Livestock - cattle

Econ 235

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Introduction

- The United States is the largest producer of cattle and beef in the world.
- The supply chain for cattle and beef is more complicated than for grains.
- Production dynamics is also different than grains and has an important impact on cattle and beef markets.
- Characteristics of cattle are also more difficult to observe than for grains, a more uniform product.

Resources

- Information about livestock farming from ISU extension.
- Cattle Markets and the Livestock Crush from Mindy Mallory textbook.

Definitions

- Cattle: Live animal;
- Beef: Meat from cattle;
- Cow: mature female able of producing calves;
- Bull: uncastrated male;
- Calf: young cattle before weaning;
- Weaned calf: calf after being removed from a cow;
- Steer: young male cattle castrated;
- Heiffer: young female, before having a first calf;
- Feeder cattle: cattle ready to be placed on feed in a feedlot;
- Fed/slaughter cattle: cattle ready for *harvest*;
- Boxed beef: beef ready to be sold at retail.

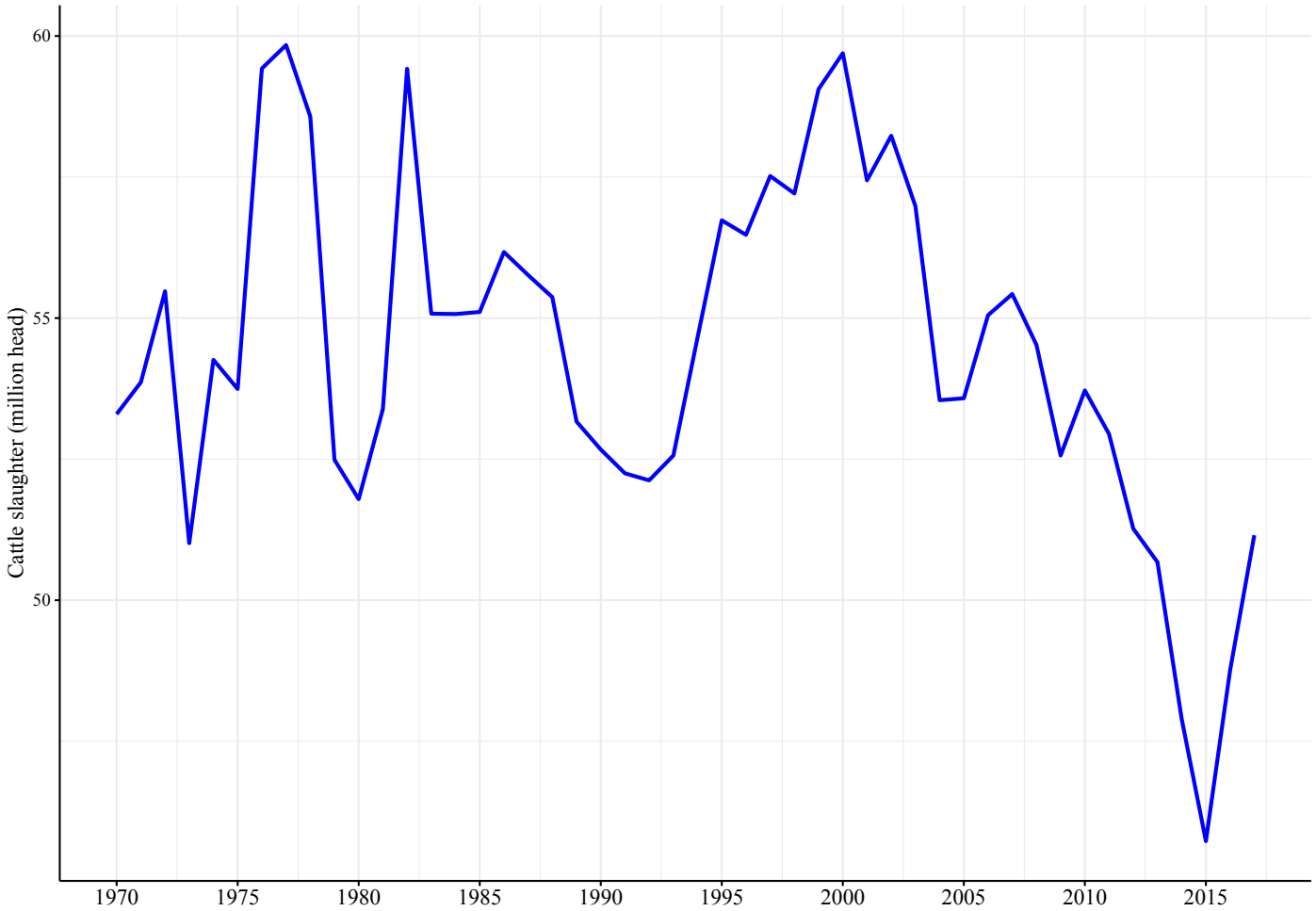
Supply chain I

- Cow-calf operations:
  - Sell weaned calves (6-7 months of age);
  - Usually smaller operations;
  - For example, corn growers diversifying their operation.
- Stocker (spring) - backgrounding (fall):
  - Stockers use pasture;
  - Backgrounders use feeds;
  - Buy weaned calves;
  - Sell feeder cattle (about a year old).
- Feedlots - finishing:
  - Buy feeder cattle;
  - Sell fed/slaughter cattle (18 to 24 months old);
  - Can be very large (over 100,000 heads).

Supply chain II

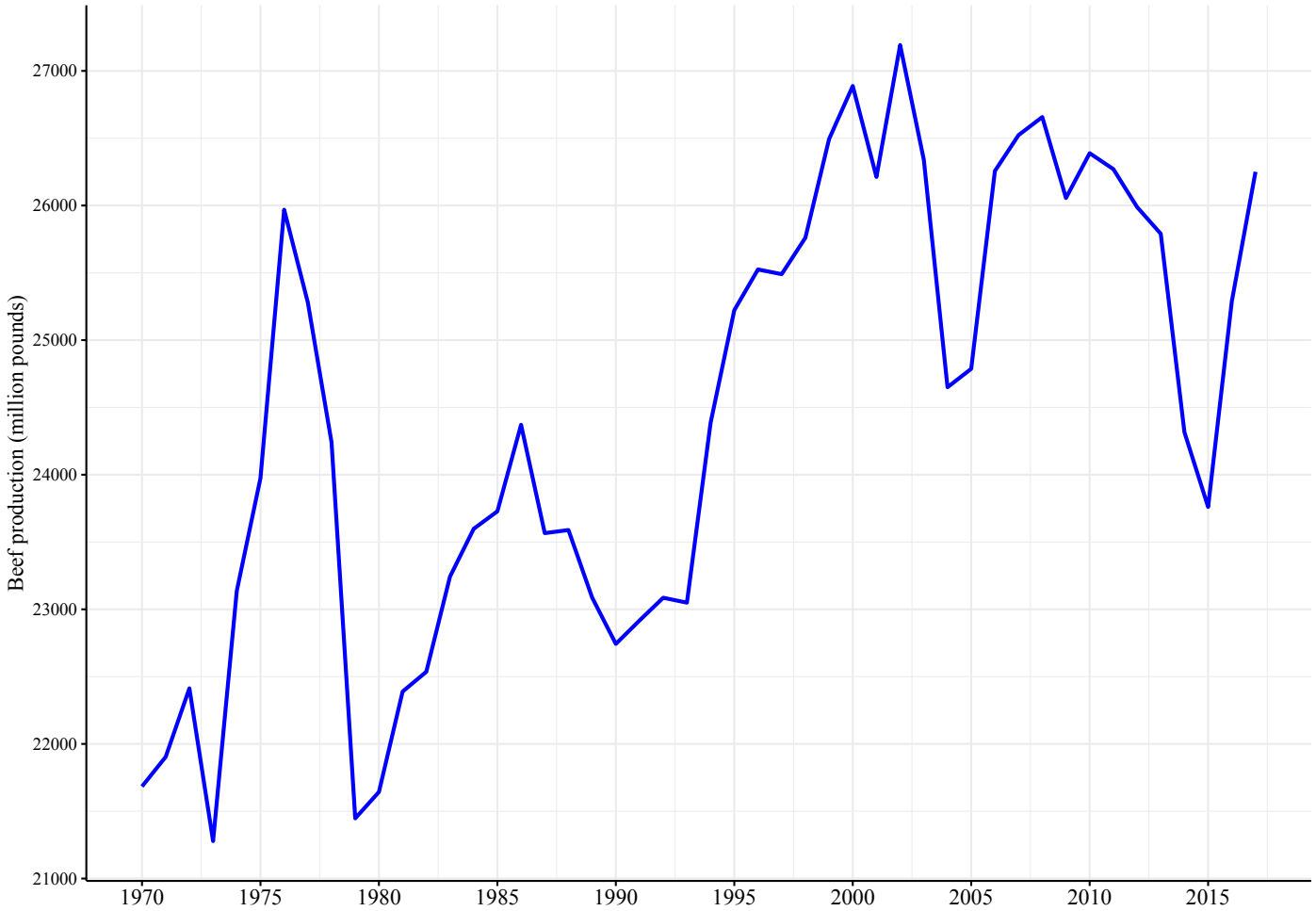
- Packing/slaughter plant:
  - Buy fed cattle;
  - Sell boxed beef.
- Retail/food service:
  - Buy boxed beef;
  - Sell beef to consumers.

