsive customers who took rain checks from other stores will not visit the deviant store. The deviant store expects its fair share of those customers who did not need rain checks. The profit floor is

$$\pi_F = \mu\{R + (1 - \alpha)p + \alpha\beta(R + p) + \beta R[(1 - \alpha) + (n - 1)(1 - A)]/n$$
$$- (1 - \alpha)C - \alpha\beta C\}N/n + (1 - \mu)(1 - A)\beta RN/n. \quad (24)$$

It turns out that the profit floor is maximized either by choosing zero stock outs, $\alpha = 0$, and setting the price of the leader item equal to the reservation value, V, or choosing to always have stock outs, $\alpha = 1$, and setting the price equal to $\beta V - t$, the highest price that a consumer would pay for a rain check when he is in the store. For the parameter values used in the examples the optimal strategy involves setting α equal to zero in the profit floor (24).

If all the stores use leader pricing and rain checks, the profit function of the representative store is given by:

$$\hat{\pi}(p, \alpha) = (1 - \mu)\pi(p, \alpha) + \mu\{R + (1 - \alpha)p + \alpha\beta(R + p)$$
$$+ \beta R[(1 - \alpha) + (n - 1)(1 - A)]/n - (1 - \alpha)C - \alpha\beta C\}N/n. \quad (25)$$

As in case (a), the profit from the responsive segment is obtained by multiplying $\pi(p, \alpha)$ from equation (7) by the proportion $1 - \mu$. The nonresponsive segment visits stores randomly in the first period, buying impulse goods and, if possible, the leader product. Their second period behavior is different. In this case nonresponsive customers do take advantage of rain checks. Therefore, the representative store expects $\mu\alpha N/n$ nonresponsive customers to use their rain checks, in addition to its fair share of customers who did obtain the leader product in the first period.

Table 5 provides a numerical example of the equilibrium, using the same parameter values as in the example of Table 2 with various values of μ. The following results can be observed:

TABLE 5

	0.0	0.1	0.2	0.3	0.4	$\mu =$ 0.5	0.6	0.7	0.8	0.9	1.0
p^*	6.0	6.1	6.2	6.3	6.5	6.7	7.0	7.5	8.3	9.9	15.0
α^*	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.333	0.000
π^*	18	26	34	42	50	58	67	75	83	91	107
u^*	8.41	8.32	8.21	8.08	7.91	7.67	7.36	6.88	6.10	4.58	0.00

Parameter Values: $t = 2.895$, $R = 3$, $V = 15$, $\beta = 0.9$, $C = 10$, $N = 100$, $n = 10$

(G) As the proportion of nonresponsive customers, μ, increases, the equilibrium price of the leader product, p^*, increases.

(H) If there is heterogeneity, the probability of a stock outage, α^*, is independent of the proportion of nonresponsive customers, μ.

It can be shown that these results hold in general.

The intuition for result (G) is the same as for result (E), case (a). To explain result (H), recall that the nonresponsive consumers do not respond to leader pricing, but do take advantage of rain checks. Since all consumers respond in the same way to rain checks, returning to the store in the second period, α does not change when the proportion of the population that is nonresponsive changes.

7. Conclusions

Loss leader pricing and rain check policy are used by retailers in markets where impulse goods are sold. Loss leader pricing draws customers to the store, where they also buy highly profitable impulse goods. Rain checks are introduced to enhance the effect of the loss leader. By running out of the leader item and offering rain checks, sellers bring the customers to their store a second time. The market equilibrium derived above is used to study the effect of changes in marketing parameters on the store's profits and market outcomes. The FTC law that prohibits the use of stock outs and rain checks is also analyzed.

The model generates interesting results. An entrepreneur who introduces rain checks to a market with loss leader pricing initially can earn higher profit. However, should other sellers follow suit, they all would prefer a law that prohibits use of rain checks. Stores benefit from the current FTC regulation as it mitigates this "prisoner's dilemma." On the other hand, one consumer who opposed the repeal of the 1971 ruling forbidding stock outages wrote: "Do you remember how much it costs to make all those trips to a store on the other side of town only to be told they're all out? I bet my costs are a lot higher in gas, time, and trouble and temper" (Saddler 1985). This consumer has not considered the full consequences of repeal. In our model all consumers take advantage of rain checks, but the personal benefit from the reduced prices that rain checks generate exceeds the transaction costs associated with them. Therefore, consumers are better off without the FTC rule. From the social perspective, however, the rule is desirable because it promotes efficiency by reducing transaction costs and delayed consumption.

There appear to be four key elements in the model. First, consumers do not plan purchases of impulse goods and buy only one unit of the leader product. Second, they visit only one store each period (the cost of visiting other stores is too high and exceeds the cost of using rain checks). Third, the number of consumers in the market is fixed and independent of prices that are below the reservation prices. Fourth, all agents are informed and rational. (Stores accurately predict demand and consumers accurately predict stock outs.)

Some of the model's results prevail under weaker assumptions. Leader pricing and rain checks may occur even when customers do not buy impulsively. A typical grocery, general merchandise or drug store carries thousands of products and only a small portion of the products are advertised, since advertising is costly. Consumers may plan consumption of unadvertised goods whose exact prices are not discovered until the consumer is at the store (see, for example, Feichtinger et al. 1987). This gives stores some monopoly power and they can apply higher markups to unadvertised products.

Stores will still have incentives to use rain checks even if consumers would like to purchase leader products every period, or if some consumers would like to purchase only leader products. Even if other leader products are sold every period, rain checks may still be offered. Using rain checks, an entrepreneur can increase the probability that some customers will come back to the store, and in turn, increase profits. If some consumers buy only the loss leader item, sellers could impose a "minimum purchase" requirement that requires buyers of the loss leader item to purchase a certain value of other products to get the leader product at a reduced price. This bundling strategy mitigates this problem of "cherry picking" and does not affect consumers who would purchase more than the minimum anyway.

The economic inefficiencies that occur in our model are due to transaction costs and delayed consumption that result from stock outages (expression (21)). These inefficiencies would still prevail if we assumed that consumers have continuous demand for impulse products and obtain positive utility from consuming them. Another type of inefficiency would result if the cost of producing and selling the loss leader exceeds consumer willingness to pay for the product. Kemp (1955) discusses additional sources of inefficiencies created by leader pricing.

In our model consumers do not punish stores for stock outages. Consumers know about rain check policy, so they anticipate the possibility of a stock out. They accept rain checks as partial compensation, if their transaction costs of using rain checks are not too high. It would be interesting to explore loss leader pricing and rain check policy in a framework where uninformed customers are so frustrated by unexpected stock outs, that they never return to an offending store. This and the limitations just discussed provide areas of exploration for future research.

Finally, loss leaders with rain checks is not the only way to entice customers to return to a seller. Airlines' frequent flyer programs are designed to attract customers back to a particular airline for the next trip. And recently, a fast food restaurant offered a sweepstakes game in which every customer was a winner of a soft drink, sandwich, or french fries. However, the prize could only be redeemed on the next visit to the restaurant![8]

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[8] This paper was received in April 1986 and has been with the authors for 2 revisions.

Appendix

If the transaction cost of using rain checks is not too high, the representative store is better off selling the leader product with rain checks in the first period, since every buyer who gets a rain check buys impulse goods twice: in the first period and in the second. If, however, the transaction cost of using rain checks is high, consumers who do not find the leader product on the shelf would pay a significantly higher price for the leader product in the second period to avoid the costs of rain checks. Therefore, when all other stores offer rain checks, a deviant store can increase profit by shutting down in the first period and offering the leader product only in the second period.

The following condition guarantees that a deviant store cannot increase profit by offering the leader product only in the second period:

$$t < \beta(2 - \beta)R/(1 + \alpha_0\beta - \alpha_0). \tag{i}$$

Suppose the leader product is offered only in the second period by a deviant store. Consumers who do not find the leader product on the shelf at the other stores in the first period will prefer to not take a rain check and buy the product from the representative store if its price, p, satisfied $p \leq p_0 + \alpha t/\beta$. That is, p does not exceed the price at the other stores plus the delayed value of the transaction cost customers incur when using rain checks.

