

Unpacking the Paradox of Profit Margins: An Analysis of Market Concentration and Economic Dynamics in the U.S. Meat Processing Industry

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ABSTRACT

This paper scrutinizes the meat processing industry, with an empirical focus on the United States from 2000 to 2022. Utilizing Tyson Foods as a representative case, the research examines the paradox of persistently low gross profit margins in a sector known for high market concentration, which is a scenario at odds with conventional economic predictions of increased profitability amidst reduced competition. The analysis is rooted in a detailed exploration of supply chain intricacies and demand-side dynamics, revealing the industry's vulnerability to livestock market volatility and the powerful influence of consolidated retailers on meat product pricing. Key findings suggest that despite market dominance, meat processors face constrained margins due to their limited control over variable input costs and aggressive price negotiations by a few large grocery retailers. The study's insights extend beyond meat processing, offering a lens to understand similar phenomena in other highly concentrated industries and providing solutions to reduce meat prices faced by nowadays consumers.

HISTORY

This section will offer a meticulous exploration of the meat processing industry, covering aspects such as market size, technological progress, defining milestones, and shifts in market concentration, as well as price fluctuations, profit trajectories, and principal entities involved. Subsequently, it will identify and articulate a particular conundrum within the industry. The

research is precisely tailored to chart the development of the U.S. meat processing sector over the period from 2000 to 2020, delivering a detailed panorama over the course of twenty years.

Meat Processing Industry Overview

Market Scope

The meat processing industry, also known as meat packing industry, is an industry that transforms livestock into various consumer meat products through slaughtering, butchering, and value-added processes like curing and smoking (MarketLine (2023)). It prioritizes food safety, regulatory compliance, efficient packaging, distribution, and marketing to meet global food supply demands while adhering to animal welfare and environmental standards. Meatpacking operates as a high-volume, low-margin business (Ward (2004)). Gross margins are similar when meatpackers pay similar prices for cattle, labor, and inputs, and receive comparable prices for meat and by-products. Profitability hinges on controlling operating costs.

Technology

Traditional technologies in the meat processing industry have predominantly centered on extending the shelf-life of meat products through techniques such as chilling, freezing, curing, smoking, drying, heat treatments, and specialized packaging (Suresh and Kudre (2019)). However, with technological advancements, the industry has witnessed the emergence of innovative processes such as High-Pressure Processing (HPP), hydrodynamic pressure, pulsed electric field, ohmic heating, cold plasma technology, ultrasound processing, electrical stimulation technology, and PiVac, among others (Suresh and Kudre (2019)). Moreover, in the era of digitization and rising labor costs, there is a marked shift towards automation in meat processing facilities. This shift necessitates the incorporation of advanced technologies such as the Internet of Things (IoT), Cybersecurity measures, Blockchain applications, Data Analytics &

Modeling, and Machine Learning techniques, notably Computer Vision, to streamline and enhance production processes (Echegaray et al. (2022)).

Development of Meat Processing Industry

Before 21st Century

The roots of the American meat industry trace back to the meat packing businesses established during colonial times (Clemen (1923)). Initially, farmer-packers preserved, cured, and smoked meat primarily for local consumption, especially during winter months. A significant shift occurred between 1870 and 1875 with the advent of refrigeration. This technological advancement not only enabled year-round production but also maximized the livestock supply from the Midwest and Texas. Coupled with the extension of railroad transportation and the emergence of new livestock sources, refrigeration diminished the dominance of localized meat factories. Nevertheless, a reconsolidation wave hit the meat industry in the 1980s. The number of cattle and hog processing plants saw a significant decline, a trend that persisted until 2000s (Green (2020)). As entering the 21st century, the meat processing sector emerged as a highly concentrated industry where dominant players wielded significant market influence.

From 2000 to 2020

Before the 2000s, the Four-Firm Concentration Ratio (CR4) was trending downward (Barkema et al. (2001)). However, throughout the subsequent two decades from 2000 to 2020, while the CR4 consistently exceeded 50%, suggesting a highly concentrated market, it did not follow a clear increasing or decreasing trend.

Recent data spanning from 2002 to 2019 indicate that the CR4 varied within a range of 65 to 70%. The application of the Mann-Kendall test in this study, which produced a test statistic

of 0.0871 and a p-value of 0.648, supports the conclusion that there is no discernible monotonic increase in the CR4 during this period.