Annual commercial steer and heiffer slaughter



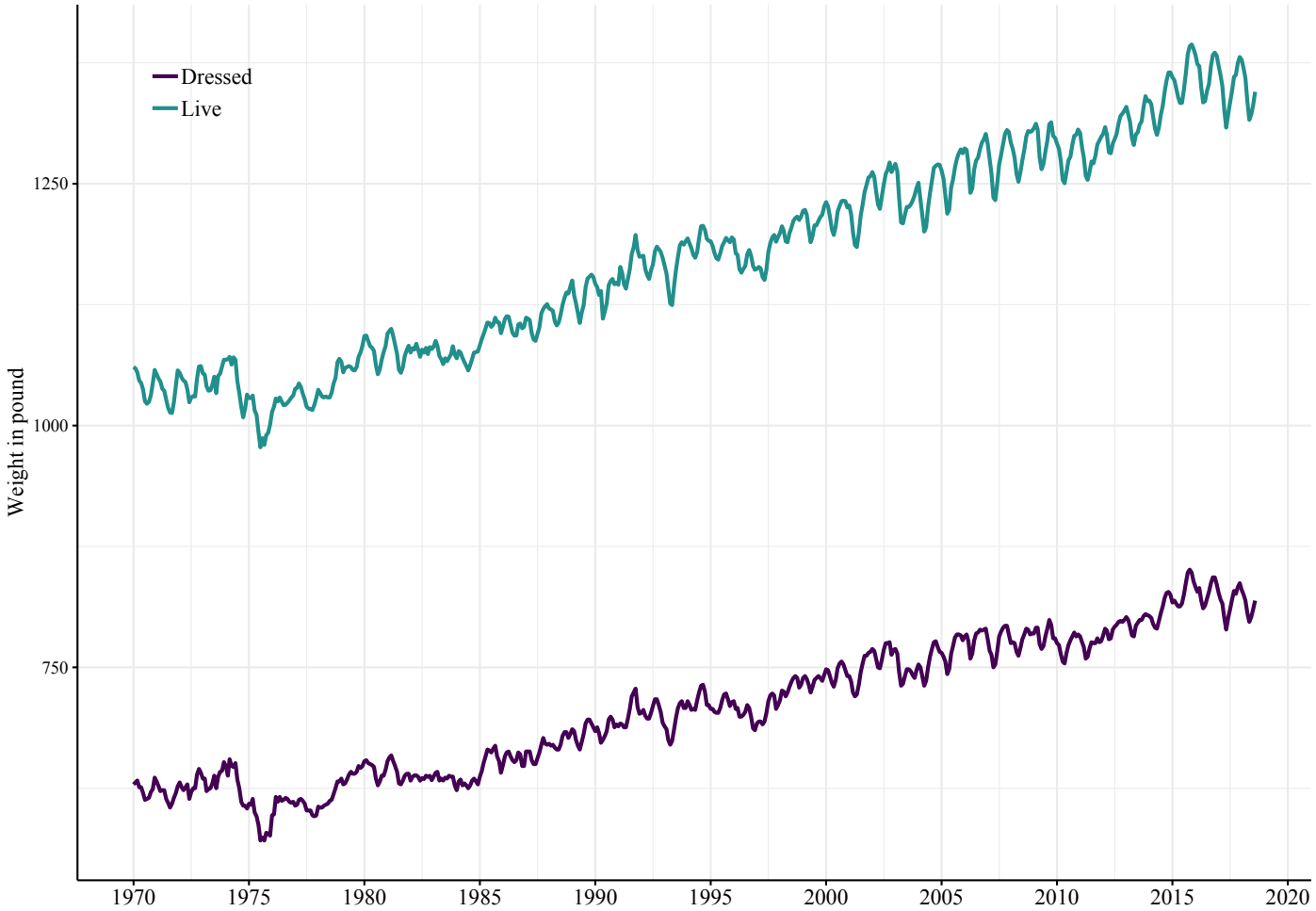
Data source: USDA - Economic Research Service (2018a).

Annual beef production



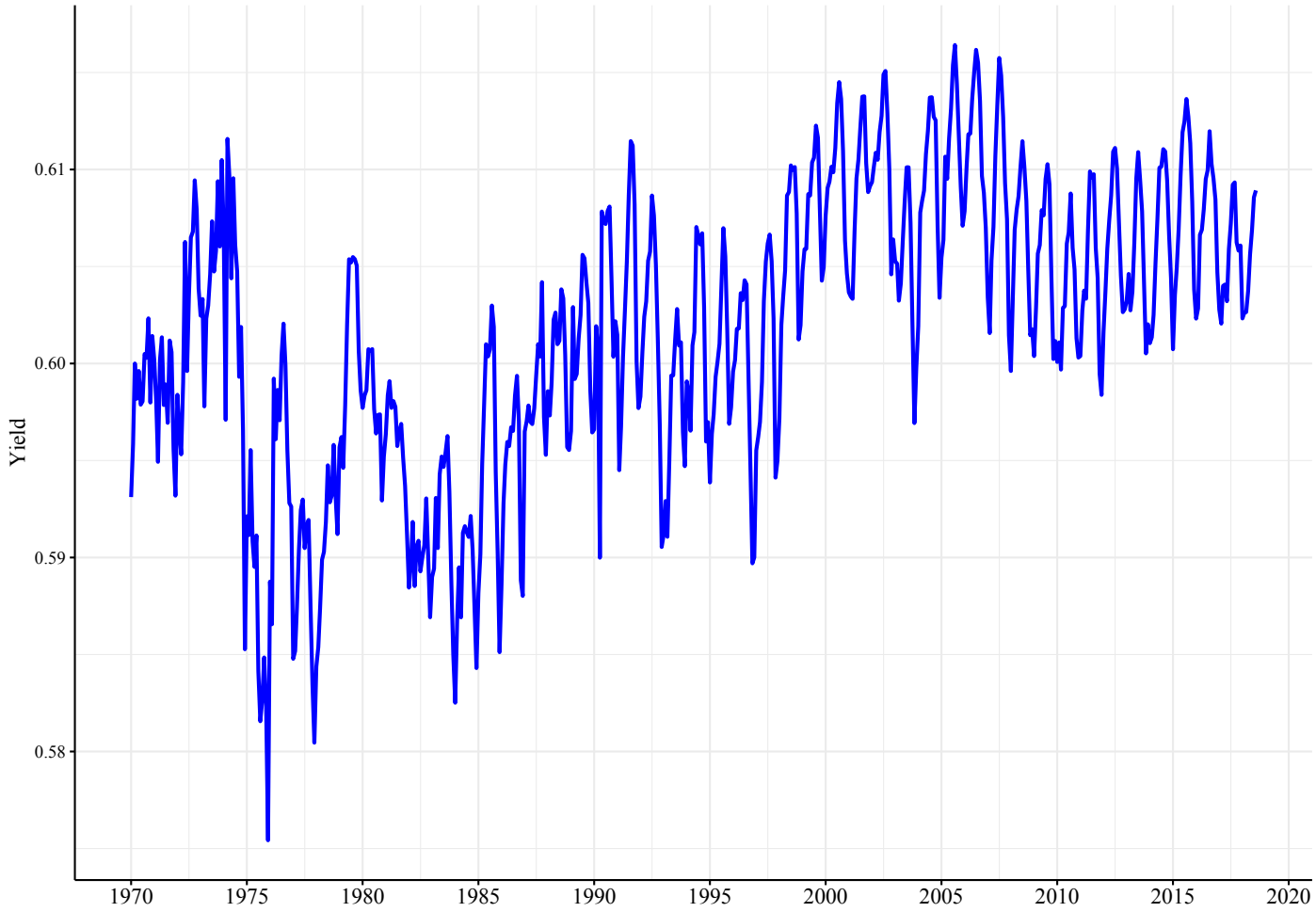
Data source: USDA - Economic Research Service (2018a).

Average live and dressed cattle weight in federally inspected facility



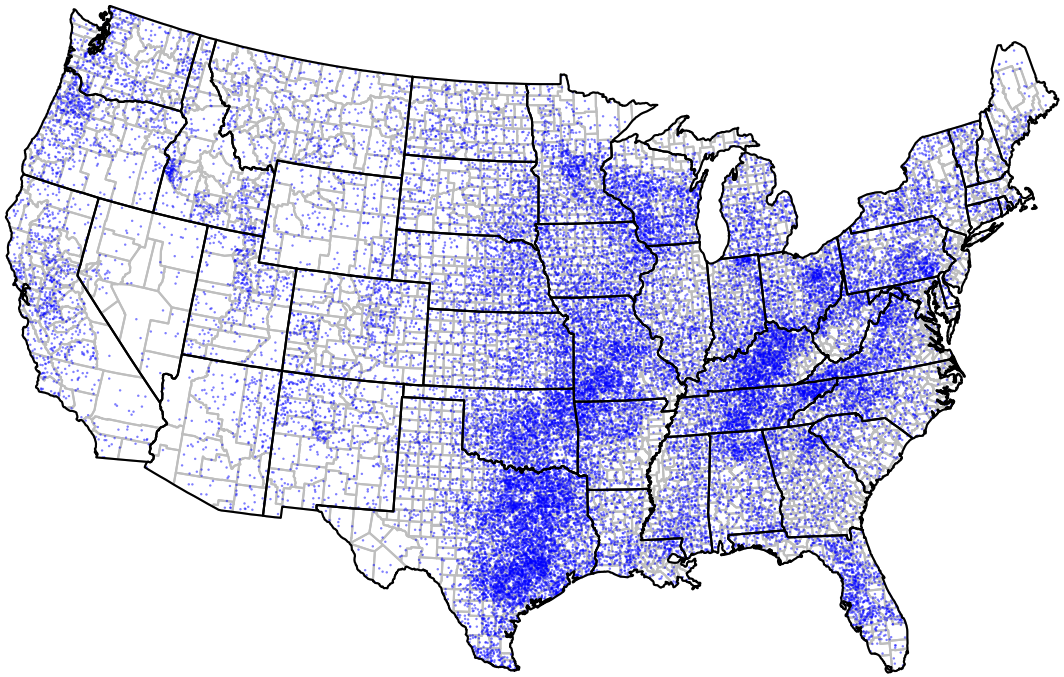
Data source: USDA - Economic Research Service (2018a).

