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 the markets.
- Characteristics of cattle are also more difficult to observe than for grains, a more uniform product.
- I will begin with definitions, the review some market data and finally turn to the economics of cattle marketing.

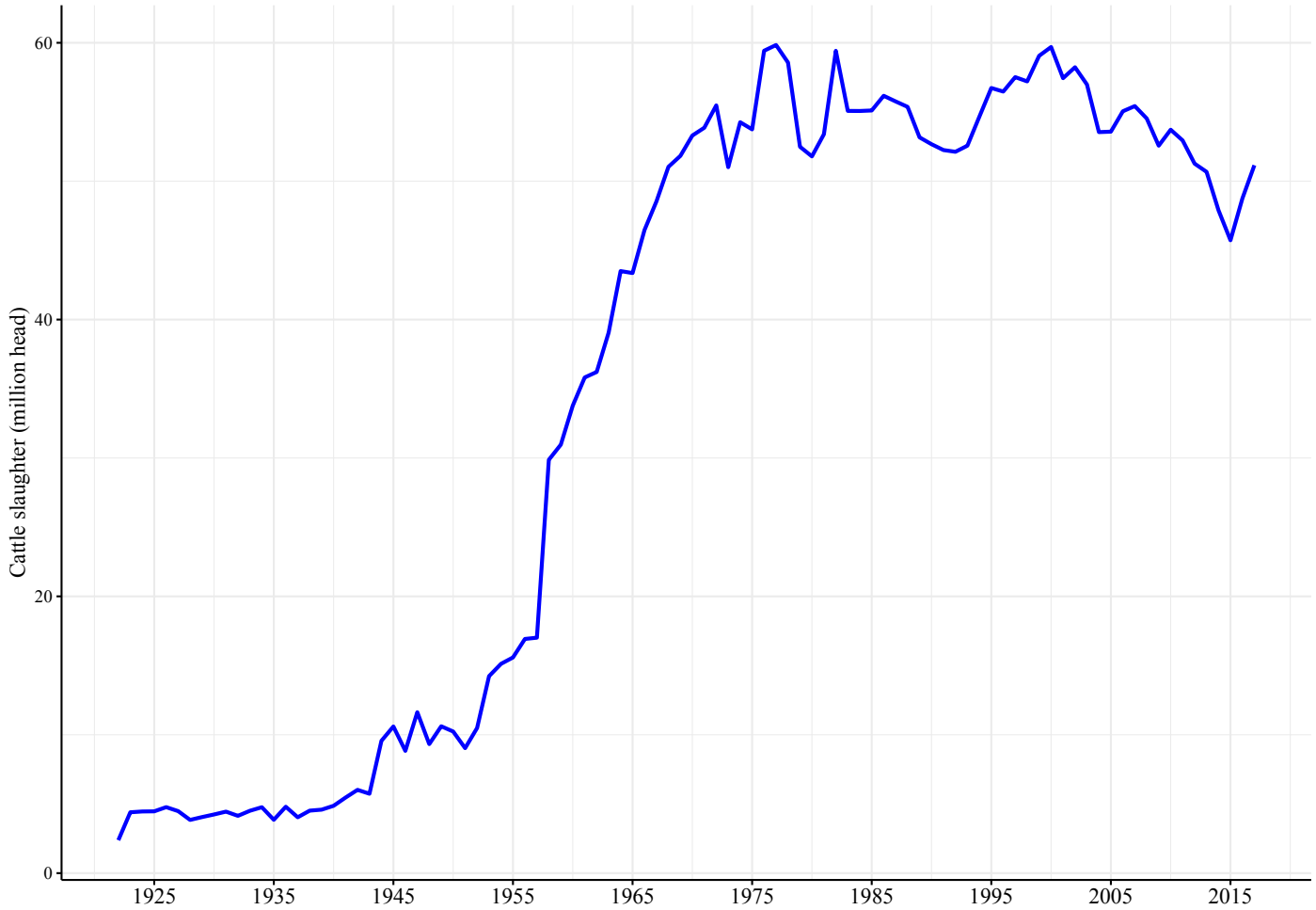
Definitions

- 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

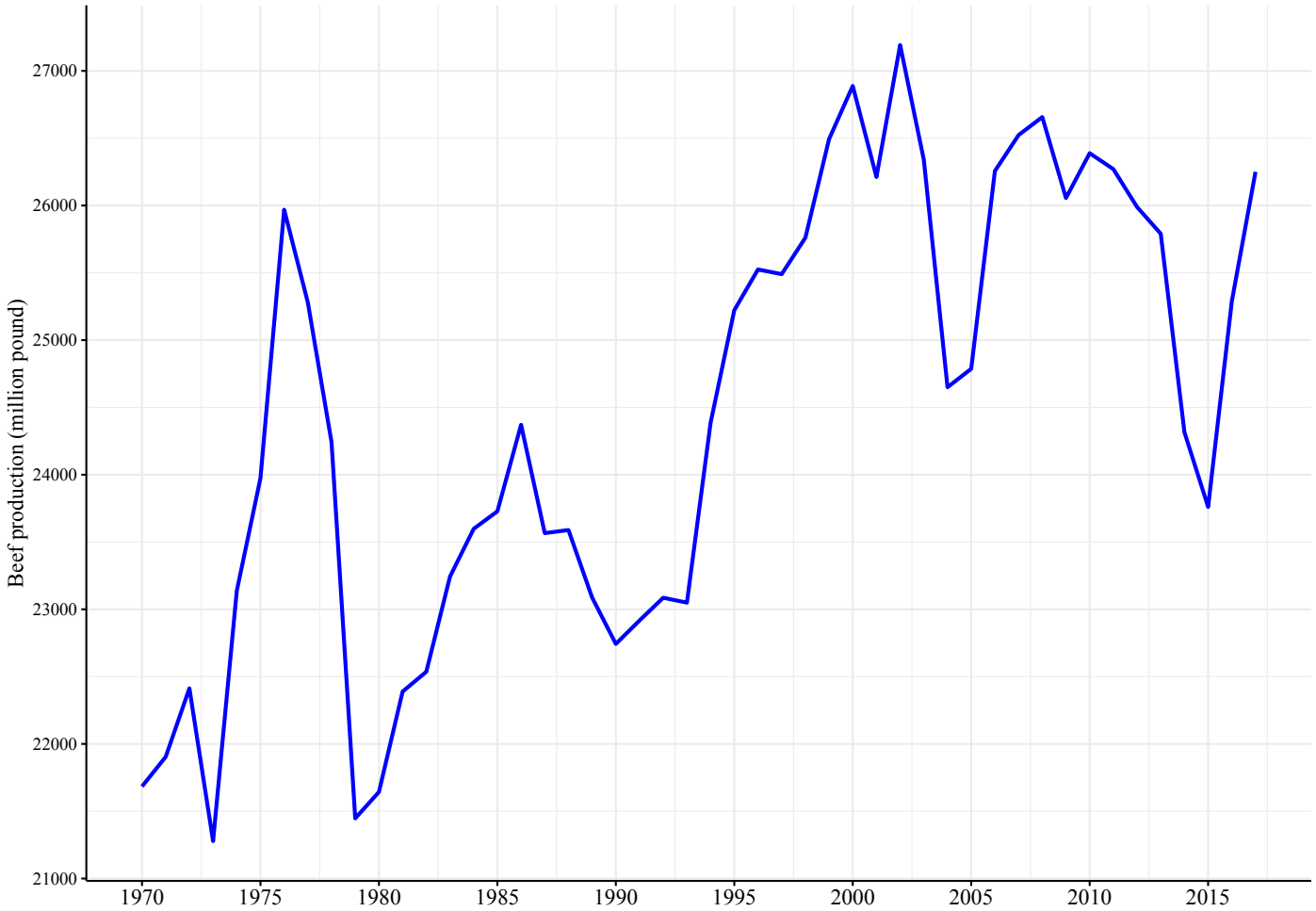
- Cow-calf operations:
  - Sell weaned calves (6-7 months of age).
- Stocker (spring) - backgrounding (fall):
  - Stockers use pasture;
  - Backgrounders use feeds;
  - Buy weaned calves;
  - Sell feeder cattle (about a year old).
- Feedlots - finishing:
  - Buy feeder cattle;
  - Sell fed/slaughter cattle (18 to 24 months old).
- Packing/slaughter plant:
  - Buy fed cattle;
  - Sell boxed beef.
- Retail/food service:
  - Buy boxed beef;
  - Sell beef to consumers.

