A Portrait of Firms that Trade in Meat Products

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Abstract

This paper provides an integrated view of U.S. firms that engage in international meat trade. We explore a newly constructed dataset linking firm-level trade transactions to a unique panel on U.S. business activities from 2010 to 2020. This novel dataset enables us to examine several dimensions of firm activity in the meat industry, including how many different products firms trade, how many countries with which firms trade, the characteristics of those countries, and the concentration of foreign sales across firms. We find that more globally engaged firms which export meat products dominate trade flows among trading firms. Larger exporters/importers trade more of a given product with a given destination/source country than smaller exporters/importers and export/import more products to/from more destinations/sources. Between 2010 and 2020, the meat import market became less concentrated, while the concentration in the export market grew considerably. This significant market concentration implies that meat processing and foreign trade disruptions could have system-wide consequences beyond the United States.

Keywords: Meat industry, global supply chains, market concentration, HHI

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Introduction

Meat products are a significant driver of agricultural trade. U.S. meat export and import value more than doubled since 2010, reaching about $14 billion and $5 billion in 2020 (see Figure 1). They average about 35 percent and 19 percent of total trade in processed agricultural products (USDA, 2022). During the coronavirus pandemic, domestic supply chains have come to the forefront of public consciousness, particularly for meat, where market concentration and its implications at the processing level are discussed in depth by the academic literature (e.g., McKendree et al., 2020; Hamilton and Sunding, 2021; Ma and Lusk, 2021). In contrast, little is known about shipment characteristics or the attributes of U.S. meat trading firms. Aggregated trade statistics tell us that meat exports are often containerized, and, aside from Canada and Mexico, meat shipments go primarily to Asia, where demand for proteins is exploding. In addition, as evidenced by the purchase of Smithfield Foods in the early 2010s, foreign firms have acquired U.S. companies to bolster and diversify their meat supply chains.

These anecdotes are compelling as we observe some firms strategically reorganizing their supply chains. The previous literature broadly investigated the determinants and behavior of food firms engaging in international trade. These studies use firm-level data from Europe, while no study has looked at U.S. meat firms (Curzi and Olper, 2012; Eum et al., 2021; Jafari et al., 2022). The existing research focused on the U.S. meat trade encompasses trade policies and agreements, welfare analyses, pricing, export/import demand, and competitiveness (Arnade et al., 1998; Paarlberg and Lee, 2001; Miljkovic et al., 2003; Henneberry and Mutondo, 2009; Hejazi et al., 2019). However, this directly relevant research is based on aggregated rather than firm- or transaction-level data, establishing a need for more granular statistical analysis to fill in the details about the participants in the U.S. meat trade.

We provide context to the existing literature and current trends in U.S. meat trading patterns by creating a new dataset linking ocean shipping bills of lading to U.S. firms from 2010 to 2020. Specifically, we explore this firm-level data by the number of products, number of countries, HHI concentration, and firm characteristics. We find that the import and export markets are concentrated with few firms and few sources and destinations accounting for the lion's share of trade value. Moreover, these firms tend to trade simultaneously in multiple products and locations. The data also shows that market concentration and the U.S. sources and destinations of trade are changing over time. Export market concentration increased while import market concentration decreased. There are considerable regional differences in market concentration among both sources and destinations.

Our contribution is to provide a richer picture of the U.S. meat trade and its participants by creating a firm-level meat trading activity dataset. The new dataset provides insight into meat market concentration that may point to vulnerabilities in the robustness of U.S. meat trade and supply chains. Supply chain risks refer to the probability of sudden events that severely disable a system (Tang and Musa, 2011). Specifically, trade and supply risk can be found when high market concentration is either on a region or company level. Specific sources of agri-food supply risk and the ability to manage this risk are geographic, political, or organizational in nature (Zhao et al., 2017). These sources of supply chain risk may have been suspected but have not been documented until now.