Average carcass yield (live weight/dressed weight)



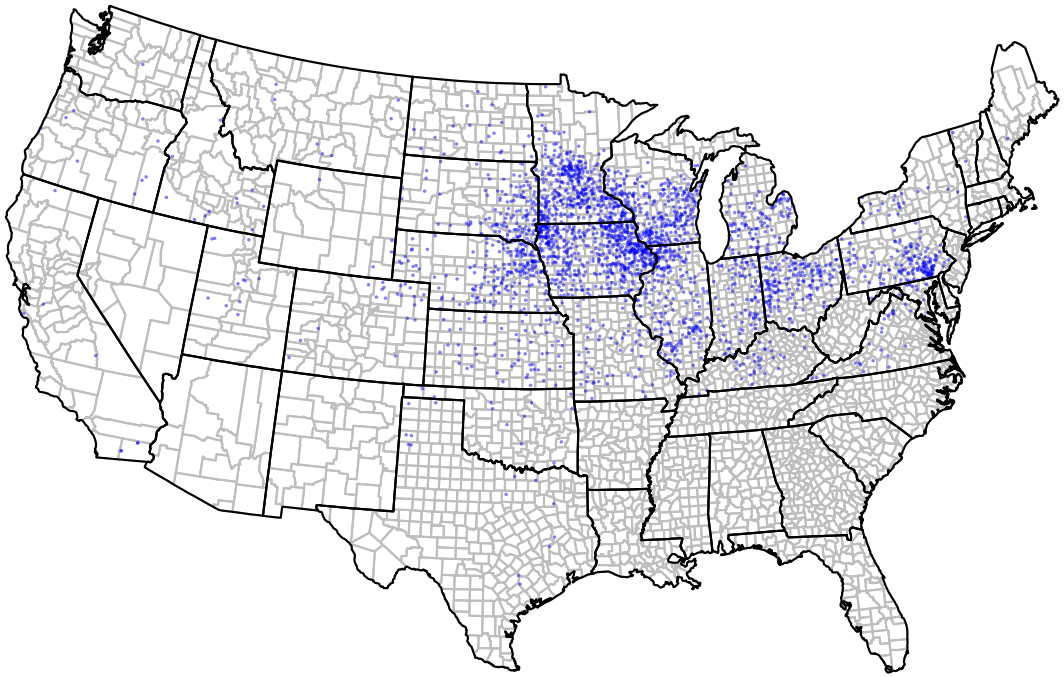
Data source: USDA - Economic Research Service (2018a).

Operations with cattle inventory by county (2012 census of agriculture)



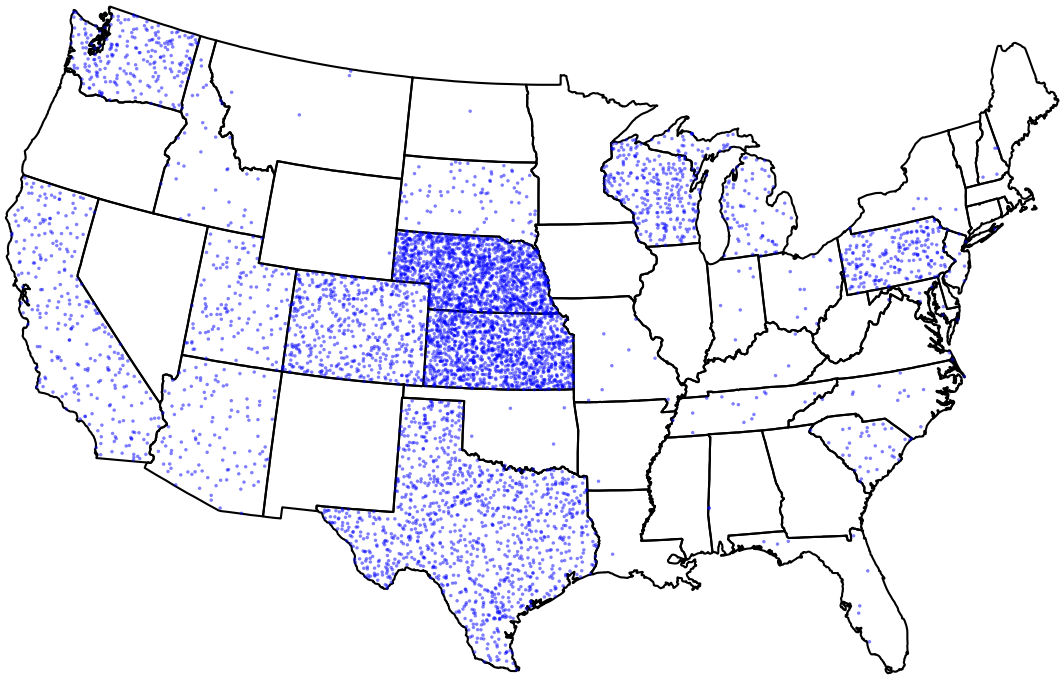
This is a density dot map where each dot represents about 25 operations, randomly located within a county. Data source: USDA - National Agricultural Statistics Service (2018).

Operations with cattle on feed by county (2012 census of agriculture)



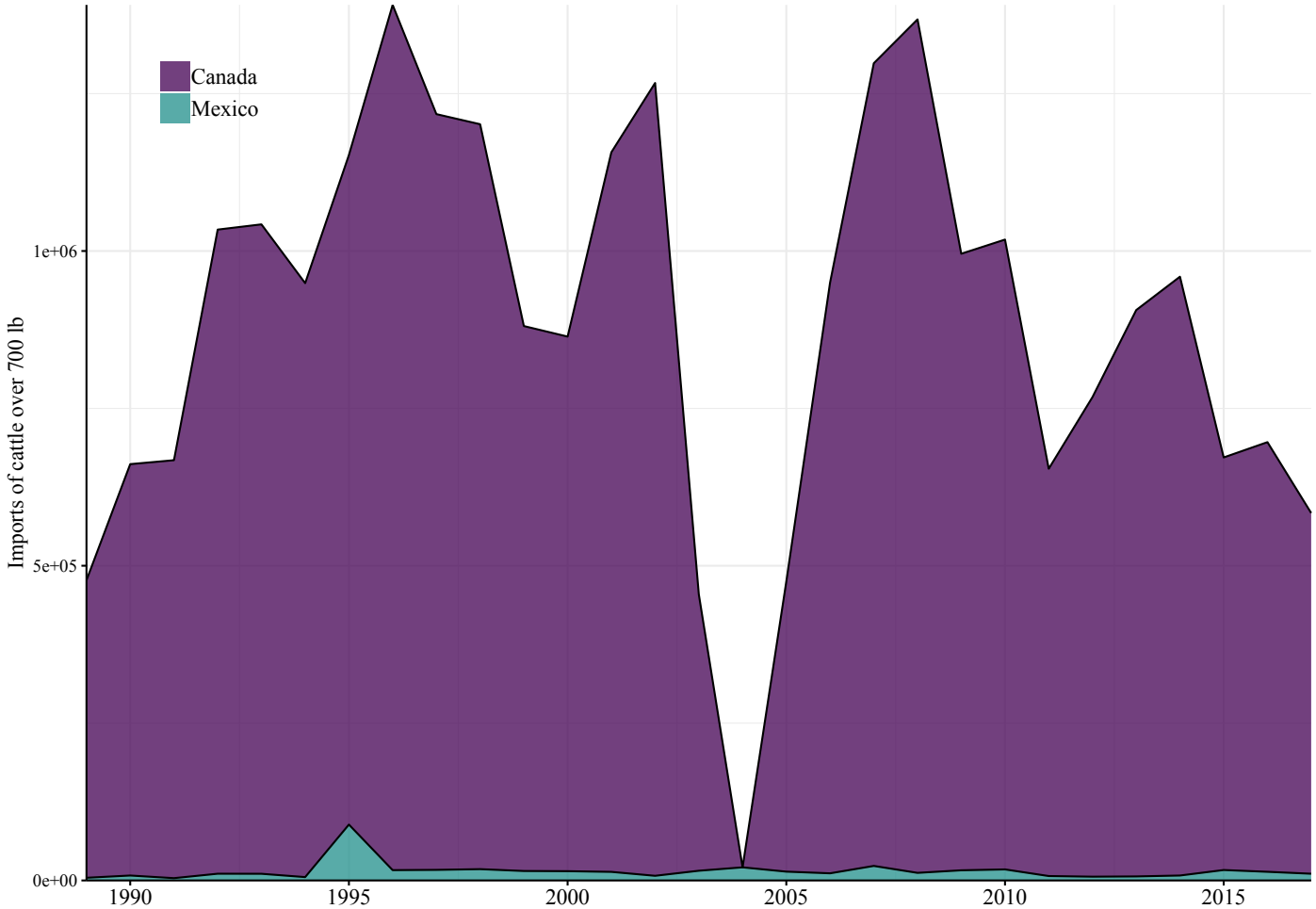
This is a density dot map where each dot represents about 10 operations, randomly located within a county. Data source: USDA - National Agricultural Statistics Service (2018).