Let $\bar{p} = p_0 + \alpha t/\beta$ be the highest price the representative store can charge for the leader product in the second period. Selling the leader product in the second period is not profitable when $C - \bar{p} > R$; that is, the loss per customer from selling the leader product exceeds the gain from sales of impulse goods. Condition (i) is obtained by substituting p_0 from (11) in the relation $\bar{p} = p_0 + \alpha t/\beta < C - R$ and rearranging.

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EXHIBIT 88

Terms of Use

Last Updated: October 30, 2019

Welcome to Blue Apron and our Terms of Use (these "Terms"). These Terms are important and affect your legal rights, so please read them carefully. Note that Section 18 of these Terms contains a mandatory arbitration provision that requires the use of arbitration on an individual basis and limits the remedies available to you in the event of certain disputes.

By (a) accessing or using the websites, mobile applications or blogs (collectively, the "Sites") provided by or on behalf of Blue Apron, LLC or our subsidiaries or other affiliates (collectively, "Blue Apron," "we," "us" or "our") that link to these Terms or (b) ordering, receiving or using any meal ingredients or other products or

services offered by Blue Apron through the Sites or through any third party retailer, online or e-commerce platform, mobile application, blog or other third party channel (collectively, "Third Party Channels") ((a) and (b) together, the "Products"), you agree to be bound by these Terms and all of the terms incorporated herein by reference, including our Privacy Policy. If you do not agree to these Terms, you may not access or use the Sites, order, receive or use the Products.

These Terms do not alter in any way the terms or conditions of any other agreement you may have with us in respect of any products, services or otherwise. If you are using the Sites on behalf of any person or entity, you represent and warrant that you are authorized to accept these Terms on such person or entity's behalf and that such person or entity agrees to be responsible to us if you or such person or entity violates these Terms.

Blue Apron reserves the right to change or modify these Terms at any time and in our sole discretion. If we make changes to these Terms, we will provide notice of such changes, such as by sending an email notification, providing notice through the Sites or updating the "Last Updated" date at the beginning of these Terms. By continuing to access or use the Sites or order, receive or use Products, you confirm your acceptance of the revised Terms and all of the terms incorporated therein by reference. We encourage you to review the Terms frequently to ensure that you understand the terms and conditions that apply when you access or use the Sites or order, receive or use the Products. If you do not agree to the revised Terms, you may not access or use the Sites or order, receive or use the Products.

1.   **Privacy Policy**

Please refer to our Privacy Policy for information about how we collect, use and disclose information about you.

2.   **Eligibility**

The Sites are not targeted toward or intended for use by anyone under the age of 18. By using the Sites, you represent and warrant that you (a) are 18 years of age or older, (b) are a legal resident of the United States, (c) have not been previously suspended or removed from the Sites, or engaged in any activity that could result in suspension or removal from the Sites, (d) have not created or do not have more than one Blue Apron account, unless expressly permitted by Blue Apron, and (e) have full power and authority to enter into these Terms and in so doing will not violate any other agreement to which you are a party. In addition, if you are the purchaser or recipient of any wine Products via the Sites, you further represent and warrant that (x) you are 21 years of age or older and are otherwise eligible to purchase or receive such wine Products, and (y) the person signing for and accepting delivery of any such wine Products is an adult 21 years of age or older, and presented a valid form of identification confirming such fact, at the time of delivery of such wine Products.

We continually test new functionalities, services, options, initiatives, user interfaces, products and other features that we are considering developing, adding or incorporating into our Sites or Products (collectively, "Test Features"). We reserve the right, in our sole discretion, to include or exclude you, from these tests without notice and to discontinue or to modify any Test Feature at any time, for any or no reason, without prior notice and with no liability, to the fullest extent permitted by applicable law.

3.   **Registration, Account and Communication Preferences**

To access and use certain areas or features of the Sites, you will need to register for a Blue Apron account. By creating an account, you agree to (a) provide accurate, current and complete account information, (b) maintain and promptly update, as necessary, your account information, (c) maintain the security of your account credentials, (d) be responsible for the acts or omissions of any third party who has authority to access or use the Sites on your behalf, and (e) immediately notify us if you discover or otherwise suspect any security breaches related to the Sites or your account. You further understand and agree that Blue Apron may take actions we deem reasonably necessary to prevent, respond to, pursue or remedy suspected or actual fraud and abuse, including without limitation, termination or suspension of your account.

By creating a Blue Apron account, you also consent to receive electronic communications from Blue Apron (e.g., via email or by posting notices to the Sites). These communications may include notices about your account (e.g., payment authorizations, password changes and other transactional information) and are part of your relationship with us. You agree that any notices, agreements, disclosures or other communications that we send to you electronically will satisfy any legal communication requirements, including, but not limited to, that such communications be in writing. You should maintain copies of electronic communications from us by printing a paper copy or saving an electronic copy. We may also send you promotional communications via email, including, but not limited to, newsletters, special offers, surveys and other news and information we think will be of interest to you. You may opt out of receiving these promotional emails at any time by following the unsubscribe instructions provided therein.

By providing your mobile phone number to us through the Sites or in connection with your order, receipt or use of our Product(s), you consent to receive calls or text messages at any such phone number sent by or on behalf of Blue Apron, including autodialed calls and/or text messages, for marketing, promotional, operational or transactional purposes, such as updates on the delivery status of your order of our Product. You may opt out of marketing and promotional calls or messages by following the applicable unsubscribe instructions provided to you. Following such opt-out, you may continue to receive calls or messages for a short period of time while Blue Apron processes your request. It is your responsibility to keep your account information, including your phone number, updated. Standard message and data rates applied by your mobile phone carrier may apply to the text messages we send you. Please contact your mobile phone carrier for details.

4.   Terms of Sale

4.1. Meal Subscriptions; Continuous Subscriptions; Cancellation Policy

Meal Subscriptions. We offer different subscription plans for our meal ingredients (each, a "Meal Subscription"). The number of meal servings (*i.e.*, an individual portion of meal ingredients) you receive and the amount you are charged may vary from week to week depending on the dietary preferences and other selections you make. For example, we may provide you with greater flexibility to choose the number of meal servings you receive each week. If your Meal Subscription changes, the applicable weekly Meal Subscription price may also change. Changes to your Meal Subscription, or other choices you may make (such as the number of meal servings you receive), may also result in changes to any applicable shipping and handling charges and meal delivery times. If we change the prices or other charges associated with our various Meal Subscription plans, we will provide you with notice of such changes, such as by email or a notice posted on our Sites. The fees for the Meal Subscriptions can be found on your Plan Settings page and may be subject to change in the future. For more information about our Meal Subscriptions, please visit the Pricing page on our website and our FAQs. Note that we do not currently deliver Meal Subscriptions to every location, so please visit our Zip Code Finder to see if we deliver to your area.

Continuous Subscriptions. WHEN YOU REGISTER FOR A MEAL SUBSCRIPTION, YOU EXPRESSLY ACKNOWLEDGE AND AGREE THAT (A) BLUE APRON (OR OUR THIRD-PARTY PAYMENT PROCESSOR) IS AUTHORIZED TO CHARGE YOU ON A WEEKLY BASIS FOR YOUR MEAL SUBSCRIPTION (IN ADDITION TO ANY APPLICABLE TAXES AND OTHER CHARGES) FOR AS LONG AS YOUR MEAL SUBSCRIPTION CONTINUES, (B) THE AMOUNT YOU ARE CHARGED AND THE NUMBER OF MEAL SERVINGS YOU RECEIVE EACH WEEK MAY VARY DEPENDING ON THE PREFERENCES YOU SELECT, AND (C) YOUR MEAL SUBSCRIPTION IS CONTINUOUS UNTIL YOU CANCEL IT OR WE SUSPEND OR STOP PROVIDING ACCESS TO THE SITES OR APPLICABLE PRODUCTS IN ACCORDANCE WITH THESE TERMS. YOU MAY SKIP YOUR WEEKLY MEAL ORDER AS OFTEN AS YOU'D LIKE BY MANAGING YOUR DELIVERY SCHEDULE LOCATED ON YOUR UPCOMING PAGE. FOR MORE INFORMATION ABOUT OUR PRICING AND BILLING POLICIES RELATED TO MEAL SUBSCRIPTIONS, PLEASE VISIT THE PRICING PAGE ON OUR WEBSITE AND OUR FAQS.