Commercial steer and heiffer slaughter



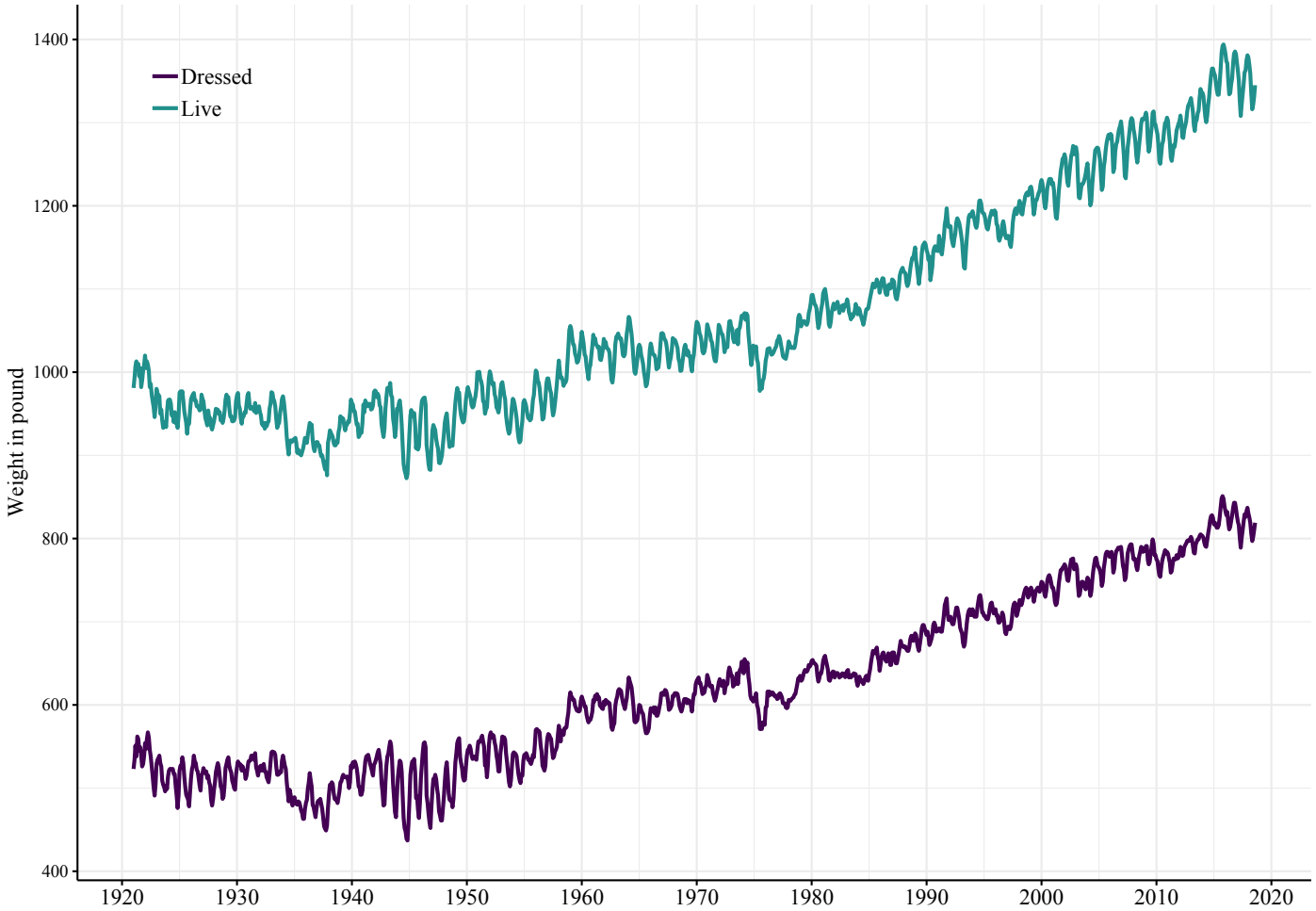
Source: USDA - Economic Research Service (2018b).