Cattle slaughter (500 lb and more) by state (2017)



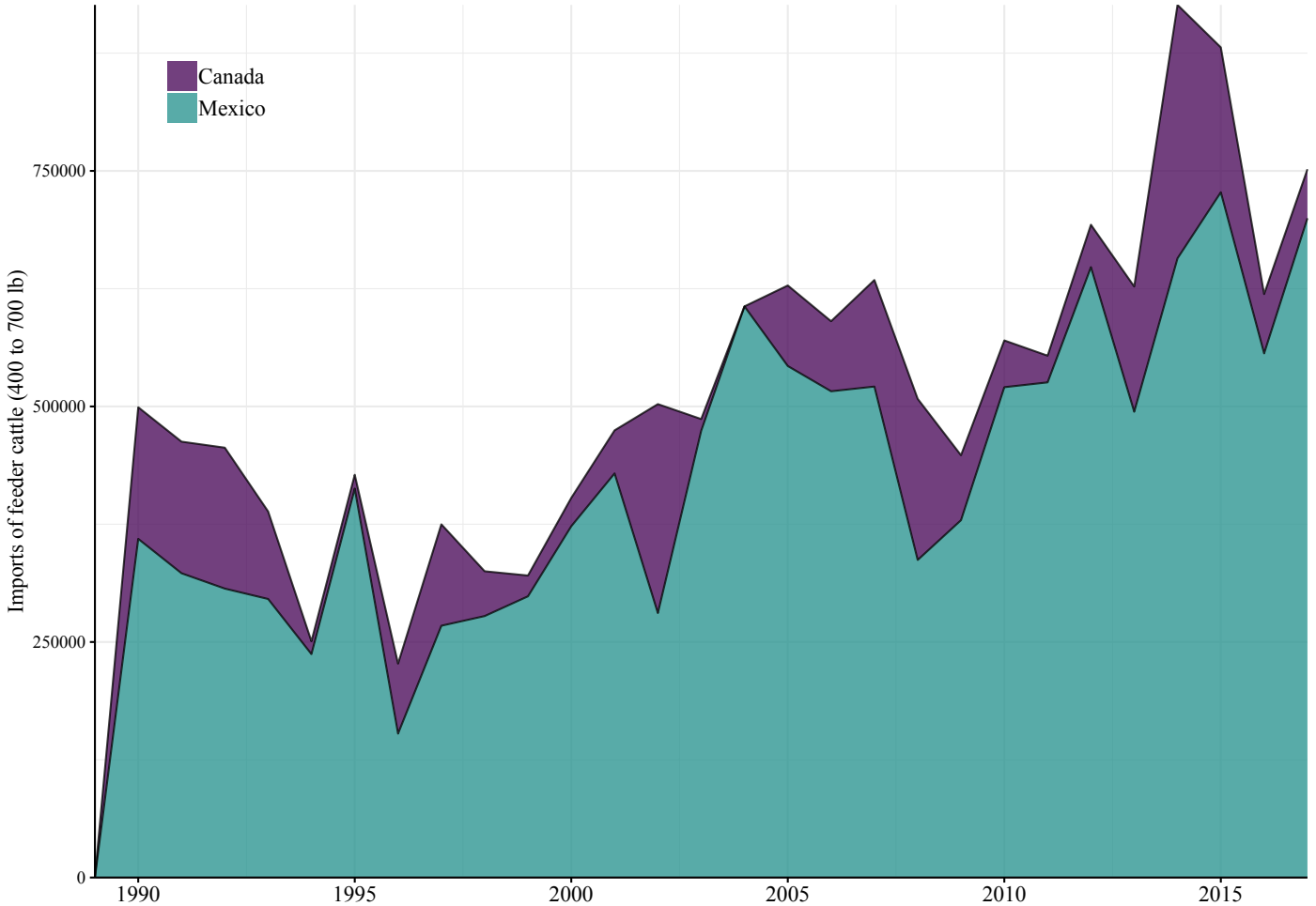
This is a density dot map where each dot represents about 5,000 heads, randomly located within a state. Date source: USDA - National Agricultural Statistics Service (2018).

Annual imports of cattle over 700 lb



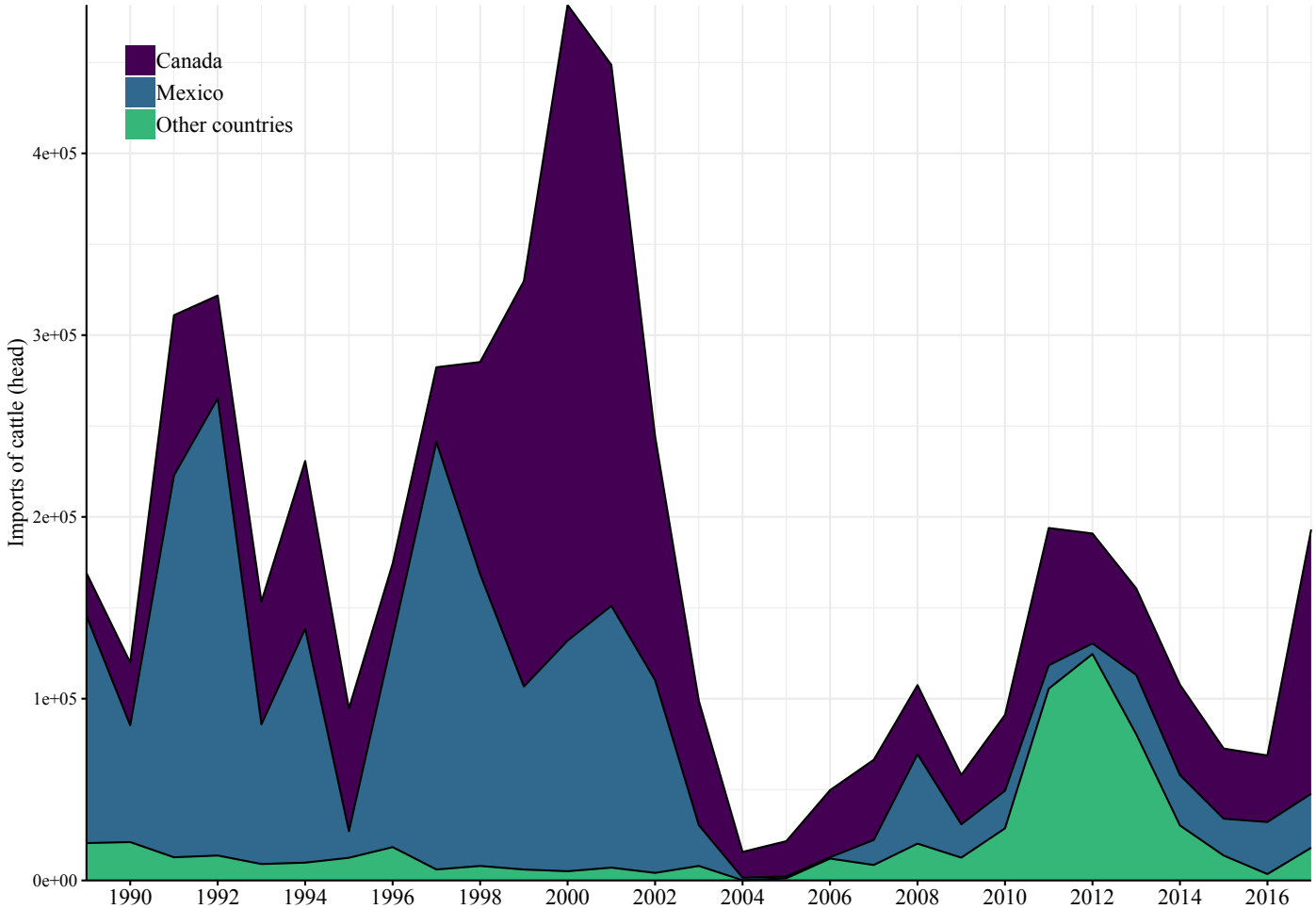
Most are fed cattle for slaughter. Source: USDA - Economic Research Service (2018b).

Annual imports of feeder cattle (400 to 700 lb)