Cancellation Policy. YOU MAY CANCEL YOUR MEAL SUBSCRIPTION ONLINE AT ANY TIME

BY EMAILING CANCELLATIONS@BLUEAPRON.COM AND FOLLOWING THE INSTRUCTIONS IN OUR RESPONSE OR BY CONTACTING CUSTOMER SUPPORT. ANY MEAL ORDER(S) IDENTIFIED AS "PROCESSING" OR "SHIPPED" ON YOUR UPCOMING PAGE, HOWEVER, CANNOT BE CANCELLED. YOU WILL BE RESPONSIBLE FOR ALL CHARGES (INCLUDING ANY APPLICABLE TAXES AND OTHER CHARGES) INCURRED WITH RESPECT TO ANY MEAL ORDER IDENTIFIED AS "PROCESSING" OR "SHIPPED" PRIOR TO THE CANCELLATION OF YOUR MEAL SUBSCRIPTION.

In the event you cancel your Meal Subscription, please note that we may still send you promotional communications about Blue Apron, unless you opt out of receiving those communications by following the unsubscribe instructions provided therein.

4.2. Wine Subscriptions; Continuous Subscriptions; Cancellation Policy

Wine Subscriptions. In addition to our Meal Subscriptions, we offer a subscription plan for wine (a "Wine Subscription"). For more information about our Wine Subscription, please visit the Wine page on our website and our FAQs. Wine Products offered pursuant to our Wine Subscription are sold by us and fulfilled by our licensed fulfillment partners. We and our fulfillment partners maintain the applicable licenses and permits required for the sale and fulfillment of wine Products to you. As the rules restricting the sale and shipment of wine Products are complicated, we reserve the right to reject any wine Order for compliance reasons or otherwise. Note that we do not currently deliver wine to every location, so please visit our FAQs page to see if we deliver to your area.

Continuous Subscriptions. WHEN YOU REGISTER FOR A WINE SUBSCRIPTION, YOU EXPRESSLY ACKNOWLEDGE AND AGREE THAT (A) BLUE APRON (OR OUR THIRD PARTY PAYMENT PROCESSOR) IS AUTHORIZED TO CHARGE YOU ON A MONTHLY BASIS FOR YOUR WINE SUBSCRIPTION (IN ADDITION TO ANY APPLICABLE TAXES AND OTHER CHARGES) FOR AS LONG AS YOUR WINE SUBSCRIPTION CONTINUES, AND (B) YOUR WINE SUBSCRIPTION IS CONTINUOUS UNTIL YOU CANCEL IT OR WE SUSPEND OR STOP PROVIDING ACCESS TO THE SITES OR APPLICABLE PRODUCTS IN ACCORDANCE WITH THESE TERMS. YOU MAY SKIP YOUR MONTHLY WINE ORDER AS OFTEN AS YOU'D LIKE BY MANAGING YOUR DELIVERY SCHEDULE LOCATED ON YOUR UPCOMING PAGE. FOR MORE INFORMATION ABOUT OUR PRICING AND BILLING POLICIES RELATED TO WINE SUBSCRIPTIONS, PLEASE VISIT THE WINE PAGE ON OUR WEBSITE AND OUR FAQS.

Cancellation Policy. YOU MAY CANCEL YOUR WINE SUBSCRIPTION ONLINE AT ANY TIME BY EMAILING CANCELLATIONS@BLUEAPRONWINE.COM AND FOLLOWING THE INSTRUCTIONS IN OUR RESPONSE OR BY CONTACTING CUSTOMER SUPPORT. ANY WINE ORDER IDENTIFIED AS "PROCESSING" OR "SHIPPED" ON YOUR UPCOMING PAGE, HOWEVER, CANNOT BE CANCELLED. YOU WILL BE RESPONSIBLE FOR ALL CHARGES (INCLUDING ANY APPLICABLE TAXES AND OTHER CHARGES) INCURRED WITH RESPECT TO ANY WINE ORDER IDENTIFIED AS "PROCESSING" OR "SHIPPED" PRIOR TO THE CANCELLATION OF YOUR WINE SUBSCRIPTION.

In the event you cancel your Wine Subscription, please note that we may still send you promotional communications about Blue Apron, unless you opt out of receiving those communications by following the unsubscribe instructions provided therein.

4.3. Non-Subscription Products

Meal Purchases. From time to time we may make certain of our Products available on a non-subscription basis through our Sites (each, a "Meal Purchase"). For purposes of these Terms, Meal Purchases exclude meals and meal ingredients offered by Blue Apron Market, as described below.

Third Party Purchases. From time to time, certain of our Products may be offered through a Third Party

Channel (each, a "Third Party Purchase"). Your use of or interaction with any Third Party Channel are solely between you and the third party. Blue Apron does not control or endorse, and makes no representations or warranties regarding, any Third Party Channel. Third Party Channels may impose their own terms, policies or processes ("Third Party Terms"), separate from these Terms, and you should carefully review those Third Party Terms. Your access to and use of such Third Party Channels and your acceptance of Third Party Terms is at your own risk.

Blue Apron Market. The Blue Apron Market is an online marketplace operated by Blue Apron Market, LLC, an affiliate of Blue Apron, LLC, where you can purchase various kitchen, cookware, bakeware, pantry and other Products from us. All Products purchased through Blue Apron Market are sold by Blue Apron Market, LLC. For more information, please visit the Blue Apron Market and our FAQs.

For purposes of these Terms, any Products referenced in this Section 4.3 are referred to as "Non-Subscription Products."

4.4. Gift Cards

Blue Apron may offer gift cards from time to time. By purchasing or redeeming a Blue Apron gift card you agree to our Gift Card Terms and Conditions.

4.5. Free Trials

From time to time, to the extent legally permitted, we may offer free trials of certain subscriptions for specified periods of time without payment. If we offer you a free trial, the specific terms of your free trial will be provided in the marketing materials describing the particular trial or at registration. Free trials are limited to one (1) per household.

ONCE YOUR FREE TRIAL ENDS, WE (OR OUR THIRD-PARTY PAYMENT PROCESSOR) WILL BEGIN BILLING YOUR DESIGNATED PAYMENT METHOD ON A RECURRING BASIS FOR YOUR SUBSCRIPTION (PLUS ANY APPLICABLE TAXES AND OTHER CHARGES) FOR AS LONG AS YOUR SUBSCRIPTION CONTINUES, UNLESS YOU CANCEL YOUR SUBSCRIPTION PRIOR TO THE END OF YOUR FREE TRIAL. INSTRUCTIONS FOR CANCELING YOUR SUBSCRIPTION ARE DESCRIBED IN SECTIONS 4.1 AND 4.2 ABOVE. PLEASE NOTE THAT YOU WILL NOT RECEIVE A NOTICE FROM US THAT YOUR FREE TRIAL HAS ENDED OR THAT THE PAID PORTION OF YOUR SUBSCRIPTION HAS BEGUN. WE RESERVE THE RIGHT TO MODIFY OR TERMINATE FREE TRIALS AT ANY TIME, WITHOUT NOTICE AND IN OUR SOLE DISCRETION.

4.6. Payment and Billing Information

By providing a credit card or other payment method that we accept, you represent and warrant that you are authorized to use the designated payment method and that you authorize us (or our third-party payment processor) to charge your payment method for the total amount of your subscription or other purchase (including any applicable taxes and other charges) (collectively, as applicable, an "Order"). If the payment method cannot be verified, is invalid or is otherwise not acceptable, your Order may be suspended or cancelled. You must resolve any payment method problems before we proceed with your Order. If you want to change or update your payment method information, you can do so at any time by logging into your account. If a payment is not successfully settled and you do not edit your payment method information or cancel your Meal Subscription, Wine Subscription, purchase of a Non-Subscription Product, or account, as applicable, you remain responsible for any uncollected amounts and, with respect to your Meal Subscription or Wine Subscription, authorize us to continue billing the payment method, as it may be updated.

