

# Livestock - cattle

Econ 235

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- 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.

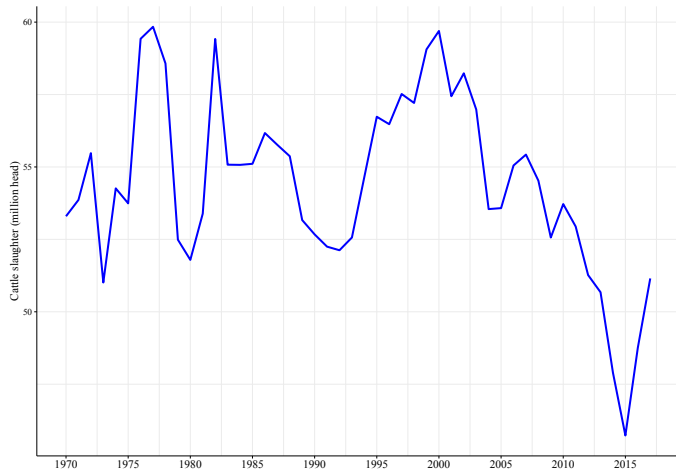
- [Information about livestock farming](#) from ISU extension.
- [Cattle Markets and the Livestock Crush](#) from Mindy Mallory textbook.

- 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.

- 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).

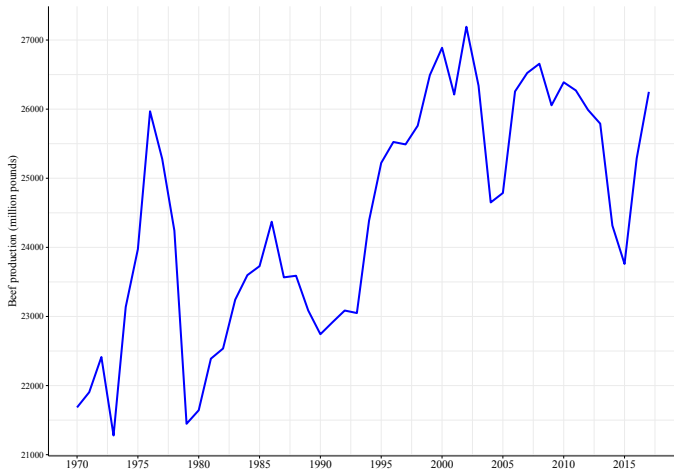
- Packing/slaughter plant:
  - ▶ Buy fed cattle;
  - ▶ Sell boxed beef.
- Retail/food service:
  - ▶ Buy boxed beef;
  - ▶ Sell beef to consumers.