	Total Value Purchases (%)	Steers & Heifers (%)	Cows & Bulls (%)	Sheep & Lambs (%)	Hogs (%)
2002	64	79	39	65	55
2003	69	80	44	65	64
2004	67	79	43	65	64
2005	67	80	48	70	64
2006	66	81	54	68	61
2007	66	80	55	70	65
2008	68	79	55	70	65
2009	71	81	54	70	63
2010	67	85	53	65	65
2011	67	84	53	59	64
2010	67	85	53	65	65
2011	67	85	52	64	67
2012	68	85	57	64	62
2013	67	85	60	64	59
2014	67	83	57	62	55
2015	68	85	58	66	56
2016	67	84	58	66	59
2017	67	83	55	66	56
2018	68	84	52	70	55
2019	66	85	50	67	53

Table 1: CR4 in Livestock Slaughter by Type of Livestock, Selected Years, 2002-2019

The Byproduct Value represents the collective worth of byproducts such as hides, skins, fats, bones, and both edible and inedible offal derived from animals. The Gross Farm Value denotes the economic worth of the animal at the point of sale, quantified in cents per pound based on its retail weight. The Wholesale Value captures the mean value of meat upon its departure from the packing facility, also expressed in cents per pound of retail weight. Finally, the Retail Value reflects the aggregated value of an animal’s various retail meat cuts, standardized in cents per pound.

Year	By Product	Gross Farm	Wholesale	Retail
2000	18.06	167.01	182.20	306.42

2001	19.01	173.48	191.98	337.73
2002	16.95	161.75	180.37	331.53
2003	19.86	201.13	222.81	374.61
2004	19.76	203.54	218.86	406.52
2005	19.51	211.33	226.41	409.09
2006	19.21	206.50	228.17	397.02
2007	24.81	222.65	231.08	415.84
2008	26.21	223.15	235.06	432.45
2009	19.41	200.38	217.19	426.10
2010	26.83	230.79	241.06	438.40
2011	34.04	274.87	275.81	481.16
2012	35.01	295.12	290.58	501.37
2013	36.75	302.65	298.48	528.94
2014	41.03	370.52	364.70	597.03
2015	32.13	356.16	362.78	628.89
2016	26.80	290.77	316.77	596.37
2017	26.79	291.94	321.46	590.86
2018	22.07	281.50	328.55	592.34
2019	19.85	277.19	341.49	604.38
2020	17.23	260.72	365.51	653.54

Table 2: Price over the Vertical Chain of Beef

Table 2 presents a pattern that suggests the possibility of cyclical movements in the value of beef byproducts, with prices initially rising from approximately 16 dollars to 30 dollars and then receding back to 16 dollars, while primarily hovering around 19 dollars. Despite this observed fluctuation, the overall trajectory shows a general upward trend.

Meat prices exhibit cyclicity driven by supply-demand dynamics, the biological growth cycles of livestock, seasonal consumption changes, and fluctuating feed costs. Economic trends, policy shifts, and global events like disease outbreaks also impact these cycles. Furthermore, market consolidation allows major industry players to influence prices, adding to the rhythmic fluctuations observed in the meat market. The influence of each factor merits its own in-depth exploration and constitutes an advanced research topic worthy of a dedicated paper for comprehensive analysis.

Nevertheless, current statistical methodologies employed in this study do not detect a consistent periodicity in these cycles. Interestingly, despite the lack of pronounced cyclicity in byproduct values, there appears to be a minor cyclical pattern among the gross farm value, wholesale value, and retail value, though it is not marked. In contrast, the trend of steady increase across these values is more evident. To substantiate this finding, hypothesis testing for a monotonic increasing trend was conducted using the Mann-Kendall Test, with the results detailed in **Table 3**. These results confirm a statistically significant upward trend in gross farm value, wholesale value, and retail value. Consequently, it can be inferred that while the cyclicity of byproduct value exerts some degree of influence on the subsequent stages of the value chain, its impact is overshadowed by the predominant and significant monotonic increase observed in these values.

	Byproduct	Gross Farm	Wholesale	Retail
Tau	0.324	0.619	0.829	0.876
P-value	0.043	< 0.01	< 0.01	< 0.01

Table 3: Mann-Kendall Test of Trend for Beef Price over the Vertical Chain

The profit margins for beef packers were notably slim, typically ranging between 1% and 4%. Beef purchasers contended that these packers engaged in coordinated supply restrictions as a strategic measure to boost their profits (Bolotova (2022)). Data transparency for smaller packers within the industry is lacking. Nonetheless, financial statements from publicly traded meatpacking companies reveal that, on average, their net profit margins remained below 10% for the period from 2010 to 2020, a fact substantiated in **Table 4**.

Main Players in Meat Processing Industry

Main Players

The meat processing and packing industry is dominated by key companies such as Tyson Foods, Cargill, JBS USA, Hormel Foods, National Beef Packing Company, and WH Group, which are pivotal in shaping the global market dynamics. Within the U.S. beef packing sector specifically, the four largest players are Tyson Foods, holding a market share of 23.6%, Cargill Meat Solutions with 22.0%, JBS USA with 14.6%, and National Beef Packing Company with 11.4%, collectively forming a significant portion of the industry’s landscape (Bolotova (2022)).