You acknowledge that the amount billed may vary due to promotional offers, preferences you select, changes you make to your Meal Subscription, Wine Subscription, purchase of a Non-Subscription Product, or changes in applicable taxes or other charges, and you authorize us (or our third party-payment processor) to

charge your payment method for the corresponding amount.

Notwithstanding anything provided above, for the purposes of this Section 4.6, any Third Party Purchase will be billed and charged in accordance with the applicable Third Party Terms.

4.7. Pricing and Availability

All prices on our Sites are shown in U.S. dollars and applicable taxes and other charges, if any, are additional. We reserve the right to adjust prices as we may determine in our sole discretion, at any time and without notice, including without limitation, as based on geographic or other criteria as we may establish from time to time; provided, however, that if we change the amounts or other charges associated with our various subscription plans, we will provide advance notice of such changes in accordance with Section 3. We will not, however, be able to notify you of changes in any applicable taxes. The shipment of meal ingredients or wine, as applicable, to you after our delivery of such notice will confirm your acceptance of such changes, unless you cancel your subscription(s) in accordance with the cancellation policies set forth in Sections 4.1 and 4.2, as applicable.

All of our Products are subject to availability, and we reserve the right to impose quantity limits on any Order, to reject all or part of an Order, to discontinue offering certain Products and to substitute Products (including, but not limited to, specific meal ingredients or entire meals) without prior notice. We strive to provide you with high-quality Products, and given the perishable nature of certain Products and market conditions beyond our control, we may be required to make substitutions from time to time. If you are not satisfied with a substitution, please contact us at contact@blueapron.com or contact@blueapronwine.com, as applicable.

If you are a resident of the State of Illinois, in lieu of having your wine Product delivered to you, you may pick up your wine Product from us in California. Please contact us at contact@blueapronwine.com by your "Changeable Before" date reflected in your Plan Settings to make such arrangements.

4.8. Taxes

We will collect applicable sales, use and other tax (collectively, "Tax") on Products shipped to jurisdictions for which we determine we have a duty to collect Tax applicable to your purchase. If an item is subject to Tax, you agree that the amount of Tax shown at checkout may be adjusted. Several factors may cause this, such as variances between processor programs and changes in applicable Tax rates.

We will collect the simplified sellers use tax on Products delivered into Alabama and the tax will be remitted on your behalf to the Alabama Department of Revenue. Our program account number with the Alabama Department of Revenue is SSU-R010237573.

4.9. Shipping and Handling

You agree to pay any shipping and handling charges shown at the time you make a purchase. We reserve the right to increase, decrease, add or eliminate shipping and handling charges from time to time, but we will provide notice of the charges applicable to you before you make your purchase. Generally, shipping is handled by a third party courier. When you purchase a Product from our Sites, any shipping times shown are estimates only. Actual delivery dates may vary. You agree that you will not obtain, or direct shipment of, a Product for export.

All Products purchased from us are made pursuant to a shipment contract. This means that when you purchase a Product that is fulfilled by one of our third party fulfillment partners title to and the risk of loss of such Product passes to you upon the fulfillment partner's delivery of such Product to the third party courier, and when you purchase a Product that is fulfilled by us title to and the risk of loss of such Product passes to you upon the third party courier's delivery of such Product to you.

Notwithstanding anything provided above, for the purposes of this Section 4.9, shipping and handling for any Third Party Purchase will be made in accordance with and subject to the applicable Third Party Terms.

4.10. Deliveries

You are responsible for inspecting all Products for any damage or other issues upon delivery. In addition, you are solely responsible for determining the freshness of the Products you receive. We recommend that you use a thermometer to ensure that the internal temperature of any meat, poultry or seafood Product is 40° F or below. In the unlikely event that such temperature is above 40° F, or you have any other reason to believe that any other Product in your delivery or purchase is not suitable for consumption, contact us at contact@blueapron.com, or the applicable Third Party Channel, and discard the item. To maintain the quality and integrity of the Products, we recommend that you immediately refrigerate all perishable Products upon delivery or purchase and follow the U.S. Department of Agriculture's ("USDA") instructions on refrigeration and food safety, which can be found here. We recommend that you follow the USDA's instructions on safe food handling, which can be found here. We also recommend that you use a food thermometer to ensure that all meat, poultry, seafood and other applicable items are cooked to the USDA's recommended internal temperatures, which can be found here. Failure to follow safe food handling practices and temperature recommendations may increase the risk of foodborne illness. In addition, pregnant women, young children, the elderly and individuals with compromised immune systems should follow the U.S. Food and Drug Administration's recommendations on food consumption for at-risk groups, which can be found here.

If you are not at home when your meal delivery arrives, the courier will generally leave the package for you at your door, unless other delivery instructions have been communicated to you. Our meal ingredients may be packaged with insulated liners and gel packs and will typically remain cold and fresh for several hours, but depending on the season and temperature in your geographic area at the time of delivery, advance planning by you should be made for immediate and proper storage of your meal ingredients prior to consumption. In certain areas, you may be able to provide additional delivery instructions when setting up your Blue Apron account, such as requesting that your delivery be left with a doorman or neighbor. Any individual at the delivery address who accepts a delivery from us is presumed to be authorized to receive such delivery. In cases in which you have designated an alternative receiver, such person shall accept the delivery under all of the same terms and conditions that would apply had you accepted the delivery yourself.

Notwithstanding anything provided above, packaging of and delivery instructions related to any Third Party Purchase may vary depending on the applicable Third Party Channel; accordingly, for the purposes of this Section 4.10, any deliveries of Third Party Purchases may be subject to additional applicable Third Party Terms.

An adult who is 21 years of age or older must be present and have a valid form of identification to sign and accept for delivery of wine Products.

In the case of inclement weather or other events beyond our control that interfere with our ability to deliver your Order, we will attempt to deliver your Order as soon as reasonably possible. In some cases, delivery may occur prior to the scheduled delivery date. If timely delivery of your meal ingredients is not feasible, we may cancel your meal delivery for the period so affected and issue you a Credit (as defined below) or refund of the purchase price for that meal delivery.

4.11. No Resale

You are not permitted to resell or otherwise use the Products for commercial purposes.

4.12. Returns, Replacements, Refunds, and Credits

If you are dissatisfied with a meal or meal ingredient ordered on our Sites for any reason, please contact us at contact@blueapron.com within seven (7) days of the date you received the meal. Depending on the circumstances, we may, in our sole discretion, replace the meal or meal ingredient at our expense, provide you a

full or partial refund of the purchase price for that meal or meal ingredient, or provide you with Credits for that meal or meal ingredient that will automatically be applied to future deliveries under your Meal Subscription or Meal Purchases, as applicable. Notwithstanding the foregoing, Credits for certain types of Meal Purchases may require additional action on your part (*e.g.*, application of a coupon code) in order to be applied to future purchases, which shall be communicated to you at the time of issuance.

If any wine Product you receive arrives damaged, please contact us at contact@blueapronwine.com within seven (7) days of the date you received the wine Product. Depending on the circumstances, we may, in our sole discretion, replace the wine Product at our expense, provide you with a full or partial refund of the purchase price of the damaged wine Product, or provide you with Credits for the damaged wine Product that will automatically be applied to future deliveries under your Wine Subscription.

We may require the return or photographic documentation of any Product that you are dissatisfied with before we provide you a refund, replacement, or Credit.

If you are dissatisfied with any non-consumable Product you purchased from Blue Apron Market, LLC, you may return such Product within thirty (30) days of the date you received such Product by contacting market@blueapron.com and following the shipping instructions we provide; provided, that all such returned Products must be unused and in their original packaging. After we receive such returned Product, we will issue you a refund for the price you paid for such Product (less any applicable shipping and handling charges). Blue Apron Market, LLC does not take title to returned Product purchased through the Blue Apron Market until such Product arrives back at Blue Apron Market's or its third party designee's fulfillment center, as applicable.