# Annual commercial steer and heifer slaughter



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

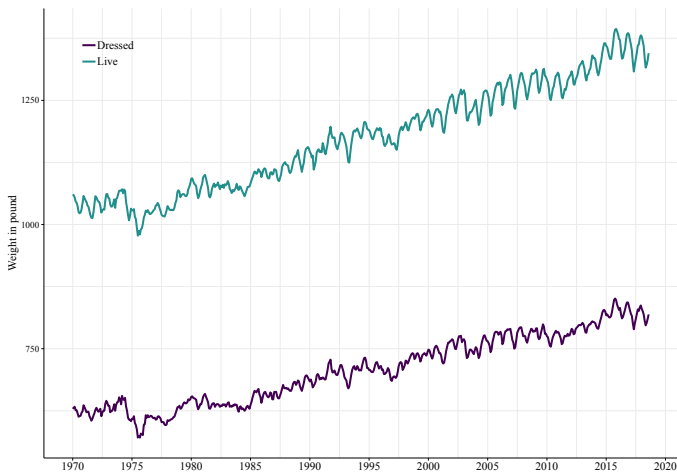
# Annual beef production



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

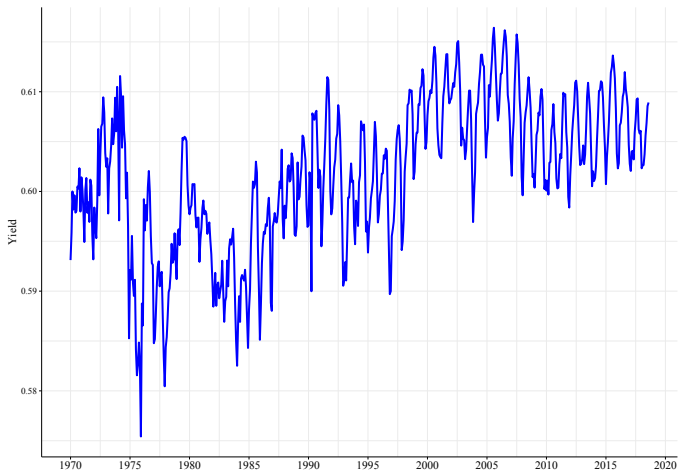


# Average live and dressed cattle weight in federally inspected facility



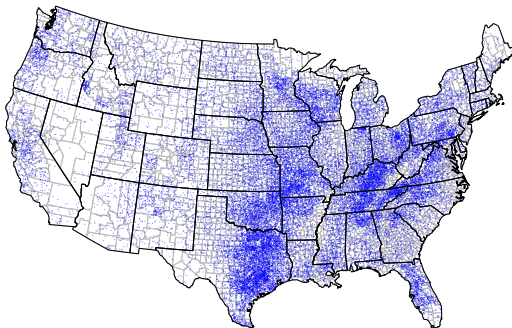
Data source: USDA - Economic Research Service (2018a).

# Average carcass yield (live weight/dressed weight)



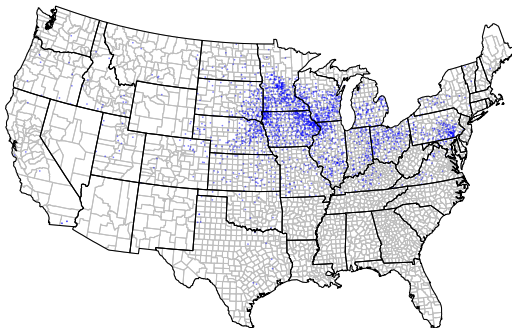
Data source: USDA - Economic Research Service (2018a).

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



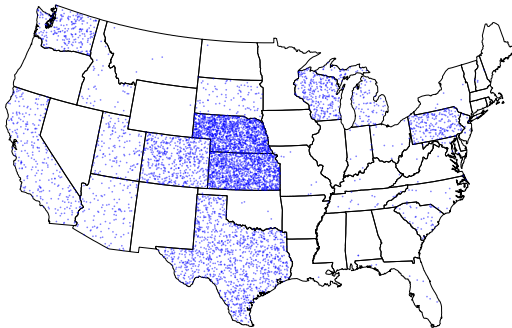
This is a density dot map where each dot represents about 25 operations, randomly located within a county. Data source: USDA - National Agricultural Statistics Service (2018).

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



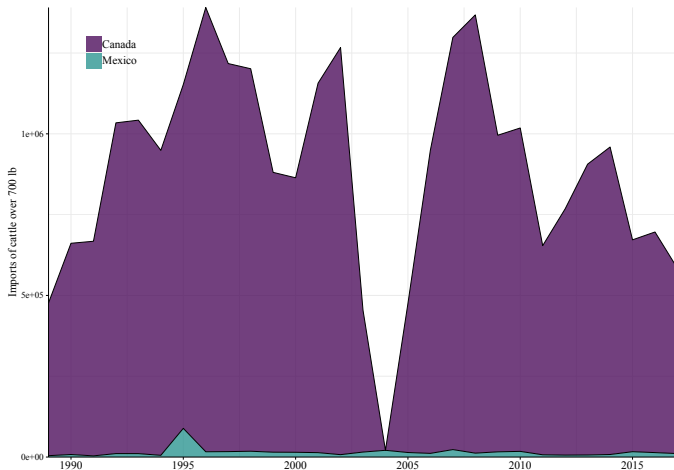
This is a density dot map where each dot represents about 10 operations, randomly located within a county. Data source: USDA - National Agricultural Statistics Service (2018).