Methods and Data

We constructed a dataset that links firm-level trade data with firm characteristics of the U.S. meat industry from 2010 to 2020. The trade data was constructed from transaction-level bills of lading for

all U.S. exporting and importing firms from the Port Import/Export Reporting Service (PIERS) database (IHS Markit, 2022). PIERS covers all maritime trade transactions through U.S. ports at the Harmonized System (HS) subheading (six digits) level, including trade quantity in kilograms and the estimated trade value. We aggregated all trade data at the HS heading (four digits), filtering companies trading in goods listed under HS headings 0201 to 0210, including all types of meat and edible meat offal.

Then, we matched the annualized firm-level trade data with firm characteristics from the National Establishment Time Series (NETS) dataset (NETS, 2022). NETS allows us to compare meat firms trading with foreign partners against companies focused on the domestic market. NETS is a longitudinal dataset that collects various characteristics of U.S. companies at the establishment level. We restrict our analysis to firms listed under the North American Industry Classification System (NAICS) codes 3116, 424470, and 445210, covering meat processing and trading firms.

The export and import values in the PIERS database are estimated. Therefore, we compared their reliability against the U.S. Trade Statistics published by the Census Bureau (2022). The PIERS import value deviates about 20 percent from the administrative dataset. We updated the trade value using unit value information from the Census Bureau, which we constructed at the state-destination-product-year level to account for this issue. This approach allowed us to reduce the gap in trade value between both datasets to less than 2 percent, providing a more reliable price dispersion measure for the market concentration analysis.[4]

Results and Discussion

Distribution Across Meat Export and Import Markets

Table 1 reports the distribution of exporting and importing firms and the export and import values by the number of products and trade destinations. Sixty-three percent of exporting firms export a single product to a single market (panel (a)), but these meat firms account for merely 2 percent of export value (panel (c)). In contrast, only 3 percent of firms export more than five products to more than five destinations but account for more than 67 percent of the export value. The picture looks similar for meat imports. We find that 73 percent of meat firms import a single product from one foreign market (panel (b)) while accounting for only 4 percent of all meat imports (panel (d)). At the same time, meat firms that import more than five products from five source markets account for merely 1 percent of all meat firms but about 45 percent of the import value. These results imply that U.S. meat export and import markets are concentrated among a few firms.

Larger exporters/importers export/import more of a given product to/from a given destination/source than smaller exporters/importers and export/import more products to/from more destinations/sources. This pattern can be explained by considerable sunk "entry" costs in the meat industry. Bernard et al. (2012) developed a multi-product and multi-destination model based on the framework proposed by Melitz (2003) to explain this pattern. Their theoretical model shows that high-ability firms that face fixed costs in serving each market with all meat products can generate sufficient revenue to recover the fixed cost of serving these markets with a variety of meat products. This mechanism can explain the observed pattern of few firms trading multiple products in multiple

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[4] The data is available for replication purposes upon request from the authors.

locations, and many firms concentrating on one destination market and offering only one to several products.

Firm Share Distribution

The export data presented in Table 2 indicate that the top 1 percent of firms (23) exported 71 percent of all meat products in 2020. This share increased by almost 10 percent compared to 2010. In contrast, the concentration in the import market decreased slightly between 2010 and 2020. The top 1 percent comprised 17 firms in 2010 and 22 businesses in 2020. These firms were responsible for 70 percent of meat imports in 2010 and 63 percent in 2020. The shares indicate that the import market became less concentrated, while the concentration in the export market grew considerably. Note that the top 10 percent of firms are responsible for more than 95 percent of the meat trade. This market concentration is considerable. In addition to that, the share of the top 1 percent of meat exporting and importing firms in the overall number of U.S. meat firms is small, reaching about 0.1 percent in 2020. This significant concentration implies that meat processing and foreign trade could have system-wide implications beyond the United States (e.g., Balagtas and Cooper, 2021; Ma and Lusk, 2021).