In certain circumstances, such as if we want to thank you for your patience with a delayed delivery or to address another customer service issue, we may provide you customer experience credits of promotional value that will be automatically applied to your next eligible Order under your Meal Subscription, Wine Subscription, or with respect to a Meal Purchase, as applicable ("Credits"). Credits may only be redeemed for the type of Product for which they were issued (*i.e.*, Credits for a meal or meal ingredient may only be applied to future deliveries under your Meal Subscription or a Meal Purchase, as applicable, and Credits for a wine Product may only be applied to future deliveries under your Wine Subscription). In addition to the foregoing, Credits for certain types of Meal Purchases may only be applied to future deliveries of the specific type of Meal Purchase for which they were issued. Credits are promotional in nature, are not transferable, and are not redeemable for cash or other property.

Credits only remain available if you maintain a valid Blue Apron account and, with respect to Credits for a Wine Product, an active Wine Subscription. That means that if you cancel your Blue Apron account or, with respect to Credits for a wine Product, your Wine Subscription, any outstanding Credits associated with your cancelled Blue Apron account or Wine Subscription, as applicable, will immediately expire. You may only redeem Credits after they are applied to your Blue Apron account. If for some reason you believe that there is a discrepancy regarding your Credit balance, please contact us at contact@blueapron.com for Meal Subscription or Meal Purchase-related Credit inquiries or contact@blueapronwine.com for Wine Subscription-related Credit inquiries. All decisions regarding your Credit balance will be determined in our sole discretion and are final.

Notwithstanding anything provided above, for the purposes of this Section 4.12, returns of and refunds for any Third Party Purchases will be subject to the applicable Third Party Terms. If you are dissatisfied with any Third Party Purchases, please contact the applicable Third Party Channel for their return and refund policies.

5.   License to Access and Use Our Sites and Content

Unless otherwise indicated in writing by us, the Sites and all content and other materials contained therein, including, without limitation, the Blue Apron logo and all designs, text, graphics, pictures, information, data, software, sound files, User Content (as defined in Section 11), other files and the selection and arrangement thereof (collectively, "Content") are the proprietary property of Blue Apron or our licensors or users, as

applicable, and are protected by U.S. and international copyright laws.

You are hereby granted a limited, nonexclusive, nontransferable, nonsublicensable license to access and use the Sites and Content. However, such license is subject to these Terms and does not include any right to (a) sell, resell or use commercially the Sites or Content, (b) distribute, publicly perform or publicly display any Content, (c) modify or otherwise make any derivative uses of the Sites or Content, or any portion thereof, (d) use any data mining, robots or similar data gathering or extraction methods, (e) download (other than the page caching) any portion of the Sites or Content, except as expressly permitted by us, and (f) use the Sites or Content other than for their intended purposes. Any use of the Sites or Content other than as specifically authorized herein, without our prior written permission, is strictly prohibited and will terminate the license granted herein. Such unauthorized use may also violate applicable laws, including, without limitation, copyright and trademark laws and applicable communications regulations and statutes. Unless explicitly stated by us, nothing in these Terms shall be construed as conferring any right or license to any patent, trademark, copyright or other proprietary rights of Blue Apron or any third party, whether by estoppel, implication or otherwise. This license is revocable at any time.

Notwithstanding anything to the contrary in these Terms, the Sites and Content may include software components provided by Blue Apron or a third party that are subject to separate license terms, in which case those license terms will govern such software components.

6. Repeat Infringer Policy; Copyright Complaints

In accordance with the Digital Millennium Copyright Act and other applicable laws, we have adopted a policy of limiting access to the Sites by, or terminating the accounts of, users, in appropriate circumstances and in our sole discretion, who infringe the intellectual property rights of others. If you believe that anything on the Sites infringes any copyright that you own or control, you may file a notification of such infringement with our designated agent as set forth below:

> Name of Designated Agent: General Counsel
> Address: Blue Apron, LLC, 28 Liberty Street, 28th Floor, New York, NY 10005
> Phone: 888-278-4349
> Fax: (585) 735-4819
> Email: copyright@blueapron.com

Please see 17 U.S.C. § 512(c)(3) for the requirements of a proper notification. You should also note that if you knowingly make any material misrepresentation in your notification that the material or activity is infringing, you will be liable for any damages, including, without limitation, costs and attorneys' fees, incurred by us or the alleged infringer as the result of our relying upon such misrepresentation in removing or disabling access to the material or activity claimed to be infringing.

7. Trademarks

"Blue Apron," the Blue Apron logo and any other Blue Apron Product or service names, logos or slogans that may appear on the Sites or Products are trademarks of Blue Apron and may not be copied, imitated or used, in whole or in part, without our prior written permission. You may not use any metatags or other "hidden text" utilizing "Blue Apron" or any other name, trademark or Product or service name of Blue Apron without our prior written permission. In addition, the look and feel of the Sites and Products, including, without limitation, all page headers, custom graphics, button icons and scripts, constitute the service mark, trademark or trade dress of Blue Apron and may not be copied, imitated or used, in whole or in part, without our prior written permission. All other trademarks, registered trademarks, Product names and company names or logos mentioned on the Sites or Products are the property of their respective owners and may not be copied, imitated or used, in whole or in part, without the permission of the applicable trademark holder. Reference to any Products, services, processes or other information by name, trademark, manufacturer, supplier or otherwise does not constitute or imply endorsement, sponsorship or recommendation by Blue Apron.

8. Hyperlinks

You are granted a limited, nonexclusive, nontransferable right to create a text hyperlink to the Sites for noncommercial purposes, provided that such link does not portray Blue Apron or any of our Products in a false, misleading, derogatory or otherwise defamatory manner, and provided further that the linking site does not contain any adult or illegal material or any material that is offensive, harassing or otherwise objectionable. This limited right may be revoked at any time. You may not use a Blue Apron logo or other proprietary graphic of Blue Apron to link to the Sites without our express written permission. Further, you may not use, frame or utilize framing techniques to enclose any Blue Apron trademark, logo or other proprietary information, including the images found on the Sites or Products, the content of any text or the layout or design of any page, or form contained on a page, on the Sites without our express written consent.

Blue Apron makes no claim or representation regarding the quality, content, nature or reliability of third party websites accessible by hyperlink from the Sites or of websites linking to the Sites. Such sites are not under our control and we provide these links to you only as a convenience. The inclusion of any link does not imply our affiliation, endorsement or adoption of any site or any information contained therein. Except as otherwise provided herein, when you leave the Sites, you should be aware that our terms and policies no longer govern. You should review the applicable terms and policies, including privacy and data gathering practices, of any site to which you navigate from the Sites.

9. Third Party Content

We may display content, advertisements and promotions from third parties through the Sites or in shipments with Products (collectively, "Third Party Content"). We do not control, endorse or adopt any Third Party Content, and we make no representations or warranties of any kind regarding such Third Party Content, including, without limitation, regarding its accuracy or completeness. You acknowledge and agree that your interactions with third parties providing Third Party Content are solely between you and such third parties.

10. User Conduct

You agree that you will not violate any law, contract, intellectual property or other third party right or commit a tort, and that you are solely responsible for your conduct, while accessing or using the Sites. You agree that you will abide by these Terms and will not:

- Engage in any harassing, threatening, intimidating, predatory or stalking conduct;
- Use or attempt to use another user's account without authorization from such user and Blue Apron;
- Use the Sites in any manner that could interfere with, disrupt, negatively affect or inhibit other users from fully enjoying the Sites or that could damage, disable, overburden or impair the functioning of the Sites in any manner;
- Reverse engineer any aspect of the Sites or do anything that might discover source code or bypass or circumvent measures employed to prevent or limit access to any Content, area or code of the Sites;
- Attempt to circumvent any content-filtering techniques we employ or attempt to access any feature or area of the Sites that you are not authorized to access;
- Develop any third party applications that interact with User Content or the Sites without our prior written consent;
- Use any robot, spider, crawler, scraper, script, browser extension, offline reader or other automated means or interface not authorized by us to access the Sites, extract data or otherwise interfere with or modify the rendering of Site pages or functionality; or
- Use the Sites for any illegal or unauthorized purpose, or engage in, encourage or promote any activity that violates these Terms.