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



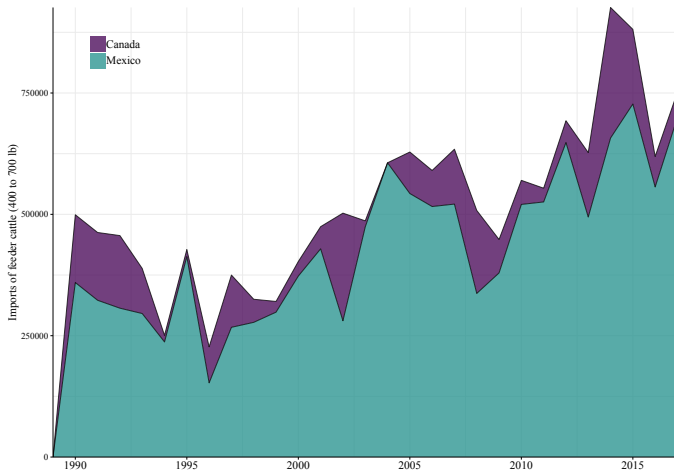
This is a density dot map where each dot represents about 5,000 heads, randomly located within a state. Date source: USDA - National Agricultural Statistics Service (2018).

# Annual imports of cattle over 700 lb



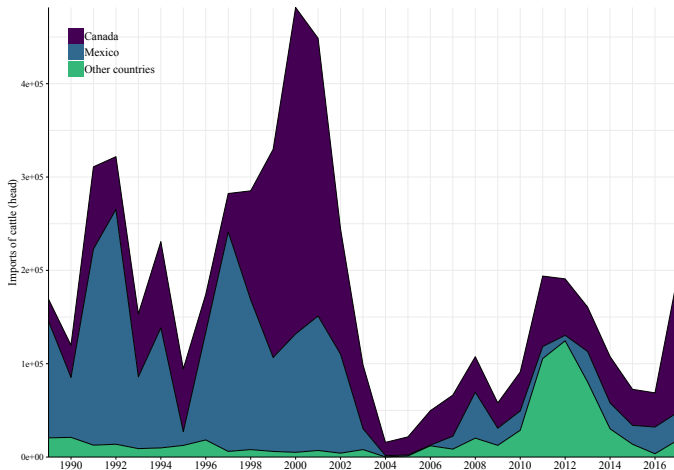
Most are fed cattle for slaughter. Source: USDA - Economic Research Service (2018b).

# Annual imports of feeder cattle (400 to 700 lb)



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

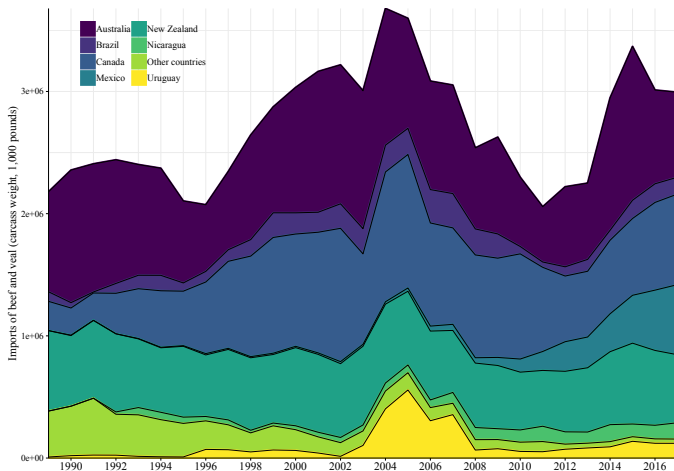
# Annual exports of cattle (all weight)