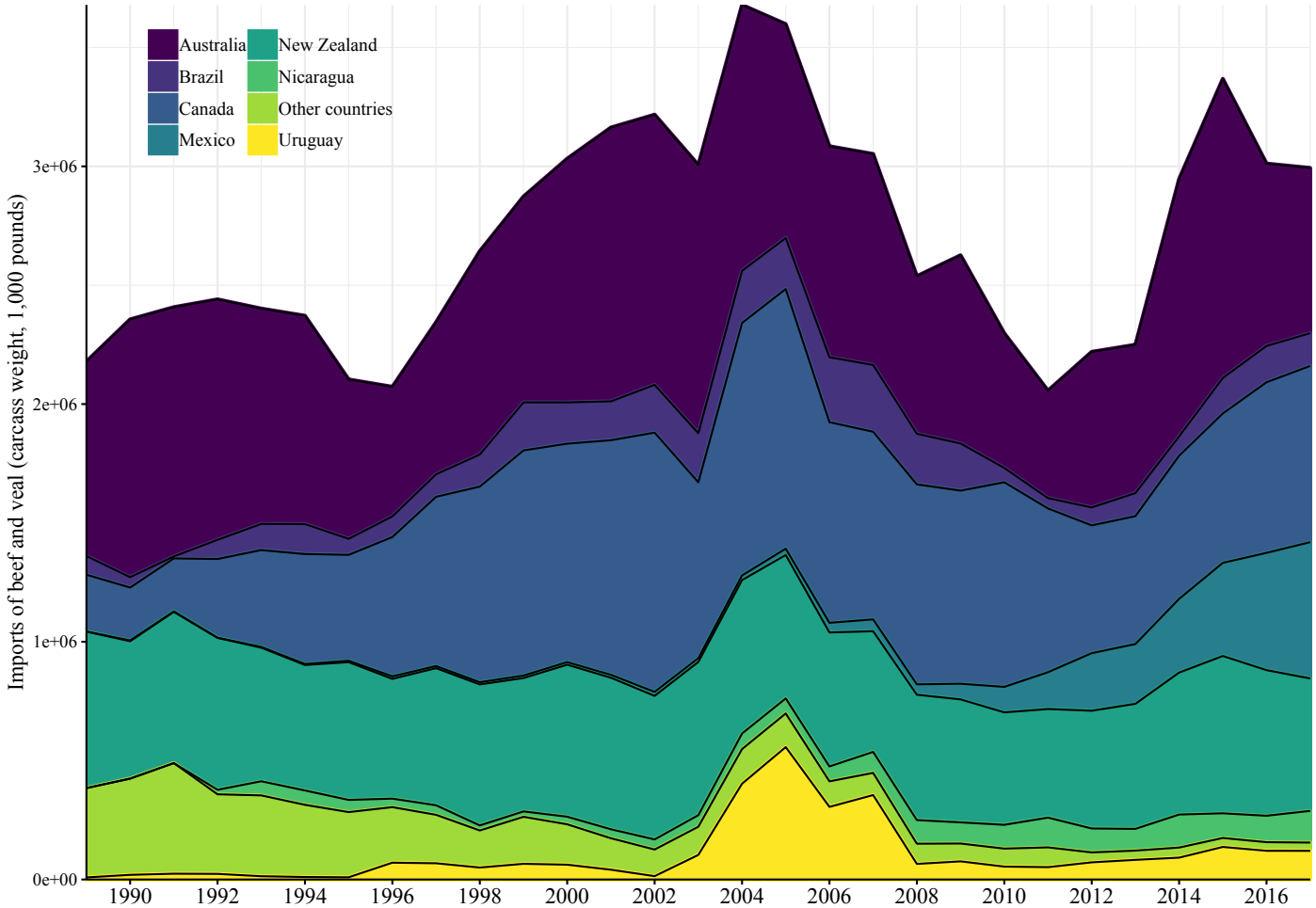
Most are feeder cattle for placement. Data source: USDA - Economic Research Service (2018b).

Annual exports of cattle (all weight)



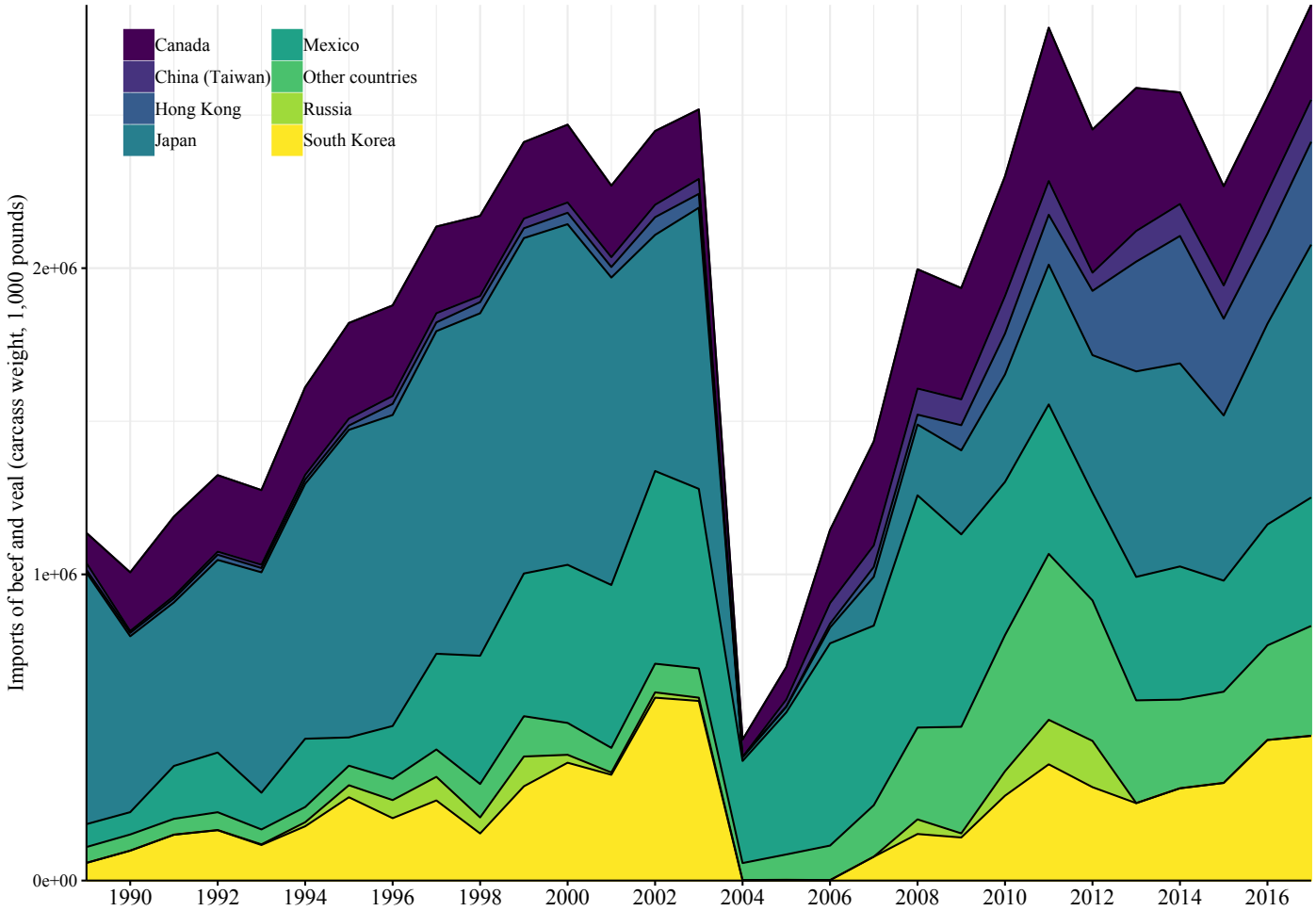
Data source: USDA - Economic Research Service (2018b).

Beef and veal imports (carcass weight, 1,000 pounds)



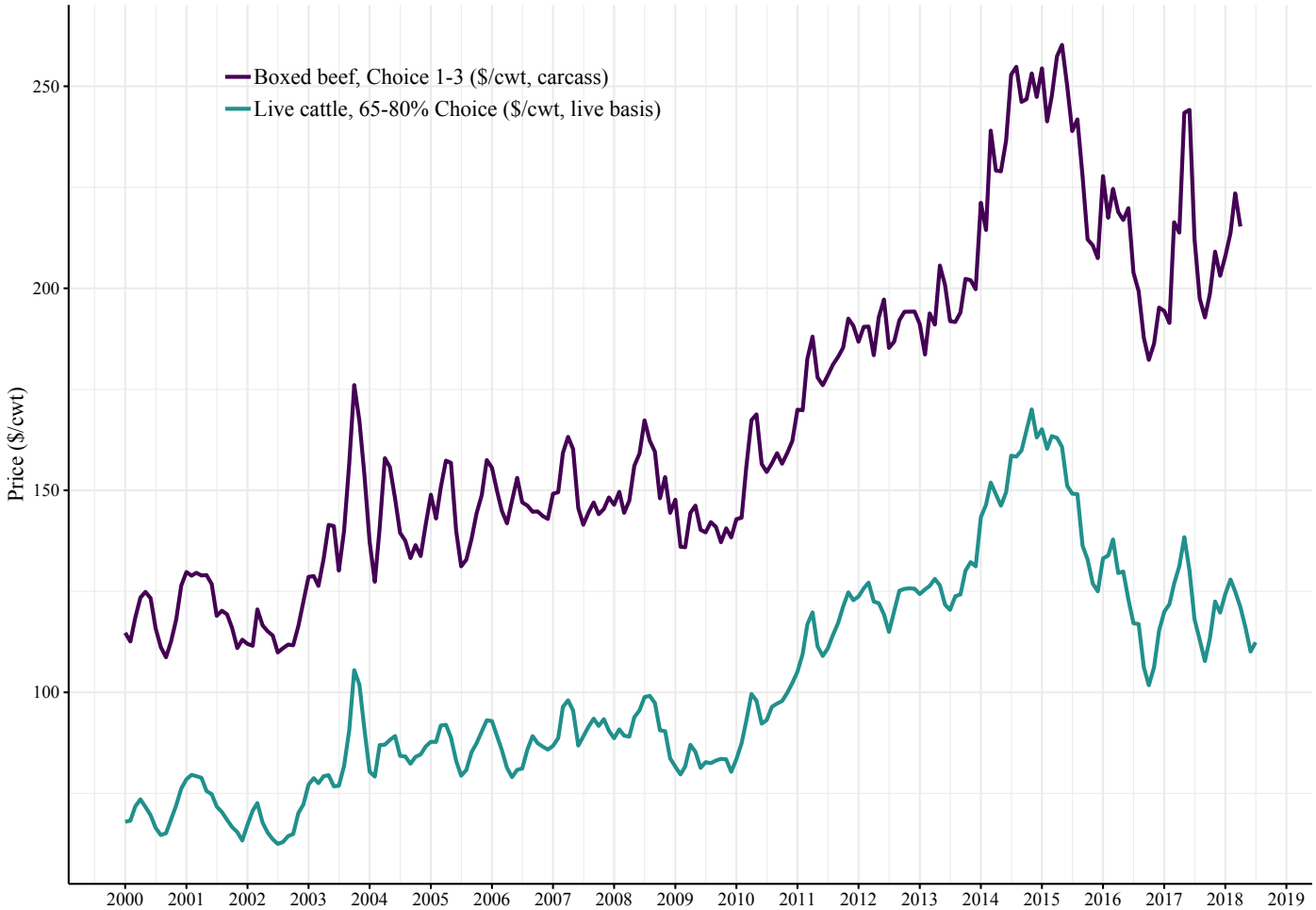
Data source: USDA - Economic Research Service (2018a).