11. User Content

The Sites may include interactive features and areas that allow users to create, post, share or store content, including, but not limited to, recipes, reviews, photos, videos, music, sound, text, graphics, code, items or other materials (collectively, "User Content"). If you decide to share your User Content with others through the Sites or third party platforms, you understand that this User Content will be viewable by others in accordance with the privacy settings you establish. You agree that you are solely responsible for your User Content and for your use of any interactive features and areas of the Sites.

By using the interactive features and areas of the Sites, you further agree not to create, post, share or store any of the following:

- User Content that is unlawful, libelous, defamatory, obscene, pornographic, indecent, lewd, suggestive, harassing, threatening, invasive of privacy or publicity rights, abusive, inflammatory, fraudulent or otherwise objectionable;
- User Content that would constitute, encourage or provide instructions for a criminal offense, violate the rights of any party or otherwise create liability or violate any local, state, national or international law;
- User Content that may infringe any patent, trademark, trade secret, copyright or other intellectual or proprietary right of any party;
- User Content that contains or depicts any statements, remarks or claims that do not reflect your honest views and experiences;
- User Content that impersonates, or misrepresents your affiliation with, any person or entity;
- User Content that references or depicts Blue Apron or our Products but fails to disclose a material connection to us, if you have one (for example, if you are a Blue Apron employee or paid blogger);
- User Content that contains any unsolicited promotions, political campaigning, advertising or solicitations;
- User Content that contains any private or personal information of a third party without such third party's consent;
- User Content that references alcohol irresponsibly, such as references to overconsumption or use by minors;
- User Content that contains any viruses, corrupted data or other harmful, disruptive or destructive files or content; or
- User Content that, in our sole judgment, is objectionable or that restricts or inhibits any other person from using or enjoying the Sites or Products, or that may expose Blue Apron or others to any harm or liability of any type.

Although we have no obligation to screen, edit or monitor User Content, we reserve the right, and have absolute discretion, to remove, screen or edit User Content posted or stored on the Sites at any time and for any reason, and you are solely responsible for creating backup copies of and replacing any User Content you post or store on the Sites at your sole cost and expense.

12.   Rights in User Content

If you submit content you own, you retain your ownership of your intellectual property rights. We do not claim any ownership interest in your User Content. However, by uploading, posting or submitting User Content to the Sites or to our pages or feeds on third party social media platforms (e.g., Blue Apron's Facebook page, Instagram page or Twitter feed), you hereby grant Blue Apron a nonexclusive, royalty-free, worldwide, perpetual, irrevocable and fully sublicensable right and license to use, reproduce, modify, adapt, publish, translate, create derivative works from, distribute, perform and publicly display your User Content, in whole or in part, and your name, likeness, voice and persona in any manner or media and for any purpose whatsoever at our sole discretion, including, without limitation, for publicity, promotional, advertising, trade, business, illustration, artistic and other commercial and noncommercial purposes.

By uploading, posting or submitting User Content to Blue Apron through the Sites or through our pages or feeds

on third party social media platforms, you represent and warrant that (a) such User Content is nonconfidential, (b) you own and control all of the rights to the User Content or you otherwise have all necessary rights to post such User Content, (c) you authorize Blue Apron to use such User Content for the purposes described in these Terms, (d) the User Content is accurate and not misleading or harmful in any manner, and (e) the User Content, and your use and posting thereof, does not and will not violate these Terms or any applicable law, rule, regulation or third party right.

13.   Feedback

Separate and apart from User Content, you can submit questions, comments, suggestions, ideas, original or creative materials or other information about Blue Apron, the Sites or the Products (collectively, "Feedback"). Feedback is nonconfidential and shall become the sole property of Blue Apron. Blue Apron shall own exclusive rights, including, without limitation, all intellectual property rights, in and to such Feedback and shall be entitled to the unrestricted use and dissemination of this Feedback for any purpose, commercial or otherwise, without acknowledgment or compensation to you.

14.   Indemnification

To the fullest extent permitted by applicable law, you agree to indemnify, defend and hold harmless Blue Apron, and our respective past, present and future employees, officers, directors, contractors, consultants, equityholders, suppliers, vendors, service providers, parent companies, subsidiaries, affiliates, agents, representatives, predecessors, successors and assigns (individually and collectively, the "Blue Apron Parties"), from and against all actual or alleged Blue Apron Party or third party claims, damages, awards, judgments, losses, liabilities, obligations, penalties, interest, fees, expenses and costs of every kind and nature whatsoever, whether known or unknown, foreseen or unforeseen, matured or unmatured, or suspected or unsuspected, in law or equity, whether in tort, contract or otherwise (collectively, "Claims"), including, but not limited to, damages to property or personal injury, that are caused by, arise out of or are related to (a) any use or misuse of the Sites, Content or Products by you or any third party you authorize to access or use such Sites, Content or Products, (b) any User Content you create, post, share or store on or through the Sites or our pages or feeds on third party social media platforms, (c) any Feedback you provide, (d) your violation of these Terms, and (e) your violation of the rights of another. You agree to promptly notify Blue Apron of any third party Claims, cooperate with the Blue Apron Parties in defending such Claims and pay all fees, costs and expenses associated with defending such Claims (including, but not limited to, attorneys' fees and expenses, court costs, costs of settlement and costs of pursuing indemnification and insurance). You further agree that the Blue Apron Parties shall have control of the defense or settlement of any third party Claims. This indemnity is in addition to, and not in lieu of, any other indemnities set forth in a written agreement between you and Blue Apron.

15.   Disclaimers

YOU ARE SOLELY RESPONSIBLE FOR, AND ASSUME ALL RISKS RELATED TO, THE PROPER AND SAFE WASHING, HANDLING, PREPARATION, STORAGE, COOKING, USE AND CONSUMPTION OF THE PRODUCTS. YOU ARE ALSO SOLELY RESPONSIBLE FOR KNOWING ABOUT ANY FOOD ALLERGIES YOU MAY HAVE AND VERIFYING THE PRODUCTS AND THEIR CONTENTS BEFORE HANDLING, PREPARING, USING OR CONSUMING SUCH PRODUCTS. FURTHER, YOU UNDERSTAND, ACKNOWLEDGE AND AGREE THAT WE STORE, PORTION AND PACKAGE PRODUCTS CONTAINING ALL EIGHT (8) MAJOR U.S. ALLERGENS (MILK, WHEAT, EGG, SOY, FISH, SHELLFISH, PEANUTS AND TREENUTS) AND CANNOT GUARANTEE THAT CROSS-CONTAMINATION WILL NOT OCCUR BETWEEN PRODUCTS.

WE ATTEMPT TO DISPLAY THE PRODUCTS AND OTHER MATERIALS AND INFORMATION YOU VIEW ON THE SITES, INCLUDING PRICING AND NUTRITIONAL INFORMATION, AS ACCURATELY AS POSSIBLE. HOWEVER, WE DO NOT GUARANTEE THE ACCURACY OF SUCH MATERIALS AND INFORMATION. IN THE EVENT OF AN ERROR ON OUR SITES, IN AN ORDER CONFIRMATION, IN PROCESSING OR DELIVERING AN ORDER OR OTHERWISE, WE RESERVE THE RIGHT TO

CORRECT SUCH ERROR AND REVISE YOUR ORDER ACCORDINGLY (INCLUDING CHARGING THE CORRECT PRICE) OR TO CANCEL YOUR ORDER AND ISSUE YOU A REFUND. YOU FURTHER AGREE THAT THE PRODUCTS AND OTHER MATERIALS YOU RECEIVE IN YOUR ORDER MAY VARY FROM THE PRODUCTS AND MATERIALS DISPLAYED ON THE SITES DUE TO A NUMBER OF FACTORS, INCLUDING, WITHOUT LIMITATION, SYSTEM CAPABILITIES AND CONSTRAINTS OF YOUR COMPUTER, MANUFACTURING PROCESS OR SUPPLY ISSUES, THE AVAILABILITY AND VARIABILITY OF PRODUCTS, DISTINCT COOKING OR OTHER PREPARATION METHODS AND VARIABILITY OF COOKING EQUIPMENT AND APPLIANCES. THE SITES MAY CONTAIN INFORMATION ABOUT PRODUCTS THAT ARE NOT AVAILABLE IN EVERY LOCATION. A REFERENCE TO A PRODUCT ON THE SITES DOES NOT IMPLY OR GUARANTEE THAT IT IS OR WILL BE AVAILABLE IN YOUR LOCATION OR AT THE TIME OF YOUR ORDER. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, WE MAKE NO REPRESENTATIONS OR WARRANTIES OF ANY KIND REGARDING ANY CONTENT RELATED TO OUR PRODUCTS PROVIDED BY OR DISPLAYED THROUGH A THIRD PARTY CHANNEL, INCLUDING, WITHOUT LIMITATION, REGARDING ITS ACCURACY OR COMPLETENESS.