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

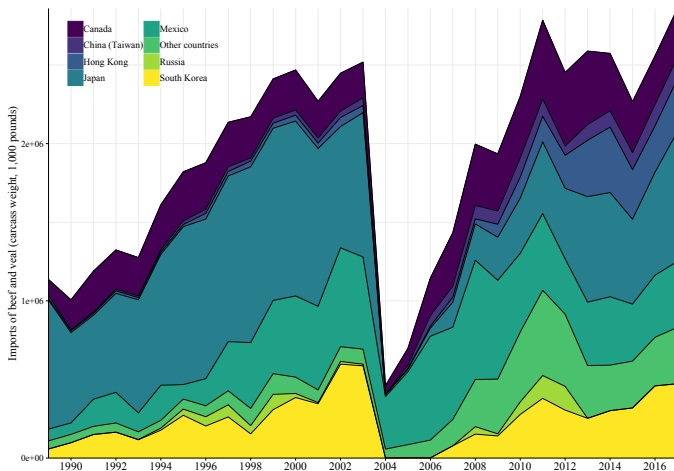


# Beef and veal imports (carcass weight, 1,000 pounds)



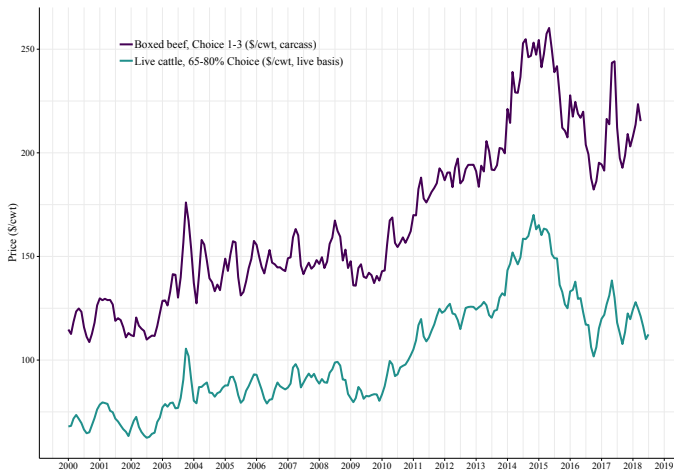
Data source: USDA - Economic Research Service (2018a).

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



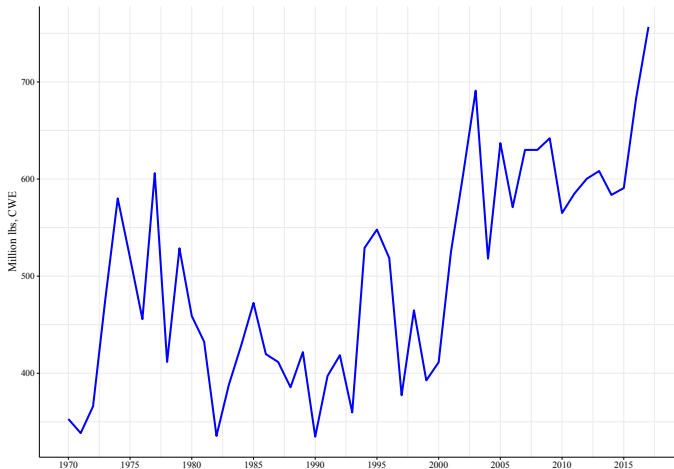
Data source: USDA - Economic Research Service (2018a).

# 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).

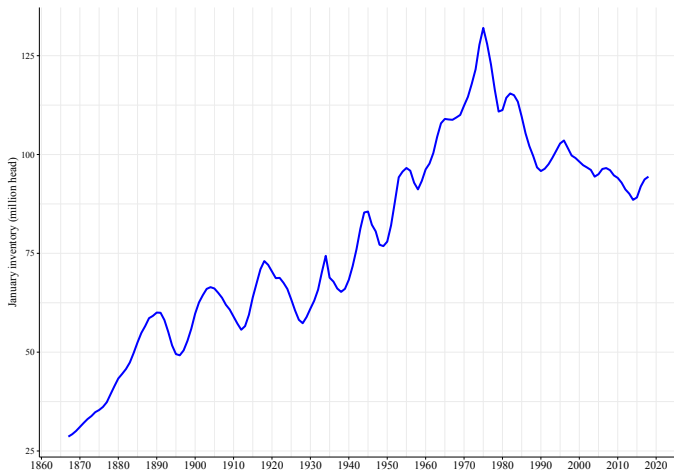
- Cattle cycles are expansions and contractions of cattle inventories at regular intervals (see cattle inventory figure below).
- A cycle lasts on average about ten years.
- Cycles occur because of biological nature of cattle production:
  - ▶ A heifer can be bred for the first time at about 15 months.
  - ▶ A heifer 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.