Profitability

In evaluating the historical profitability of the meat processing industry, the net profit margins of the foremost market participants are critical metrics. This analysis is based on the financial reports of the four leading publicly traded companies, as data for private entities remain inaccessible. Notably, Tyson and Hormel Foods report their net profit margins quarterly, thus their annual margins are derived by averaging these quarterly data points. In contrast, the WH Group discloses its figures biannually, which requires a calculation of the mean of these semi-annual numbers to ascertain the annual net profit margin. **Table 4** that follows aggregates the computed annual profit margins of these key industry players for the period from 2010 to 2022.

Years	<i>Tyson Food</i>	<i>WH Group</i>	<i>Hormel Food</i>
2010	1.56%	\	5.56%
2011	2.50%	\	6.00%
2012	1.73%	\	5.85%
2013	2.10%	\	5.95%
2014	2.53%	4.24%	6.36%
2015	2.90%	3.09%	7.01%
2016	4.52%	4.82%	8.76%
2017	5.36%	4.93%	9.35%
2018	6.57%	4.47%	10.19%
2019	4.81%	5.25%	10.24%
2020	4.47%	4.00%	9.75%
2021	6.00%	4.16%	8.61%
2022	6.57%	4.58%	7.85%
Average	3.86%	4.40%	7.75%

Table 4: *Net Profit Margin for 3 Dominating Firms in U.S. Meat Industry*

Puzzle

Current literature characterizes the meat processing industry as markedly concentrated (Barkema et al. (2001)). This sector concentration is often correlated with lower input (cattle, hogs, etc.) prices due to decreased competition among buyers (Ward (2002)). It logically follows that with rising levels of concentration, the industry should benefit from lower production costs. Literature also suggests that the consolidation of market power in the hands of a few major retail and processing entities may lead to higher consumer food prices while depressing the prices paid to livestock producers (Barkema et al. (2001)). Furthermore, research indicates that firms with strong market dominance can sustain higher profit margins, which would suggest a trend toward increasing profitability for the meat processing industry over time (Clarke et al. (1984)).

However, this expected profitability is not evident when examining the financials of the leading meat processing firms, which show an average Gross Profit Margin of about 15%. This places the meat processing industry among those with the lowest gross profit margins, posing a paradox: why does an industry known for its concentration and dominant market players report such low Gross Profit Margins?

Gross Profit Margin is a measure of a company's operational efficiency and production effectiveness. High Gross Profit Margins are characteristic of companies that have optimized their production costs, while low margins typically indicate higher production expenses or lower sales prices. With significant investments in technology, one would predict a notable separation between the cost and sales curves, reflected in a sharply increasing gross profit trajectory. However, this expected trend is not observed in the available data, which lacks evidence of a steep increase in gross profit or a significant gap between sales and costs.

Addressing this discrepancy could illuminate the structural peculiarities of a concentrated industry that seems to operate with surprisingly low gross profits, enhancing our comprehension of the economic interplay within the meat processing industry.

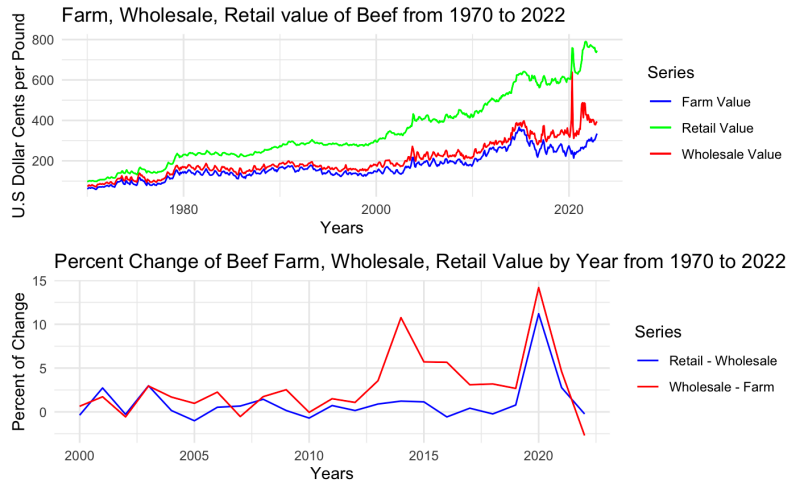


Figure 1: Farm, Wholesale, Retail Value of Beef from 1970 to 2022

ANALYSIS

Data

This research draws upon a diverse array of data sources to construct a comprehensive view of the meat processing industry. The data concerning price spreads for beef are sourced from the U.S. Department of Agriculture (USDA), Economic Research Service. This provides a detailed insight into the evolving dynamics of beef pricing over time. For net profit margin data, the study relies on annual reports from Tyson Foods, Inc., spanning from 1999 to 2022. These reports, publicly available at Tyson Foods’ Investor Relations website, offer a valuable perspective on the financial health and profitability trends of a leading player in the industry. The Four-Firm Concentration Ratio (CR4) of the Meat Packing Industry, a critical measure of market concentration, is obtained from the USDA Agricultural Marketing Service, Packers and Stockyards Division Annual Report for the years 2012 and 2020. Finally, data on the

concentration of food retailers are sourced from the USDA, Economic Research Service's work on Concentration and Competition in U.S. Agribusiness. This diverse dataset underpins the analysis, enabling a multi-faceted understanding of the industry's structure and trends.