Beef and veal exports (carcass weight, 1,000 pounds)



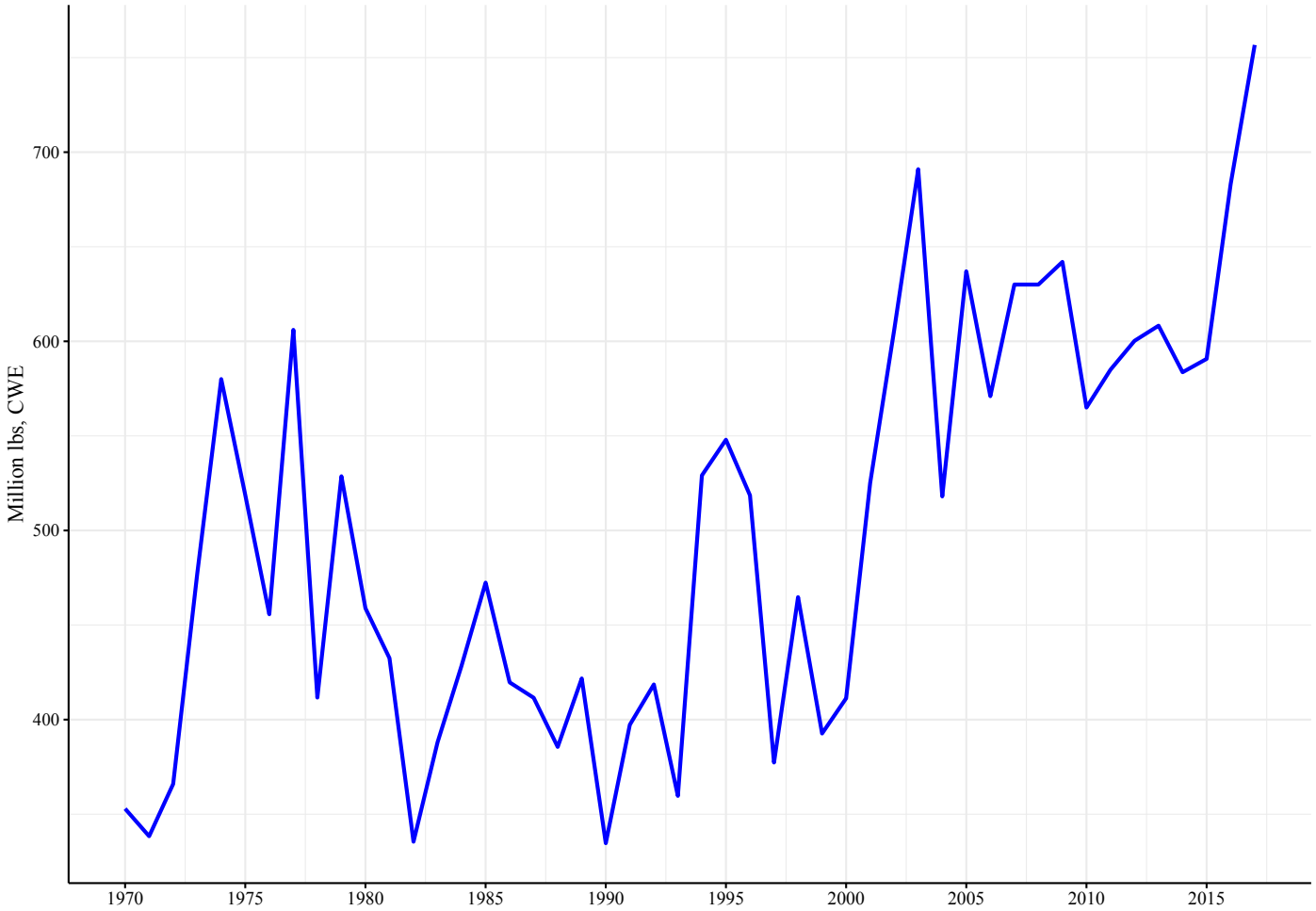
Data source: USDA - Economic Research Service (2018a).

Live cattle price and boxed beef prices



Data source: USDA - Economic Research Service (2018a).

Beginning stocks of beef (Million lbs, CWE)



CWE means Carcass Weight Equivalent. Data source: USDA - Economic Research Service (2018a).

Cattle cycles

- Cattle cycles are expansions and contractions of cattle inventories at regular intervals (see cattle inventory figure below).
- A cycle lasts on average about ten years.
- Cycles occur because of biological nature of cattle production:
  - A heiffer can be bred for the first time at about 15 months.
  - A heiffer will have its first calf about nine months later.
  - It takes between 18 and 24 months between birth and slaughter.

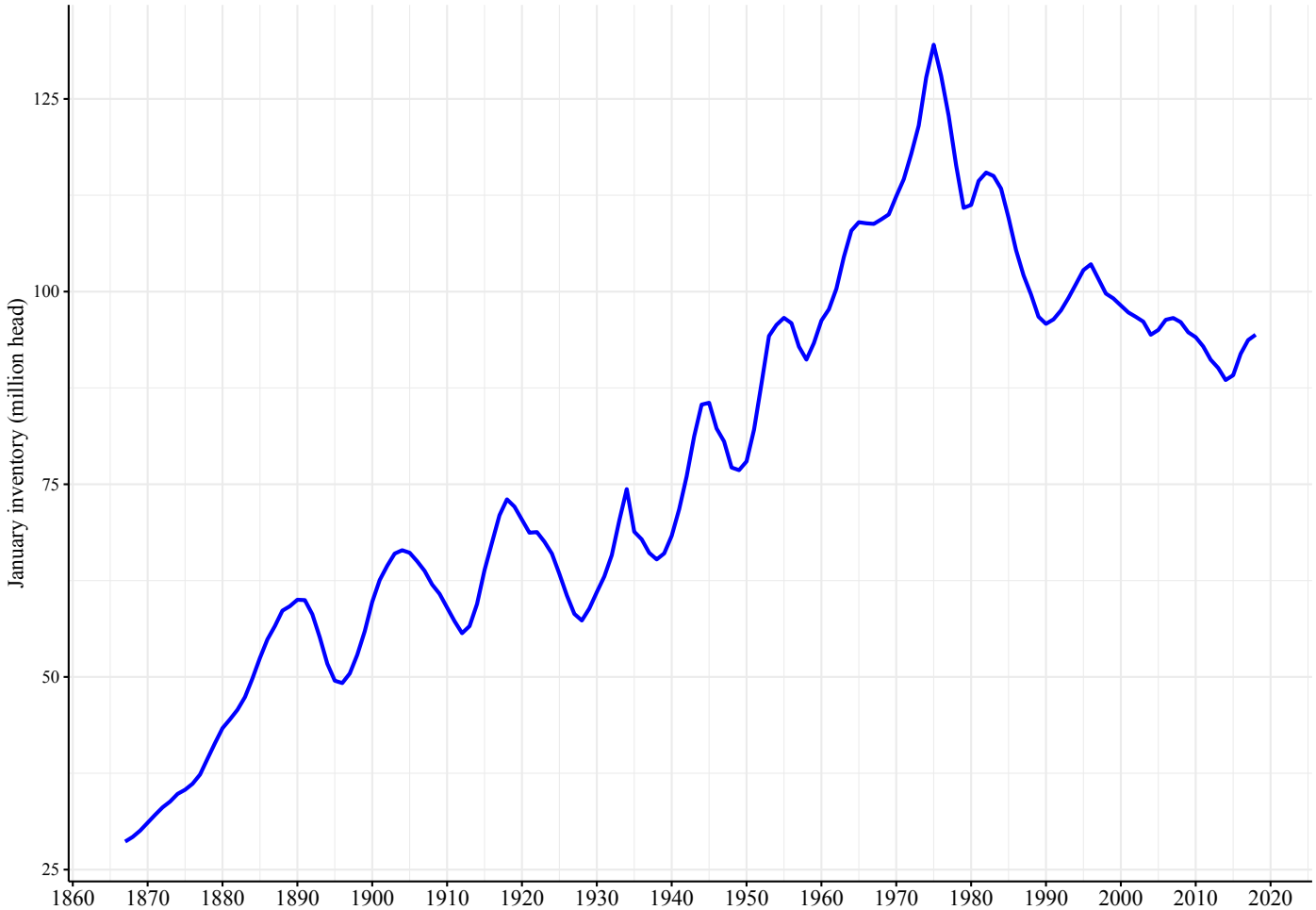
Cattle cycles

- Biological lags cause a delayed response between a market shock and a change in production.
  - For example, if the price of feeder cattle increase, cow-calf producers increase the size of their breeding herd.
  - During the time it takes to increase the breeding herd, the price continues to increase because fewer cattle are sent to slaughter.
  - Expansion continues until the prices for feeder cattle, fed cattle and beef begins declining from the increased production.
  - Cows are productive for about 10 years and producers usually do not cull cows that are still productive.
  - Cow-calf producers reduce the size of their herd by not replacing all of their old cows.
  - Beef cattle then declines and prices start increasing once again, re-starting the cycle.
- Cycles last about ten years because it is the age that most cows are culled.