Beef production



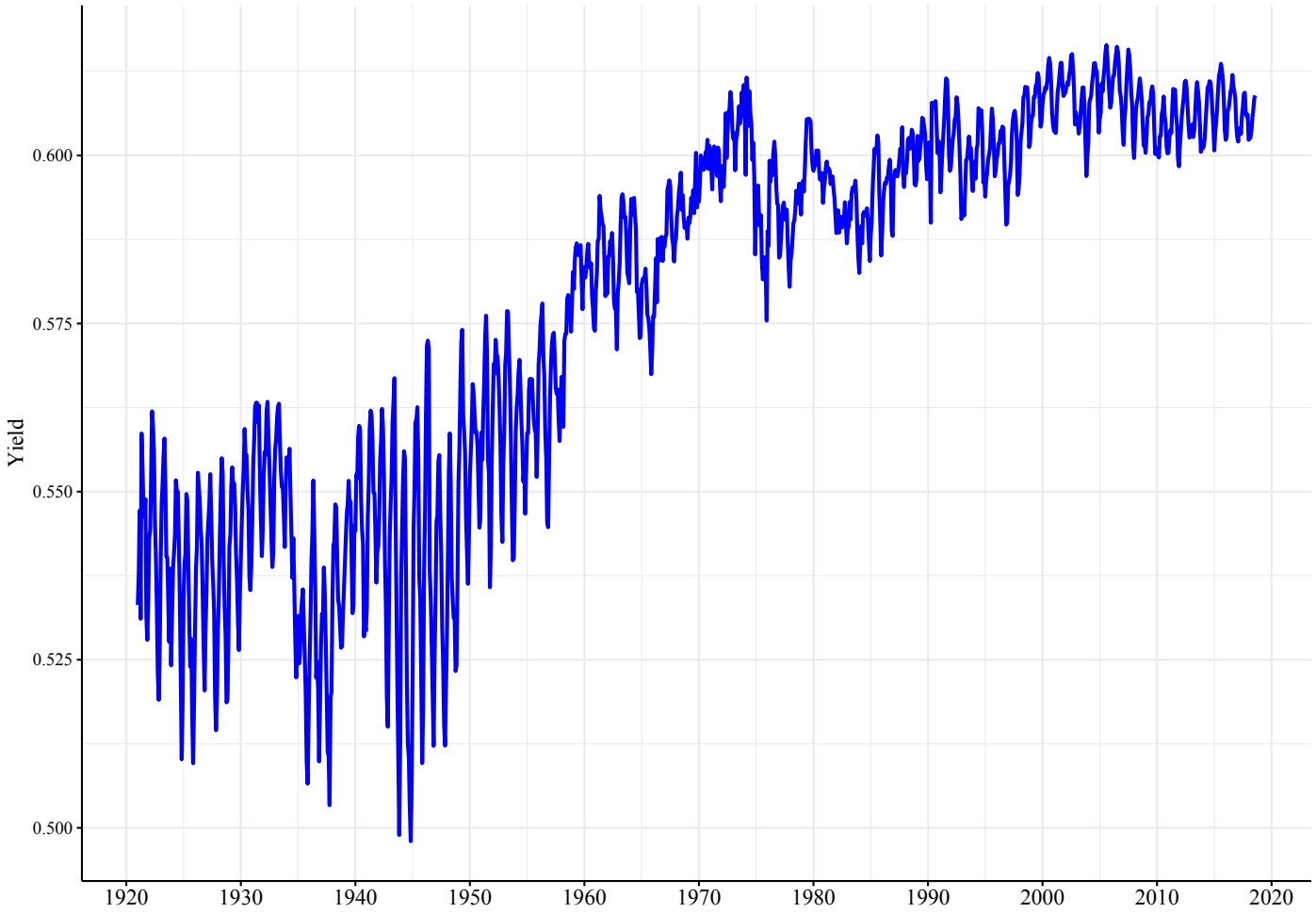
Source: USDA - Economic Research Service (2018b).