Methodology

Mann-Kendall test

The Mann-Kendall test, a non-parametric method for detecting trends in time series data, is defined as shown in Equation 1. Here, n represents the total number of observations in the series, while x_j and x_k are the data values at respective time points j and k , with the condition that $j > k$. The function $\text{sign}(x_j - x_k)$ denotes the sign of the difference between these data points: it is assigned a value of 1 if $(x_j - x_k) > 0$, -1 if $(x_j - x_k) < 0$, and 0 when $(x_j - x_k) = 0$. This function plays a crucial role in calculating the test statistic by evaluating the directionality of the trends between each pair of data points.

$$S = \sum_{k=1}^{n-1} \sum_{j=k+1}^n \text{sign}(x_j - x_k) \quad \text{Equation 1}$$

Lasso Linear Regression

Lasso regression incorporates a regularization term with a penalty equal to the absolute value of the magnitude of the coefficients. This term is added to the usual least squares loss function used in linear regression. The regularization term in Lasso regression tends to shrink the coefficients of less important variables to exactly zero. Mathematically, the objective function in Lasso regression is described in **Equation 2** where y_i are the observed values, X_{ij} are the predictor variables, β_j are the coefficients, n is the number of observations, p is the number of predictors, and λ is a tuning parameter that controls the strength of the penalty.

$$\min_{\beta} \left\{ \frac{1}{2N} \sum_{i=1}^N (y_i - X_i \beta)^2 + \lambda \sum_{j=1}^p |\beta_j| \right\} \quad \text{Equation 2}$$

Economic of Scale in Meatpacking Industry

To address the enigma of why a highly concentrated industry such as meat processing appears to operate with unexpectedly low gross profits, it is critical to first explore the factors driving this sector toward market concentration. This research posits that the industry's evolution into a concentrated market can be attributed to strategies of product differentiation and the realization of economies of scale over a specific time period.

In the literature discourse on meat processing industry consolidation, the economies of scale emerge as a pivotal factor, particularly within the meat processing sector. Economies of scale refer to the cost efficiencies that are realized as the volume of production increases. Empirical research from the 1990s identifies these economies as modest yet pervasive, with their relevance intensifying progressively over time (Paul (2001)). However, some other studies suggest that the economies of scale in the meat processing industry might not be as pronounced as some research purports (MacDonald (1999)).

To further elucidate the drivers of consolidation in the meat processing industry, this study incorporates the Search, Experience, Credence (SEC) framework for classifying goods and services. This approach allows for a more nuanced understanding of how the characteristics of goods can influence market structure and the propensity for industry consolidation.

Experience goods are characterized by the inherent difficulty for consumers to ascertain their quality or value prior to purchase and consumption (Deneckere (2022)). Only through direct interaction with the product or service can consumers accurately judge its merits. Within the context of the meat industry, beef serves as a quintessential example of such goods. For these products, where the veracity of advertising claims is not immediately discernible, there is a greater propensity for manufacturers to overstate benefits, potentially undermining consumer

confidence. Consequently, marketing strategies for experience goods often prioritize persuasion over information, striving to cultivate brand loyalty and engender repeat patronage (Deneckere (2022)). The effectiveness of advertising in this domain relies heavily on the establishment of a trusted brand identity and the forging of an emotive bond with the consumer, as noted in recent scholarship. Additionally, companies that offer a broader array of brands tend to command higher equilibrium prices compared to those with a more limited brand portfolio. Each merger within this context not only yields benefits for the consolidating parties but also produces positive externalities for non-merging competitors (Deneckere (2022)). These external benefits manifest as an opportunity for the latter to increase their prices in response to the altered market dynamics.

Larger firms, endowed with ample financial resources and marketing capabilities, are better positioned to engage in such brand-building exercises. They can allocate substantial funds toward advertising campaigns that not only enhance brand reputation but also imbue their products with perceived credence. This dynamic serves as a catalyst for consolidation within the meat processing industry, prompting mergers and acquisitions as companies vie for market dominance. The resultant industry landscape is one of ever-expanding entities, equipped with the means to launch increasingly sophisticated marketing initiatives and present their products in ever more appealing packaging.

Supply Analysis

The procurement methods in the meat processing industry encompass mechanisms such as Forward Contracts, Marketing Agreements, and Packer-owned feeding operations (Ward (2004)). Both Forward Contracts and Marketing Agreements do not fix prices but are influenced by prices from the Chicago Mercantile Exchange (CME) futures or cash markets. An

examination of the supply chain reveals that major players, including Tyson and Kraft Heinz, do not operate their own feedlots; rather, they primarily rely on independent feeders and ranchers for their supply. As a result, the US meat processing industry's supply chain is heavily reliant on independent producers, with some contribution from processing firms themselves.