Market Concentration

We compare market concentration in foreign trade of meat products in Table 3. The table shows the Herfindahl-Hirschman Index (HHI) between 2010 to 2020. We compare the total HHI against the smallest and largest 25 percent percentiles and report the count of meat trading firms by year. The HHI provides limited evidence for considerable market concentration in the meat export market at the aggregated level. The HHI is upward trending between 2010 and 2020, while the number of meat firms that exported remained stable at around 2,100. In contrast, the import market recorded a significant increase in the number of firms importing meat products. The count reached an all-time high in 2016 when more than 2,300 firms imported meat products. This increase is reflected in the import HHI, which decreased from about 1,400 to 360. The smallest and largest 25 percent percentiles support this pattern. We find that two meat exporters were responsible for 25 percent of all foreign sales in 2020. The observed concentration pattern in the import market is similar. Although the aggregated calculations provide little evidence for considerable market power, the concentration is higher when limiting the product scope and destination/source coverage.

Destination and Source Market Concentration

Table 4 shows the destination and source country concentration measured by the firm and trade share over time between 2010 and 2020. We find that the destination market concentration in terms of firm share did not change much during the study period. In contrast, the export share increased considerably for meat firms serving ten or more destination countries. While the share of firms stagnated at about 5 percent, the export share grew by 8 percent between 2010 and 2020, reaching more than 85 percent the later year. The opposite pattern is observed for meat importing firms. While the number of firms importing from 10 or more source countries stayed at about 3 percent, their import share fell from 77 percent to 72 percent. These results indicate that the export market became more concentrated between 2010 and 2020, while the import market has the opposite trend. Amplified by the coronavirus pandemic and mergers and acquisitions, growing market power is an increasing concern in the domestic U.S. meat industry (Kuiper and Lansink, 2012; Weersink et al., 2021). Our results show that this pattern is also reflected in the export market.

Regional Difference in Destination and Source Concentration

We compare the average market concentration by destination and source region in Table 5. The table shows the HHI and firm count average for 2010 to 2020. We find the highest market concentration in the export market for Polynesia and Eastern Europe. Major export markets in terms of trade value are less concentrated. For example, the HHI for Northern America is 831 and 718 for Eastern Asia. Similar patterns are observed in the import market. The import market concentration is highest for small regions in Oceania, while we find evidence of low market concentration for significant import markets. For instance, the HHI for Australia and New Zealand is 598, 418 for Northern America, and 720 for Latin America and the Caribbean. These results point toward considerable regional differences in the market concentration for meat products.

Conclusion

We investigated the characteristics of U.S. firms trading meat products by exploring a novel dataset linking firm-level international trade transactions to a unique panel on U.S. business activities from 2010 to 2020. Our dataset implies that market power is an increasing concern in the meat export market, consistent with the growing domestic market concentration that has increased in importance and hastened during the coronavirus pandemic (Weersink et al., 2021). Although the evidence here is only suggestive regarding market power, the data documented trends and sources of potential vulnerability due to concentration, implying that meat processing and foreign trade disruptions can have system-wide consequences beyond the United States (Balagtas and Cooper, 2021; Ma and Lusk, 2021). This knowledge about meat trading activity can be helpful to policymakers when addressing domestic market issues and policy with U.S. trade partners.