Cattle cycles

- Cycles contribute to periods of prosperity followed by periods of losses to cattle farmers.
- See for example historial returns in the cattle sector from ISU extension or USDA ERS.

US January cattle inventory (including calves)



Data source: USDA - National Agricultural Statistics Service (2018).

Return to a cow-calf operation in the Heartland

Table 1. Estimated returns to finishing steer calves ($/head), Iowa, by sale month 10-year summary

Month sold	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Avg.
January	-$82.74	-$252.48	-$28.05	$54.04	$2.22	-$334.94	$197.26	$112.01	-$485.07	$30.48	-$78.73
February	-119.33	-270.70	-47.27	38.88	60.81	-87.17	157.22	-6.83	-372.07	107.78	-53.87
March	-169.97	-247.87	49.39	144.45	31.02	-162.57	266.00	-54.18	-276.77	196.98	-22.35
April	-207.68	-104.56	161.88	155.77	-5.84	-188.16	217.08	-37.48	-215.74	299.94	7.52
May	-121.76	-38.14	208.45	44.95	-43.01	-189.85	185.29	-122.57	-130.60	517.12	30.99
June	-108.96	-53.87	148.53	-9.78	-97.92	-224.64	220.99	-222.11	-51.75	369.37	-3.01
July	-74.51	-32.03	140.19	-50.01	-197.34	-259.23	292.35	-281.32	-31.66	153.02	-34.05
August	-67.25	-81.10	129.86	-84.09	-231.99	-216.94	211.47	-267.72	-146.88	41.72	-71.29
September	-155.87	-79.16	111.79	-73.32	-284.94	-183.95	229.69	-357.55	-285.91	-25.91	-110.51
October	-253.20	-90.51	82.73	-74.19	-283.62	-68.93	269.70	-489.62	-374.12	0.03	-128.17
November	-203.31	-111.36	13.50	-52.93	-281.35	-18.88	312.32	-530.85	-202.49	31.13	-104.42
December	-264.80	-101.94	28.28	-6.16	-303.72	42.64	185.22	-549.96	-72.67	-18.52	-106.16
Average	-$152.45	-$121.98	$83.27	$7.30	-$136.31	-$157.72	$228.72	-$234.02	-$220.48	$141.93	-$56.17

During the 2008-2017 period, the range in profits was from -$549.96 to $517.12.

During this period, 35.0 percent of the months were profitable and 65.0 percent of the months were unprofitable.

Month sold	Months of Profit	Months of Loss
January	50%	50%
February	40%	60%
March	50%	50%
April	40%	60%
May	40%	60%
June	30%	70%
July	30%	70%
August	30%	70%
September	20%	80%
October	30%	70%
November	30%	70%
December	30%	70%

Range		Months
Profit over $100	=	22.5%
Profit $80 to $100	=	0.8%
Profit $60 to $80	=	0.8%
Profit $40 to $60	=	4.2%
Profit $20 to $40	=	4.2%
Profit $0 to $20	=	2.5%
Loss $0 to -$20	=	5.0%
Loss -$20 to -$40	=	5.0%
Loss -$40 to -$60	=	5.8%
Loss -$60 to -$80	=	5.8%
Loss -$80 to -$100	=	5.0%
Loss over -$100	=	38.3%

The assumptions used in computing the returns are outlined in the Iowa State University Extension and Outreach Estimated Livestock Returns at www.econ.iastate.edu/estimated-returns/.

Source: Schulz (2018).

Cattle marketing (i.e. selling cattle)

- Farmers can use different methods to market feeder cattle and fed cattle.
- Each method has its advantages and disadvantages.
- Methods that we will cover are:
  - Public markets;
  - Direct sales;
  - Hybrid markets.

Cattle marketing: public markets

- Public markets include terminal markets and auction markets.
- Both fed and feeder cattle are sold in public markets.
- Terminal markets:
  - Almost no longer existent;
  - Terminals were located near railways;
  - Cattle are brought into stockyards;
  - Sale occurs through a commission agent;
  - Seller receives the sale price minus charges for the stockyard and the agent.

Cattle marketing: public markets

- Auction markets:
  - Common sale method with many auction facilities around the country;
  - Cattle are brought to an auction facility;
  - Cattle sold by public/competitive bidding;
  - No commission agent is involvedl;
  - Auction can occur live or electronically (video);
  - Buyer receives the price minus a fixed or percentage charge.

Cattle marketing: direct sales

- Producers sell directly to downstream buyers.
- Both fed and feeder cattle are sold in direct sales.
- Seller is more involved in the sale of cattle.
- No need to move cattle to an intermediate location.
- Can build long run relationship.
- Predetermined pricing method:
  - Price can be based on live weight or carcass weight.
  - A based price can be determined using a formula or negotiated.

Cattle marketing: hybrid markets

- Growing marketing method.
- Cattle are videod at the farm.
- Bidding and sales occur through electronic auctions.
- No need to move cattle to an intermediate location.
- More difficult to observe quality.

Price of feeder cattle

- The price of feeder cattle is determined at the intersection of demand and supply.
- Costs of cow-calf and stocker operations affect the supply of feeder cattle.
- Many factors affect the demand for feeder cattle:
  - Feeding costs at feedlots (e.g. cost and other feeds);
  - Costs at packing plants (e.g. labor costs);
  - Domestic consumer demand (e.g. income, price of substitute products);
  - International consumer demand (e.g. trade agreements. competition from other countries, exchange rate, tariffs).
- Characteristics of a feeder cattle (e.g. breed, weight, color) explain difference in prices across cattle.

Price of fed cattle

- The price of fed cattle is determined at the intersection of demand and supply.
- Costs of feedlots affect the supply of fed cattle:
  - Includes the cost of feeder cattle;
  - Cost of feed (e.g. corn).
- Many factors affect the demand for fed cattle:
  - Costs at packing plants (e.g. labor costs);
  - Domestic consumer demand (e.g. income, price of substitute products);
  - International consumer demand (e.g. trade agreements, competition from other countries, exchange rate, tariffs).
- Characteristics of a fed cattle (e.g. breed, weight, color) explain difference in prices across cattle.

Cattle prices

- Throughout the supply chain, the characteristics of cattle will affect their prices.
- Quality is difficult to observe for cattle but plays a big role in pricing cattle.
- Charactersitics of cattle matter because the quality of the beef output depends on those characteristics.
- Some characteristics that affect beef quality include
  - Breed;
  - Sex;
  - Age;
  - Weight.

Pricing fed cattle in direct sales

- Visual inspection of a live cattle can give an idea of meat quality but is not always accurate.
- Direct sales can include provisions to take into account the quality of the beef output.
- The final price is not determined at the sale of live cattle but rather after grading of the carcass.
- Three options possible:
  1. Live weight pricing;
  2. Carcass or dressed weight pricing considers carcass weight;
  3. Dressed weight and grade or grade and yield pricing considers both the yield and quality of the meat.
- Sales of fed cattle other than direct sales are live weight.

Pricing fed cattle in direct sales

1. Live weight:
   - Only considers live weight (on the hoof);
   - Price determined using a formula (e.g. using an average price or the futures prices) or negotiated before delivery;
   - Weighing conditions matter;
   - Potential yield and quality are estimated by observing live cattle;
   - Seller does not have to wait for grading before knowing the final price;
   - Buyer (packer) assumes yield and quality risk.
     - ★ Moral hazard may cause a discounted price compared to other selling methods.

Pricing fed cattle in direct sales

2. Carcass weight
   - The price is based on carcass weight;
   - Price determined using a formula (e.g. using an average price or the futures prices) or negotiated before delivery;
   - Seller assumes yield risk;
   - Buyer (packer) assumes quality risk.