Consequently, the costs incurred by the meat processing industry are largely at the mercy of broader market forces rather than under the direct control of individual firms. Despite the industry's concentrated nature, entities like ranchers exert little influence over the costs associated with livestock rearing. Additionally, extraneous factors, such as environmental events, can substantially impact these costs.

This leads to an inherently volatile and unpredictable cost structure within the meat processing industry, which constitutes a significant portion of total expenses. To mitigate such unpredictability, many industry players resort to holding futures contracts, which serve as a hedge against potential abrupt increases in supply costs (Tyson (2022)). While this strategy can stabilize costs to a degree, it also means that reductions in livestock costs are not fully realized. When livestock prices decrease, the corresponding losses on futures contracts maintain a high level of input costs, thus not allowing for cost minimization.

Demand Analysis

The demand of meat processing industry mainly comes from grocery retailers, wholesalers, meat distributors, warehouse clubs, military commissaries, food processing companies, restaurant chains, live markets, international exporters, and domestic distributors catering to a variety of foodservice operations and vendors. Each player within the meat processing industry targets a specific primary demand source. Cargill, for instance, engages in targeted marketing to business clients such as McDonald's rather than the wider consumer

market, shaping its strategies to align with the demands of food retailers and service providers. In contrast, Tyson demonstrates a more diversified approach, generating 31.4% of its revenue from consumer products and 46.3% from food services, as reported in their financial statement from the year 2000 (Tyson Foods (2000)).

The market structure varies by distribution channel. This study mainly focuses on consumer products and food services which are two main demand types (more than 70% of revenue) for most (public) companies in meat processing industry. Consumer products are typically sold through supermarkets, which represent a concentrated market structure. Similarly, the foodservice market is also deemed concentrated. Within this sector, providers can be bifurcated into large and small groups. Small providers, due to their insufficient demand, often rely on supermarkets or wholesale retailers, thus their needs are reflected within the concentrated retail market. Large foodservice providers, however, constitute a distinct segment within the concentrated market. Therefore, given this analysis, the output market for the beef processing industry can be characterized as concentrated, dominated by a few key firms.

Concentration on Demand Market

Over the last three decades, there has been a pronounced escalation in the concentration of retail grocery stores within urban markets, evidenced by the four-firm concentration ratio swelling from 51.4% in 1970 to 74.4% by 1998 (Marsh and Brester (2004)). This trend toward consolidation is captured in **Figure 1** in the previous section, which depicts a steady rise in the wholesale-retail (WR) margins for the beef industry. In probing the causes behind this increment in WR margins, studies indicate that the influences of meat processing technology and meat packer concentration are minimal or insignificant (Marsh and Brester (2004)).

The dynamics of this consolidation may be further understood through the framework of product differentiation theory, which posits that consumer demand for a brand is more elastic when they are cognizant of a larger assortment of similar products (Deneckere (2022)). With the growing concentration of grocery stores, these entities can strategically influence the positioning of meat products, such as by placing similar products with lower prices in close proximity. Such strategies enhance the bargaining power of retailers, allowing them to negotiate lower prices in addition to those achieved through a more concentrated market structure (Ward (2002)). Other market participants, like the food processing industry, are inclined to align their pricing with that of the retail end to stay competitive, as they have the alternative option to procure meat products directly from retail grocery stores.

Essentially, the intensifying consolidation among retailers in the meat processing industry exerts downward pressure on retail prices, subsequently compressing the profit margins for meat processors. This dynamic is underpinned by scholarly research which posits that manufacturers typically accept wholesale prices as a given, while retailers wield a measure of oligopsonistic influence, thereby impacting pricing structures within the industry (Schroeter (2000)).

Variable	Coefficient	Std. Error	Significance
GDP	0.0024	0.0009	< 0.1
Retailer Concentration	-0.0529	0.0121	< 0.05
Meatpacker Concentration	0.0219	0.3949	Not Significant
Net Farmer Value	-0.0409	0.0248	Not Significant
Farm to Wholesale	-0.0033	0.0389	Not Significant
Wholesale to Retail	-0.1010	0.0615	Not Significant

Table 5: Results of Regression Analysis

Model Results

In the meat packing industry’s regression analysis, the economic interplay between the value chain from farm to retail and its impact on profitability is thoroughly examined. The

margin from wholesale to retail, which signifies the potential markup by retailers, reveals a distinct trend where increased retail margins correlate with decreased profitability for meatpacking companies. This trend highlights the profound impact of retail pricing strategies on the financial health of meat packers. Conversely, the margin from farm to wholesale, representing the markup meat packers gain over farmers' prices, shows a minimal and statistically insignificant negative effect on their profitability.

A significant aspect of the industry's economic structure uncovered in the study is the relationship between meat packer concentration and profitability. As meat packer concentration rises, so does their profitability. However, an increase in retailer concentration leads to reduced profitability for meat packers. This bilateral oligopoly structure suggests that meat packers, despite their presence in the market, have limited bargaining power against dominant retailers, influencing their profit margins.