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Figures and Tables

Figure 1. Containerized Meat Exports and Imports by U.S. Port Region
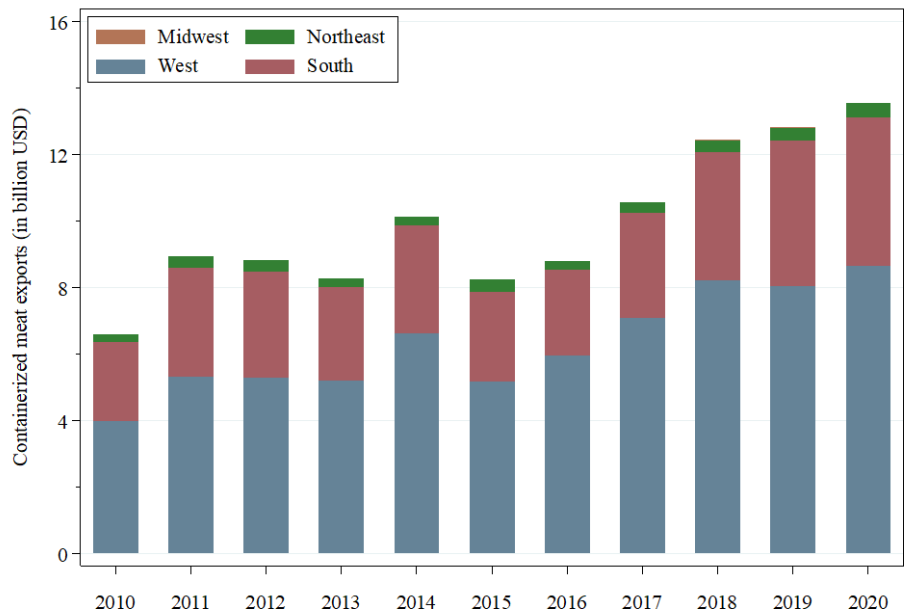
(a) Meat Exports
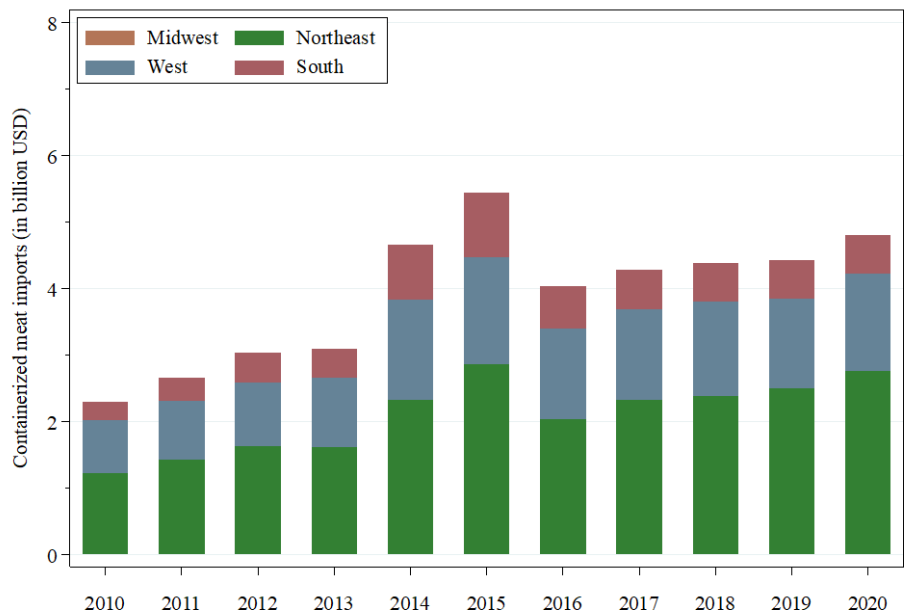
(a) Meat Imports

Note. The U.S. port region classification comes from the U.S. Census Bureau (2022).

Table 1. Distribution of Import and Export by Number of Products and Export Destinations, Average for 2010 to 2020 (All in Percent)

(a) Share of Exporting Firms

Number of Products	Number of Countries					All
	1	2	3	4	5+	
1	63.17	5.48	1.30	0.62	0.75	71.32
2	6.35	4.98	1.70	0.84	1.24	15.12
3	1.64	1.34	1.17	0.66	1.51	6.32
4	0.64	0.44	0.39	0.33	1.55	3.36
5+	0.36	0.25	0.22	0.24	2.80	3.87
All	72.16	12.50	4.79	2.70	7.86	100.00

(b) Share of Importing Firms

Number of Products	Number of Countries					All
	1	2	3	4	5+	
1	73.15	5.46	1.05	0.37	0.20	80.23
2	5.87	3.67	1.34	0.52	0.55	11.96
3	1.24	1.13	0.76	0.46	0.78	4.37
4	0.35	0.29	0.29	0.26	0.82	2.00
5+	0.13	0.07	0.11	0.07	1.05	1.43
All	80.75	10.62	3.55	1.67	3.40	100.00