Pricing fed cattle in direct sales

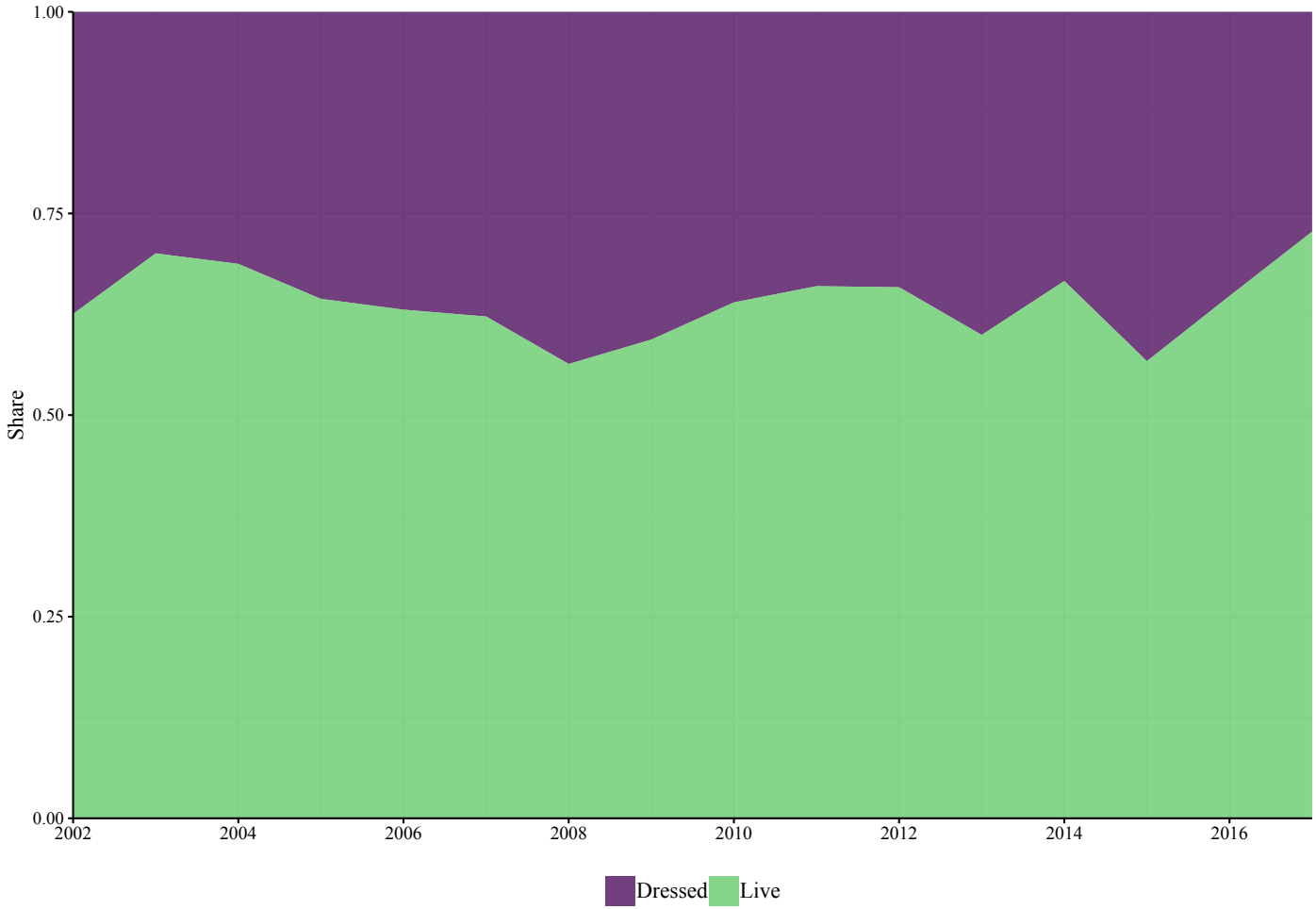
3. Dressed weight and grade
   - The price is based on carcass weight and quality;
   - Each carcass is evaluated and priced individually;
   - Premia and discounts are negotiated before delivery;
   - Base price is either negotiated or based on a formula;
     - ★ Formula pricing can set the base price considering the average cattle price in the prior week, market reports, boxed beef cutout value or futures market prices.
   - Seller assumes yield and quality risk.

Moral hazard in live versus carcass pricing I

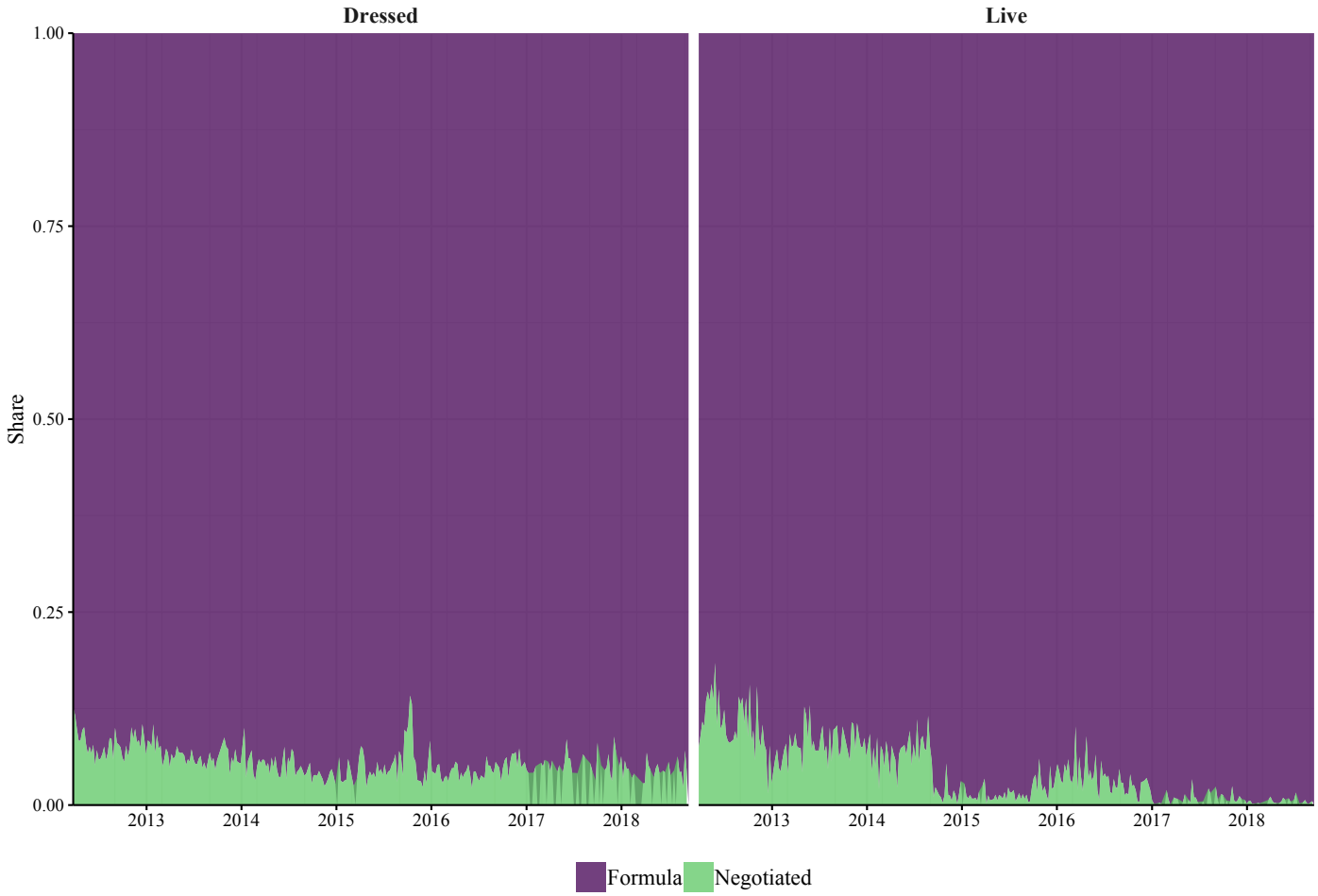
- If you are a cattle producer and know that your cattle are of lower quality, you will try to hide that from the buyer.
  - Sell lower quality cattle priced based on live weight.
- If you have high quality cattle you will try to show the high value of your cattle.
  - More likely to have high quality cattle priced based on carcass weight or dressed weight and grade.
- Buyers are well aware of that.
  - Buyers will discount the price of live cattle because they expect them to be lower quality.
  - Live cattle pricing more often used in the south because they grow lower quality breeds.
  - Long horn in the south versus angus in the north.
  - Some cattle imported from Mexico have zebu in them.
- This is an example of moral hazard where buyers discount the price of a good for which they cannot observe the quality.
  - The classic example is the market for lemons (i.e. low quality cars).

5 area markets - live vs. dressed weight (all fed cattle sales)

- The 5 markets are 1) Texas, Oklahoma & New Mexico, 2) Kansas, 3) Nebraska, 4) Colorado and 5) Iowa & Minnesota.



5 area markets - direct sales - negotiated versus formula



Carcass grading

- Carcass are graded based on the expected quality of beef and meat yield.
- This is a voluntary service offered by the USDA for which processors pay.
- It is different than inspection for wholesomeness which is mandatory and paid from public fund.
  - If a plant does not follow the proper mandated food safety practices an inspector can shut down a plant until it demonstrates compliance.
- See definitions of yield and grades at this link: https://www.ams.usda.gov/grades-standards/carcass-beef-grades-and-standards.

Yield grades

- A higher yield carcass produces more meat to sell at retail.

1. YG 1: carcass has the highest expected yield of retail cuts.
2. YG 2:
3. YG 3:
4. YG 4:
5. YG 5: carcass has the lowest expected yield of retail cuts.

Quality grades

- Higher quality means tastier beef.

1. Prime: highest quality, has the most marbling.
2. Choice:
3. Select:
4. Standard: Lowest quality, least amount of marbling.
5. Commercial: Older cattle.
6. Utility:
7. Cutter:
8. Canner: My dog would still love it.

Mandatory price reporting (MPR)

- Negotiated prices have become much less common.
- Congress passed a law in 1999 to adress concerns about lack of public disclosure of transaction prices.
- Price discovery becomes difficult if there is no public data about prices.
- Secrecy also favors abuse of market power, which is a real concern in a concentrated market such as beef packing.
- See rulemaking for MPR at USDA - Agricultural Marketing Service (2018).
- Mathews et al. (2015) shows the impact of MPR on markets.
- MPR data are available at https://mpr.datamart.ams.usda.gov/.

References I

Mathews, K., Brorsen, W., Hahn, W. F., Arnade, C., and Dohlman, E. (2015). Mandatory price reporting, market efficiency, and price discovery in livestock markets. *USDA Economic Research Service Report LDPM-254-01*.

Schulz, L. (2018). Livestock – cost & return. Available at https://www.extension.iastate.edu/agdm/ldcostsreturns.html.

USDA - Agricultural Marketing Service (2018). Livestock mandatory price reporting. Available at https://www.ams.usda.gov/rules-regulations/mmr/lmr.

USDA - Economic Research Service (2018a). Livestock & meat domestic data. Available at https://www.ers.usda.gov/data-products/livestock-meat-domestic-data/.

References II

USDA - Economic Research Service (2018b). Livestock and meat international trade data. Available at https://www.ers.usda.gov/data-products/livestock-and-meat-international-trade-data/.

USDA - National Agricultural Statistics Service (2018). Quick stats. Available at http://quickstats.nass.usda.gov/.