Policy to Reduce Meat Price

The Biden administration's strategy to lower meat prices for consumers targets the consolidation in the meatpacking industry. According to recent policies, the administration attributes high meat prices to this industry consolidation. Their proposed solution involves diminishing this consolidation by subsidizing smaller meat packers and implementing antitrust laws (Deese (2021)).

However, this policy has been met with skepticism from several economists. Centers on the "natural" aspect of consolidation in the meat processing industry, driven by significant economies of scale (Fu (2022)). Large firms have realized cost reductions by operating larger plants, challenging the notion that breaking up these firms will lead to lower prices. Additionally,

this study finds that the Four-Firm Concentration Ratio (CR4) did not show any consistent increase in the 2000s, suggesting that consolidation may not be the sole driver of meat prices.

Furthermore, this study points out that the consolidation in retail markets appears to grant retailers, such as Walmart, greater bargaining power over meat prices compared to meatpacking companies. Interestingly, public data reveals that retailers like Walmart contribute significantly more (around 10 times greater) to Democratic causes than companies like Tyson, hinting at potential political influences.

Considering these findings, the study suggests that the administration might be more effective if it initially focuses on addressing consolidation issues at the retail end before tackling consolidation in the meat processing industry. This approach could provide a more targeted solution to the challenge of high meat prices faced by consumers.

SUMMARY

This research thoroughly examines the U.S. meat processing industry, particularly addressing the paradox of low gross profit margins despite significant market concentration. It challenges the conventional economic belief that links market dominance with elevated profitability. Delving into the intricate interplay of supply and demand factors, the study identifies key influences shaping the industry's financial framework. On the supply side, the volatility inherent in the livestock market poses substantial challenges in reducing production costs. On the demand front, the escalating consolidation among retail grocery chains puts downward pressure on retail prices, thereby narrowing the profit margins of meat processors.

The investigation also highlights the dominant bargaining power of consolidated retailers, such as Walmart, which disproportionately affects meat pricing compared to the influence of

meat packing companies. This imbalance suggests that policy efforts aimed at reducing meat prices for consumers might be more effective if they target the consolidation in the retail sector. This approach could directly address the factors contributing to high consumer meat prices. Overall, this study not only sheds light on the complex dynamics within the meat processing industry but also emphasizes the importance of comprehensive strategies that encompass the entire value chain.

Like the meat processing industry, the agricultural, pharmaceutical, and oil tanker sectors display comparable structural characteristics, particularly in terms of market consolidation juxtaposed with constrained profit margins due to powerful entities on the demand side.

The pharmaceutical industry is an industry with a few dominant players in specific drug markets facing profit margin pressures from large healthcare providers, insurers, and government healthcare policies. Additionally, the oil tanker industry also experiences consolidation and effect of economies of scale. However, despite the market concentration and economies of scale, the shipping companies often face tight profit margins due to the bargaining power of major oil companies and fluctuations in global oil demand and supply dynamics.

These industries collectively illustrate a scenario where supply-side consolidation does not necessarily translate into higher profitability, primarily due to the consolidation and bargaining strength on the demand side. The findings of this research comprehensively elucidate the phenomenon through statistical evidence, offering valuable insights to inform future policy decisions aimed at enhancing competitiveness and price reduction, or mitigating consolidation within a specific industry.