(c) Share of Exporting Value

Number of Products	Number of Countries					All
	1	2	3	4	5+	
1	2.33	1.20	0.52	0.42	1.22	5.68
2	1.28	1.01	0.58	0.46	3.55	6.88
3	0.73	0.62	0.45	0.91	6.17	8.88
4	0.52	0.40	0.39	0.53	7.28	9.13
5+	0.71	0.40	0.27	0.79	67.27	69.44
All	5.58	3.62	2.21	3.11	85.48	100.00

(d) Share of Importing Value

Number of Products	Number of Countries					All
	1	2	3	4	5+	
1	4.37	1.43	0.79	0.81	0.88	8.28
2	1.76	2.50	2.81	1.73	4.30	13.10
3	0.63	1.84	1.91	1.74	9.21	15.34
4	0.32	0.44	1.19	1.75	13.51	17.21
5+	0.13	0.12	0.74	0.69	44.40	46.08
All	7.22	6.34	7.43	6.71	72.30	100.00

Note. We used the unique firm identifier to aggregate trade data for all meat trading firms at the product-country pair level. The export and import share by firm count and value was then calculated by collapsing the firm-level data at the product-country pair level and dividing by the count of all firms or trade values. We included firms trading in meat products listed under HS headings (four-digit) 0201 to 0210.

Table 2: Export and Import Market Firm Distribution for 2010 and 2020

Firm Rank (percentile)	Number of Firms		Percentage of Firms		Percentage of Trade	
	2010	2020	2010	2020	2010	2020
(a) Exports						
Top 1 percent	21	23	0.12	0.13	61.25	70.75
Top 5 percent	103	111	0.57	0.63	87.34	92.33
Top 10 percent	204	219	1.12	1.25	94.30	96.03
Top 25 percent	506	547	2.79	3.11	98.28	98.76
Top 50 percent	1,012	1,091	5.57	6.21	99.59	99.68
(b) Imports						
Top 1 percent	17	22	0.09	0.13	69.67	62.70
Top 5 percent	80	105	0.44	0.60	87.00	90.03
Top 10 percent	160	208	0.88	1.18	92.29	95.19
Top 25 percent	399	519	2.20	2.96	97.04	98.45
Top 50 percent	796	1,038	4.38	5.91	99.16	99.69

Note. We ranked firms according to their size and calculated the number of firms by percentile, their share in all meat firms, and the trade share. The number of meat firms without foreign trade comes from the NETS database (NETS, 2022). We included NAICS codes 3116, 424470, and 445210.

Table 3: Market Concentration Between 2010 and 2020

(a) Export

Year	Total HHI	Count	Smallest 25% Percentile HHI	Count	Largest 25% Percentile HHI	Count
2010	312	2,021	57	1,979	5,766	2
2012	324	2,282	68	2,248	5,514	2
2014	384	2,206	87	2,175	5,316	2
2016	397	1,973	91	1,945	5,038	2
2018	505	1,772	93	1,743	5,063	2
2020	459	2,181	94	2,154	5,161	2

(b) Import

Year	Total HHI	Count	Smallest 25% Percentile HHI	Count	Largest 25% Percentile HHI	Count
2010	1,437	1,590	62	1,565	10,000	1
2012	793	1,633	84	1,610	6,234	2
2014	306	2,272	64	2,237	5,216	2
2016	411	2,329	55	2,289	6,635	2
2018	306	2,175	68	2,132	6,677	2
2020	362	2,073	70	2,035	5,804	2

Note. We measured market concentration by the Herfindahl-Hirschman Index (HHI) at the annual level and report the count of meat firms exporting and importing each year. We also calculated the HHI for the smallest and largest 20 percent percentiles.