EXCEPT AS MAY BE PROVIDED IN A WARRANTY BY THE MANUFACTURER OF A PRODUCT, ALL PRODUCTS AND THE SITES AND CONTENT ARE PROVIDED ON AN "AS IS" BASIS WITHOUT WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED. BLUE APRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT AS TO THE SITES, CONTENT AND PRODUCTS, ANY WARRANTIES THAT ARISE FROM TRADE USAGE OR CUSTOM, AND ANY WARRANTIES THAT THE SITES OR PRODUCTS WILL BE FREE AND CLEAR FROM ANY ADVERSE LIEN OR SECURITY INTERESTS.

We reserve the right to change any and all Content and to modify, suspend or stop providing access to the Sites (or any features or functionality of the Sites) and the Products at any time without notice and without obligation or liability to you. Reference to any products, services, processes or other information by trade name, trademark, manufacturer, supplier, vendor or otherwise does not constitute or imply endorsement, sponsorship or recommendation thereof, or any affiliation therewith, by us.

16.   Limitation of Liability; Release

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL THE BLUE APRON PARTIES BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OF ANY KIND (INCLUDING, BUT NOT LIMITED TO, LOSS OF REVENUE, INCOME OR PROFITS, LOSS OF USE OR DATA, LOSS OR DIMINUTION IN VALUE OF ASSETS OR SECURITIES, OR DAMAGES FOR BUSINESS INTERRUPTION) ARISING OUT OF OR IN ANY WAY RELATED TO THE ACCESS TO OR USE OF THE SITES OR CONTENT (INCLUDING, BUT NOT LIMITED TO, USER CONTENT, THIRD PARTY CONTENT AND LINKS TO THIRD PARTY SITES), OR THE ORDER, RECEIPT OR USE OF ANY PRODUCT, OR OTHERWISE RELATED TO THESE TERMS (INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES CAUSED BY OR RESULTING FROM RELIANCE ON ANY INFORMATION OBTAINED FROM ANY BLUE APRON PARTY, OR FROM EVENTS BEYOND THE BLUE APRON PARTIES' REASONABLE CONTROL, SUCH AS SITE INTERRUPTIONS, DELETIONS OF FILES OR EMAILS, ERRORS OR OMISSIONS, DEFECTS, BUGS, VIRUSES, TROJAN HORSES, DELAYS IN OPERATION OR TRANSMISSION OR ANY FAILURE OF PERFORMANCE, WHETHER OR NOT RESULTING FROM ACTS OF GOD, COMMUNICATIONS FAILURE, THEFT, DESTRUCTION OR UNAUTHORIZED ACCESS TO THE BLUE APRON PARTIES' RECORDS, PROGRAMS OR SYSTEMS), REGARDLESS OF THE FORM OF ACTION, WHETHER BASED IN CONTRACT, TORT (INCLUDING, BUT NOT LIMITED TO, SIMPLE NEGLIGENCE, WHETHER ACTIVE, PASSIVE OR IMPUTED) OR ANY OTHER LEGAL OR EQUITABLE THEORY (EVEN IF THE PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND REGARDLESS OF WHETHER SUCH DAMAGES WERE FORESEEABLE).

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL THE MAXIMUM AGGREGATE LIABILITY OF THE BLUE APRON PARTIES (JOINTLY) ARISING OUT OF OR IN ANY WAY RELATED TO (A) THE ORDER, RECEIPT OR USE OF PRODUCTS PURCHASED FROM BLUE APRON MARKET, LLC EXCEED THE AMOUNT PAID FOR SUCH PRODUCTS; AND (B) THE ORDER, RECEIPT OR USE OF MEAL INGREDIENTS, OR ACCESS OR USE OF THE SITES OR CONTENT, EXCEED THE GREATER OF $250 OR THE AMOUNT YOU PAID TO US IN THE ONE (1) MONTH PERIOD IMMEDIATELY PRECEDING THE DATE ON WHICH YOUR CLAIM AROSE. THE FOREGOING LIMITATIONS SHALL APPLY EVEN IN THE EVENT YOUR REMEDIES HEREUNDER FAIL OF THEIR ESSENTIAL PURPOSE, AND THE FOREGOING SHALL CONSTITUTE THE BLUE APRON PARTIES' SOLE LIABILITY AND OBLIGATION IN RESPECT HEREOF, REGARDLESS OF THE FORM OF ACTION, WHETHER BASED IN CONTRACT, TORT (INCLUDING, BUT NOT LIMITED TO, SIMPLE NEGLIGENCE, WHETHER ACTIVE, PASSIVE OR IMPUTED), OR ANY OTHER LEGAL OR EQUITABLE THEORY.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, YOU, ON BEHALF OF YOUR HEIRS, EXECUTORS, ADMINISTRATORS, LEGAL AND PERSONAL REPRESENTATIVES, HEREBY RELEASE, WAIVE, ACQUIT AND FOREVER DISCHARGE THE BLUE APRON PARTIES FROM AND AGAINST, AND COVENANT NOT TO SUE ANY SUCH BLUE APRON PARTY FOR, ALL CLAIMS YOU HAVE OR MAY HAVE ARISING OUT OF OR IN ANY WAY RELATED TO THESE TERMS. IF YOU ARE A CALIFORNIA RESIDENT, YOU HEREBY WAIVE YOUR RIGHTS UNDER CALIFORNIA CIVIL CODE 1542, WHICH STATES "A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS WHICH THE CREDITOR DOES NOT KNOW OR SUSPECT TO EXIST IN HIS OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE, WHICH IF KNOWN BY HIM OR HER MUST HAVE MATERIALLY AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR."

THE LIMITATIONS SET FORTH IN THIS SECTION 16 WILL NOT LIMIT OR EXCLUDE LIABILITY FOR PERSONAL INJURY OR PROPERTY DAMAGE DIRECTLY AND PROXIMATELY CAUSED BY PRODUCTS YOU PURCHASE FROM US, OR FOR OUR FRAUD, GROSS NEGLIGENCE, OR INTENTIONAL, WILLFUL, MALICIOUS OR RECKLESS MISCONDUCT.

17. Modifications to the Sites and Products

We reserve the right in our sole discretion to modify, suspend or discontinue, temporarily or permanently, the Sites (or any features or parts thereof) or the provision of the Products at any time.

18. Dispute Resolution; Arbitration

PLEASE READ THE FOLLOWING SECTION CAREFULLY BECAUSE IT REQUIRES YOU TO ARBITRATE CERTAIN DISPUTES AND CLAIMS WITH BLUE APRON AND LIMITS THE MANNER IN WHICH YOU CAN SEEK RELIEF FROM US.

18.1. Binding Arbitration

Except for any disputes, claims, suits, actions, causes of action, demands or proceedings (collectively, "Disputes") arising out of or related to a violation of Section 10 or Disputes in which either party seeks to bring an individual action in small claims court or seeks injunctive or other equitable relief for the alleged unlawful use of intellectual property, including, without limitation, copyrights, trademarks, trade names, logos, trade secrets or patents, you and Blue Apron agree (a) to waive your and Blue Apron's respective rights to have any and all Disputes arising from or related to these Terms, or the Sites, Content or Products (including, without limitation, Third Party Purchases), resolved in a court, and (b) to waive your and Blue Apron's respective rights to a jury trial. Instead, you and Blue Apron agree to arbitrate Disputes through binding arbitration (which is the referral of a Dispute to one or more persons charged with reviewing the Dispute and making a final and binding determination to resolve it instead of having the Dispute decided by a judge or jury in court).