BIBLIOGRAPHY

- AZZAM, A. M., AND E. PAGOULATOS. (1990): “Testing oligopolistic and oligopsonistic behaviour: an application to the us meat-packing industry,” *Journal of Agricultural Economics*, 41, 362–70.
- BALL, V. E., AND R. G. CHAMBERS. (1982): “An Economic Analysis of Technology in the Meat Products Industry,” *American Journal of Agricultural Economics*, 64, 699–709.
- BARKEMA, A., M. DRABENSTOTT, AND N. NOVACK. (2001): “The new U.S. meat industry,” *Economic Review*, 33–56.
- BOEHLJE, M. D. (2006): “Economics of Animal Agriculture Production, Processing and Marketing,” *Choices*, 21, 159–63.
- BOLOTOVA, Y. V. (2022): “Competition issues in the U.S. beef industry,” *Applied Economic Perspectives and Policy*, 44, 1340–58.
- BUHR, B. L., & GINN, B. (2011): US meatpacking: Dynamic forces of change in a mature industry. *Choices*, 26(1).
- CLARKE, R., S. DAVIES, AND M. WATERSON. (1984): “The Profitability-Concentration Relation: Market Power or Efficiency?,” *The Journal of Industrial Economics*, 32, 435–50.
- CLEMEN, R. A. (1923): *The American livestock and meat industry*, New York, The Ronald Press Company
- DEESE, B., S. FAZILI, AND B. RAMAMURTI. (2021): “Addressing Concentration in the Meat-Processing Industry to Lower Food Prices for American Families,” *The White House*, <https://www.whitehouse.gov/briefing-room/blog/2021/09/08/addressing-concentration-in-the-meat-processing-industry-to-lower-food-prices-for-american-families/>, Accessed 12/03/2023.
- DEESE, B., S. FAZILI, AND B. RAMAMURTI. (2021): “Recent Data Show Dominant Meat Processing Companies Are Taking Advantage of Market Power to Raise Prices and Grow Profit Margins,” *The White House*, <https://www.whitehouse.gov/briefing-room/blog/2021/12/10/recent-data-show-dominant-meat-processing-companies-are-taking-advantage-of-market-power-to-raise-prices-and-grow-profit-margins/>, Accessed 11/03/2023.
- DENECKERE, R. (2023): “Differentiated Goods Oligopoly,” Econ 458 Lecture note, *Department of Economics, University of Wisconsin-Madison*.
- DENECKERE, R. (2023): “Imperfect Information,” Econ 458 Lecture note, *Department of Economics, University of Wisconsin-Madison*.
- DENECKERE, R. (2023): “Market Power and Returns to Scale,” Econ 458 Lecture note, *Department of Economics, University of Wisconsin-Madison*.
- DUMAS, C. R. “Economies of Scale Drove Meatpacking Concentration | Livestock | Capitalpress.Com,” https://www.capitalpress.com/ag_sectors/livestock/economies-of-scale-drove-meatpacking-concentration/article_cf5c8674-21ae-11ee-b3aa-3f524985fe7e.html, Accessed 12/03/2023.

- ECHEGARAY, N., HASSOUN, A., JAGTAP, S., TETTEH-CAESAR, M., KUMAR, M.; TOMASEVIC, I., GOKSEN, G., LORENZO, J.M. (2022): “Applied Sciences | Free Full-Text | Meat 4.0: Principles and Applications of Industry 4.0 Technologies in the Meat Industry,” <https://www.mdpi.com/2076-3417/12/14/6986>, Accessed 10/24/2023.
- ECONOMIC RESEARCH SERVICE U.S. DEPARTMENT OF AGRICULTURE. (2023): “USDA ERS - Meat Price Spreads,” <https://www.ers.usda.gov/data-products/meat-price-spreads/>, Accessed 11/10/2023.
- FOSTER, K. “Sources of Cycles in the United States Beef Industry - Purdue Agricultural Economics Report,” *Center for Commercial Agriculture*, <https://ag.purdue.edu/commercialag/home/paer-article/sources-of-cycles-in-the-united-states-beef-industry/>, Accessed 12/03/2023.
- FU, J. (2022): “Can \$1 Billion Really Fix a Meat Industry Dominated by Just Four Companies?,” *The Counter*, <https://thecounter.org/big-four-meatpackers-antitrust-consolidation/>, Accessed 12/03/2023.
- GREEN, E. (2020): “Unpacking the Meat Industry | Richmond Fed,” Federal Reserve Bank of Richmond, https://www.richmondfed.org/publications/research/econ_focus/2020/q4/feature1, Accessed 10/24/2023.
- HUSSAIN, G. (2022): “Are Americans Eating Less Meat? Are Meat Sales Declining?,” <https://sentientmedia.org/are-americans-eating-less-meat/>, Accessed 10/24/2023.
- JI, I. B., C. CHUNG, I. B. JI, AND C. CHUNG. (2010): “Dynamic Assessment of Oligopoly, Oligopsony Power, and Cost Efficie
- KELLOWAY, C. (2022): “Consolidation in America’s Food Supply Chains: A Key Factor in Price Gouging, Shortages, and Inequality,” *Open Markets*.
- KOONTZ, S. R. (2003): “Market power in the United States red meatpacking industry,” *Veterinary Clinics of North America: Food Animal Practice*, 19. Economics of the Red Meat and Dairy Industries, 519–44.
- LUSK, J. L., G. T. TONSOR, AND L. L. SCHULZ. (2021): “Beef and Pork Marketing Margins and Price Spreads during COVID -19,” *Applied Economic Perspectives and Policy*, 43, 4–23.
- MA, M., AND J. LUSK. (2021): *Concentration and Resilience in the U.S. Meat Supply Chains*, Cambridge, MA: National Bureau of Economic Research, W29103.
- MACDONALD, J. M., AND M. E. OLLINGER. (2000): “Scale Economies and Consolidation in Hog Slaughter,” *American Journal of Agricultural Economics*, 82, 334–46.
- MACDONALD, J. M., AND M. E. OLLINGER. (2005): “Technology, Labor Wars, and Producer Dynamics: Explaining Consolidation in Beefpacking,” *American Journal of Agricultural Economics*, 87, 1020–33.
- MACDONALD, J. M., M. E. OLLINGER, K. E. NELSON, AND C. R. HANDY. (1999): “Consolidation in U.S. Meatpacking.” *Agricultural Economic Report No. (AER-785) 47 pp.*
- MACDONALD, J. M., X. DONG, AND K. FUGLIE. *Concentration and Competition in U.S. Agribusiness*,. Economic Information Bulletin U.S. Department of Agriculture, Economic Research Service.