Table 4: Destination and Source Market Concentration Between 2010 and 2020

Destination or Source Countries	Share of Firms (in Percent)						Trade Share (in Percent)					
	2010	2012	2014	2016	2018	2020	2010	2012	2014	2016	2018	2020
(a) Exports												
1	62.20	66.17	62.87	60.87	59.14	62.40	3.33	3.04	2.06	2.09	1.86	1.90
2	15.44	14.15	15.10	15.21	16.08	15.08	5.25	2.13	2.07	2.51	1.82	2.39
3-4	10.24	8.90	10.92	11.40	10.89	11.05	3.75	7.73	5.98	3.88	3.59	3.34
5-9	6.78	5.96	5.98	7.35	7.34	6.56	11.11	7.43	7.15	7.83	9.23	7.31
10+	5.34	4.82	5.12	5.17	6.55	4.91	76.56	79.67	82.73	83.70	83.50	85.07
(b) Imports												
1	70.44	71.77	73.81	73.85	74.21	78.15	4.74	4.74	3.97	5.03	3.84	3.96
2	13.71	13.96	13.07	13.65	13.01	9.89	3.62	3.84	3.28	3.62	3.34	2.33
3-4	8.30	7.59	7.22	7.00	7.13	5.84	6.49	5.13	7.45	7.05	7.61	7.78
5-9	4.84	4.41	3.39	3.43	3.36	3.62	7.91	9.07	12.10	20.79	19.92	13.85
10+	2.70	2.27	2.51	2.06	2.30	2.51	77.24	77.22	73.20	63.51	65.28	72.08

Note. We used the unique firm identifier to aggregate trade data for all meat trading firms at the country-year level. The annual export and import shares were then calculated by collapsing the firm-level data at the annual level for each destination or source group and dividing it by the count of all firms or trade values.

Table 5: Destination and Source Region Concentration, Average for 2010 to 2020

(a) Export

Destination Region	Total		Smallest 25 Percentile		Largest 25 Percentile	
	HHI	Count	HHI	Count	HHI	Count
Northern Africa	1,426	68	1,029	63	8,210	1
Sub-Saharan Africa	822	94	489	86	4,764	2
Latin America and the Caribbean	246	999	63	950	2,284	5
Northern America	831	71	466	56	5,520	2
Eastern Asia	718	703	220	689	4,609	2
Southeastern Asia	439	273	201	251	3,269	3
Southern Asia	1,218	35	940	29	6,929	2
Western Asia	616	160	374	148	4,083	3
Eastern Europe	2,206	33	2,195	28	8,200	1
Northern Europe	1,561	43	967	39	8,654	1
Southern Europe	687	154	401	144	4,663	2
Western Europe	857	206	237	193	6,603	2
Australia and New Zealand	1,720	82	1,759	78	8,202	1
Melanesia	1,724	34	1,724	31	8,231	1
Micronesia	1,050	38	845	32	5,618	2
Polynesia	2,851	24	2,807	23	10,000	1

(b) Import

Source Region	Total		Smallest 25 Percentile		Largest 25 Percentile	
	HHI	Count	HHI	Count	HHI	Count
Northern Africa	2,856	10	2,388	8	8,729	1
Sub-Saharan Africa	7,295	2	6,895	2	10,000	1
Latin America and the Caribbean	720	498	120	473	6,702	2
Northern America	418	127	184	101	3,694	3
Eastern Asia	518	673	63	633	4,950	3
Southeastern Asia	1,061	152	212	138	6,782	2
Southern Asia	1,812	35	990	30	8,949	1
Western Asia	2,744	26	1,644	24	10,000	1
Eastern Europe	5,212	3	5,078	3	10,000	1
Northern Europe	2,148	57	1,116	52	8,262	1
Southern Europe	848	125	284	112	5,877	2
Western Europe	1,890	216	369	208	8,225	1
Australia and New Zealand	598	491	133	467	4,549	3
Melanesia	5,658	4	6,148	4	10,000	1
Micronesia	6,298	8	3,231	10	9,212	1
Polynesia	5,137	3	8,036	2	10,000	1

Note. The geographic region classification comes from the United Nations Statistics Division (UNSD, 2022).