- 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

	Month sold	Months of		Range	Months
		Profit	Loss		
During the 2008-2017 period, the range in profits was from -\$549.96 to \$517.12.	January	50%	50%	Profit over \$100	= 22.5%
	February	40%	60%	Profit \$80 to \$100	= 0.8%
	March	50%	50%	Profit \$60 to \$80	= 0.8%
	April	40%	60%	Profit \$40 to \$60	= 4.2%
	May	40%	60%	Profit \$20 to \$40	= 4.2%
During this period, 35.0 percent of the months were profitable and 65.0 percent of the months were unprofitable.	June	30%	70%	Profit \$0 to \$20	= 2.5%
	July	30%	70%	Loss \$0 to -\$20	= 5.0%
	August	30%	70%	Loss -\$20 to -\$40	= 5.0%
	September	20%	80%	Loss -\$40 to -\$60	= 5.8%
	October	30%	70%	Loss -\$60 to -\$80	= 5.8%
	November	30%	70%	Loss -\$80 to -\$100	= 5.0%
	December	30%	70%	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/](http://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.

- 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.

- 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 involved;
- ▶ 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 videoed at the farm.
- Bidding and sales occur through electronic auctions.
- No need to move cattle to an intermediate location.
- More difficult to observe quality.

- 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.

- 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.



- 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.
- Characteristics 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.

## 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.
  - ★ Adverse selection may cause a discounted price compared to other selling methods.

## 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.

## 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.

# Adverse selection in live versus carcass pricing I

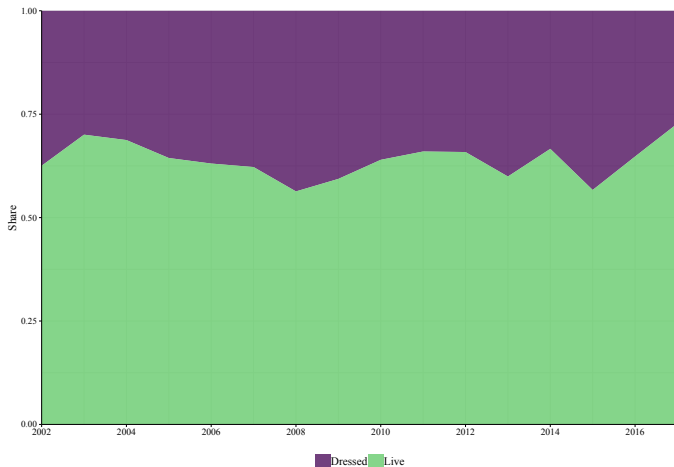
- If you are a cattle producer and know that your cattle are of lower quality, you will try to hide that from the buyer.
  - ▶ Sell lower quality cattle priced based on live weight.
- If you have high quality cattle you will try to show the high value of your cattle.
  - ▶ More likely to have high quality 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.

# Adverse selection in live versus carcass pricing II

- This is an example of adverse selection 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).

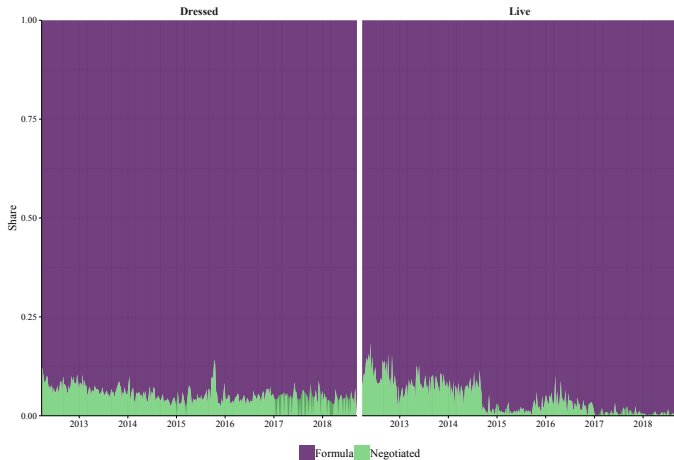
## 5 area markets - live vs. dressed weight (all fed cattle sales)

- 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 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>.

- 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.

- 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 address 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*.
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