- MALDONADO, E. S., HENSON, S. J., CASWELL, J. A., LEOS, L. A., MARTINEZ, P. A., ARANDA, G., & CADENA, J. A. (2005): Cost–benefit analysis of HACCP implementation in the Mexican meat industry. *Food control*, 16(4), 375-381.
- MARKETLINE. (2023): Meat in the United States, MarketLine Industry Profile, Reference Code: 0072-2345
- MARSH, J., AND G. BRESTER. (2004): “Wholesale-Retail Marketing Margin Behavior in the Beef and Pork Industries,” *Journal of Agricultural and Resource Economics*, 29.
- MARTIN, H. M., K. T. SMITH, AND L. M. SMITH. (2016): “A financial and public policy analysis of the meat industry,” *International Journal of Economics and Accounting*, 7, 74–88.
- MORRISON PAUL CJ. (2000): Cost economies and market power in US meat packing. Monograph 44, Giannini Found., San Francisco, Calif.
- MORRISON PAUL, C. J. (2001): “Market and Cost Structure in the U.S. Beef Packing Industry: A Plant-Level Analysis,” *American Journal of Agricultural Economics*, 83, 64–76.
- NANDGAONKAR, R. “• Tyson Food’s Revenue by Segment (2016-2023) - Business Quant,”<https://businessquant.com/tyson-foods-revenue-by-segment>, Accessed 12/03/2023.
- NGUYEN, S. V., AND M. OLLINGER. (2009): “Mergers and acquisitions, employment, wages, and plant closures in the U.S. meat product industries,” *Agribusiness*, 25, 70–89.
- OLLINGER, M., J. M. MACDONALD, AND M. MADISON. (2005): “Technological Change and Economies of Scale in U.S. Poultry Processing,” *American Journal of Agricultural Economics*, 87, 116–29.
- PANAGIOTOU, D., ED. (2005): IS PRICING ABOVE MARGINAL COST AN INDICATION OF MARKET POWER IN THE U.S. MEATPACKING INDUSTRY?, Selected Paper 137155.
- PANAGIOTOU, D., AND A. STAVRAKOUDIS. (2018): “A stochastic frontier estimator of the aggregate degree of market power exerted by the US meat packing industry,” *Economia e Politica Industriale*, 45, 387–401.
- PAUL, C. J. M. (2001): “Cost Economies and Market Power: The Case of the U.S. Meat Packing Industry,” *Review of Economics and Statistics*, 83, 531–40.
- SANDESH SURESH, K., AND T. G. KUDRE. (2022): “Chapter 3 - Advances in Meat Processing Technologies and Product Development,” in *Research and Technological Advances in Food Science*, ed. by Prakash, B. Academic Press, 61–89.
- SCHROETER, J., & AZZAM, A. (1990): Measuring market power in multi-product oligopolies: the US meat industry. *Applied Economics*, 22(10), 1365-1376.
- SCHROETER, J. R., A. M. AZZAM, AND M. ZHANG. (2000): “Measuring Market Power in Bilateral Oligopoly: The Wholesale Market for Beef,” *Southern Economic Journal*, 66, 526–47.
- SWEATT, E. L., D. N. PEEL, AND C. E. WARD. (1996): Estimating Gross Margins in Meat Packing for Beef, Pork, and Lamb, Staff Paper, Virginia Polytechnic Institute and State University, Department of Agricultural and Applied Economics.

- TYSON FOODS, INC. (1999-2022): Annual Reports, Springdale, AR: Tyson Foods, Inc., <https://ir.tyson.com/reports/annual-reports/default.aspx>, Accessed 11/10/2023.
- WARD, C. E. (2004): “Packer Concentration and Captive Supplies,” *Oklahoma Cooperative Extension Service*
- WARD, C. E. (2002): “A Review of Causes for and Consequences of Economic Concentration in the U.S. Meatpacking Industry,” *CAFRI: Current Agriculture, Food and Resource Issues*, 1–28.
- WATSON, A. (2014): “Measuring occupational concentration by industry : Beyond the Numbers: U.S. Bureau of Labor Statistics,” *Beyond the Numbers*, 3.
- WOHLGENANT, M. K. (2013): “Competition in the US Meatpacking Industry,” *Annual Review of Resource Economics*, 5, 1–12.
- YANG, W., & RENWICK, A. (2019): Consumer willingness to pay price premiums for credence attributes of livestock products—A meta-analysis. *Journal of Agricultural Economics*, 70(3), 618-639.
- ZEBALLOS, E. “A Disaggregated View of Market Concentration in the Food Retail Industry.,” U.S. Department of Agriculture, Economic Research Service.