18.2. No Class Arbitrations, Class Actions or Representative Actions

You and Blue Apron agree that any Dispute arising out of or related to these Terms or the Sites, Content or Products is personal to you and Blue Apron and that such Dispute will be resolved solely through individual arbitration and will not be brought as a class arbitration, class action or any other type of representative proceeding. You and Blue Apron agree that there will be no class arbitration or arbitration in which an individual attempts to resolve a Dispute as a representative of another individual or group of individuals. Further, you and Blue Apron agree that a Dispute cannot be brought as a class or other type of representative action, whether within or outside of arbitration, or on behalf of any other individual or group of individuals.

18.3. Federal Arbitration Act

You and Blue Apron agree that these Terms affect interstate commerce and that the enforceability of this Section 18 shall be both substantively and procedurally governed by and construed and enforced in accordance with the Federal Arbitration Act, 9 U.S.C. § 1 et seq. (the "FAA"), to the maximum extent permitted by applicable law.

18.4. Notice; Informal Dispute Resolution

You and Blue Apron agree that each party will notify the other party in writing of any arbitrable or small claims Dispute within thirty (30) days of the date it arises, so that the parties can attempt in good faith to resolve the Dispute informally. Notice to Blue Apron shall be sent by certified mail or courier to Blue Apron, LLC, Attn: General Counsel, 28 Liberty Street, 28th Floor, New York, NY 10005. Your notice must include (a) your name, postal address, telephone number, the email address you use or used for your Blue Apron account and, if different, an email address at which you can be contacted, (b) a description in reasonable detail of the nature or basis of the Dispute, and (c) the specific relief that you are seeking. Our notice to you will be sent electronically in accordance with Section 3 and will include (x) our name, postal address, telephone number and an email address at which we can be contacted with respect to the Dispute, (y) a description in reasonable detail of the nature or basis of the Dispute, and (z) the specific relief that we are seeking. If you and Blue Apron cannot agree how to resolve the Dispute within thirty (30) days after the date notice is received by the applicable party, then either you or Blue Apron may, as appropriate and in accordance with this Section 18, commence an arbitration proceeding or, to the extent specifically provided for in Section 18.1, file a claim in court.

18.5. Process

EXCEPT FOR DISPUTES ARISING OUT OF OR RELATED TO A VIOLATION OF SECTION 10 OR DISPUTES IN WHICH EITHER PARTY SEEKS TO BRING AN INDIVIDUAL ACTION IN SMALL CLAIMS COURT OR SEEKS INJUNCTIVE OR OTHER EQUITABLE RELIEF FOR THE ALLEGED UNLAWFUL USE OF INTELLECTUAL PROPERTY, INCLUDING, WITHOUT LIMITATION, COPYRIGHTS, TRADEMARKS, TRADE NAMES, LOGOS, TRADE SECRETS OR PATENTS, YOU AND BLUE APRON AGREE THAT ANY DISPUTE MUST BE COMMENCED OR FILED BY YOU OR BLUE APRON WITHIN ONE (1) YEAR OF THE DATE THE DISPUTE AROSE, OTHERWISE THE UNDERLYING CLAIM IS PERMANENTLY BARRED (WHICH MEANS THAT YOU AND BLUE APRON WILL NO LONGER HAVE THE RIGHT TO ASSERT SUCH CLAIM REGARDING THE DISPUTE). You and Blue Apron agree that (a) any arbitration will occur in the State of New York, County of New York, Borough of Manhattan, (b) arbitration will be conducted confidentially by a single arbitrator in accordance with the rules of the Judicial Arbitration and Mediation Services ("JAMS"), which are hereby incorporated by reference, and (c) that the state or federal courts of the State of New York and the United States, respectively, sitting in the State of New York, County of New York, Borough of Manhattan, have exclusive jurisdiction over any appeals and the enforcement of an arbitration award. You may also litigate a Dispute in the small claims court located in the county of your billing address if the Dispute meets the requirements to be heard in small claims court.

18.6. Authority of Arbitrator

As limited by the FAA, these Terms and the applicable JAMS rules, the arbitrator will have (a) the exclusive authority and jurisdiction to make all procedural and substantive decisions regarding a Dispute, including the determination of whether a Dispute is arbitrable, and (b) the authority to grant any remedy that would otherwise be available in court; provided, however, that the arbitrator does not have the authority to conduct a class arbitration or a representative action, which is prohibited by these Terms. The arbitrator may only conduct an individual arbitration and may not consolidate more than one individual's claims, preside over any type of class or representative proceeding or preside over any proceeding involving more than one individual.

18.7. Rules of JAMS

The rules of JAMS and additional information about JAMS are available on the [JAMS website](#). By agreeing to be bound by these Terms, you either (a) acknowledge and agree that you have read and understand the rules of JAMS, or (b) waive your opportunity to read the rules of JAMS and any claim that the rules of JAMS are unfair or should not apply for any reason.

18.8. Severability

If any term, clause or provision of this Section 18 is held invalid or unenforceable, it will be so held to the minimum extent required by law, and all other terms, clauses and provisions of this Section 18 will remain valid and enforceable. Further, the waivers set forth in Section 18.2 are severable from the other provisions of these Terms and will remain valid and enforceable, except as prohibited by applicable law.

18.9. Opt-Out Right

You have the right to opt out of binding arbitration within thirty (30) days of the date you first accepted the terms of this Section 18 by writing to: Blue Apron, LLC, Attn: General Counsel, 28 Liberty Street, 28th Floor, New York, NY 10005. In order to be effective, the opt out notice must include your full name and clearly indicate your intent to opt out of binding arbitration. By opting out of binding arbitration, you are agreeing to resolve Disputes in accordance with Section 19.

19.   Governing Law and Venue

These Terms, your access to and use of the Sites and your order, receipt and use of the Products shall be governed by and construed and enforced in accordance with the laws of the State of New York, without regard to conflict of law rules or principles (whether of the State of New York or any other jurisdiction) that would cause the application of the laws of any other jurisdiction. Any Dispute between the parties that is not subject to arbitration or cannot be heard in small claims court, shall be resolved in the state or federal courts of the State of New York and the United States, respectively, sitting in the State of New York, County of New York, Borough of Manhattan.

20.   Termination

Notwithstanding anything contained in these Terms, we reserve the right, without notice and in our sole discretion, to terminate your right to access or use the Sites and to order, receive and use the Products, at any time and for any or no reason, and you acknowledge and agree that we shall have no liability or obligation to you in such event and that you will not be entitled to a refund of any amounts that you have already paid to us, to the fullest extent permitted by applicable law.

21.   Severability

If any term, clause or provision of these Terms is held invalid or unenforceable, then that term, clause or

provision will be severable from these Terms and will not affect the validity or enforceability of any remaining part of that term, clause or provision, or any other term, clause or provision of these Terms.

22.   Survival

The following sections will survive the expiration or termination of these Terms and the termination of your Blue Apron account: all defined terms and Sections 1, 3, 4, 5 (first paragraph only), 6, 7, 8 (second paragraph only), 9 through 23.

23.   Miscellaneous

These Terms constitute the entire agreement between you and Blue Apron relating to your access to and use of the Sites and your order, receipt and use of Products. These Terms, and any rights and licenses granted hereunder, may not be transferred or assigned by you without the prior written consent of Blue Apron. No waiver of any provision of these Terms will constitute a waiver of such provision in any prior, concurrent or subsequent circumstance, and Blue Apron's failure to assert any right or provision under these Terms shall not constitute a waiver of such right or provision. Except as otherwise provided herein, these Terms are intended solely for the benefit of the parties and are not intended to confer third party beneficiary rights upon any other person or entity.

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Customer Support:

- [Help Center & FAQ](#)
- contact@blueapron.com
- [(646) 891-4349](tel:6468914349)

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