Average live and dressed cattle weight in federally inspected facility



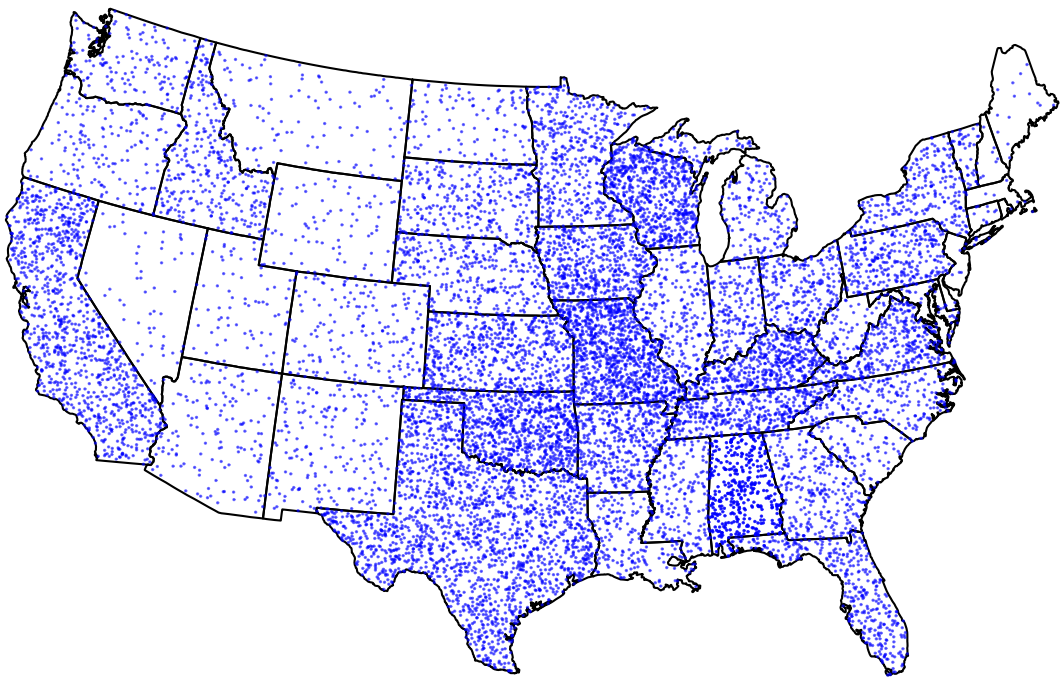
Source: USDA - Economic Research Service (2018b).

Average carcass yield (live weight/dressed weight)



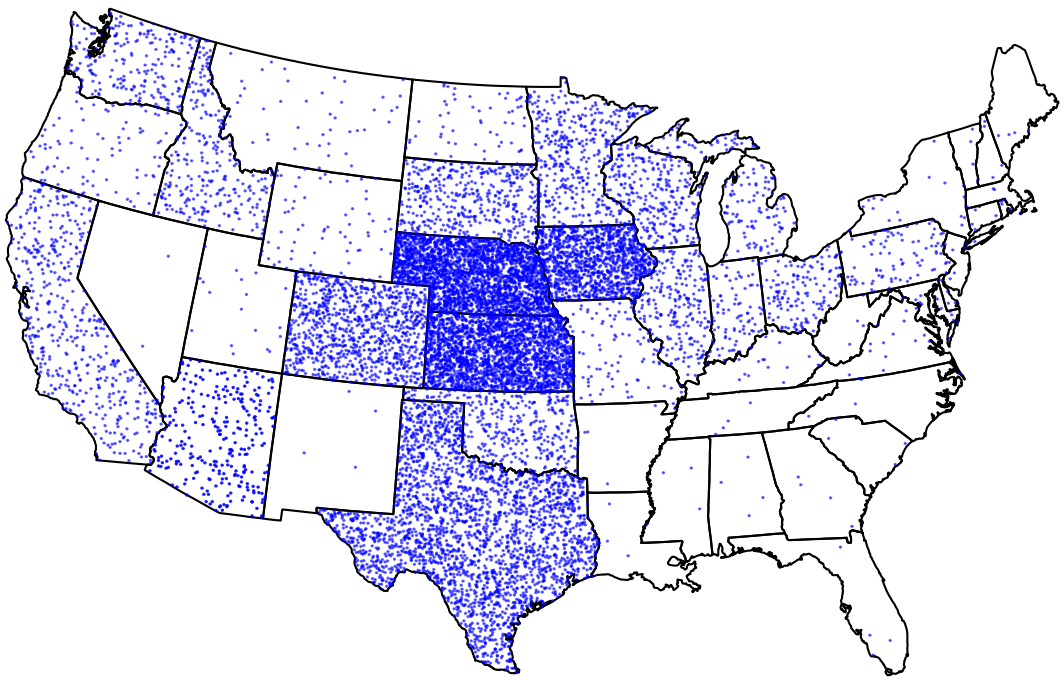
Source: USDA - Economic Research Service (2018b).

Cattle inventory by state (January 1, 2018)



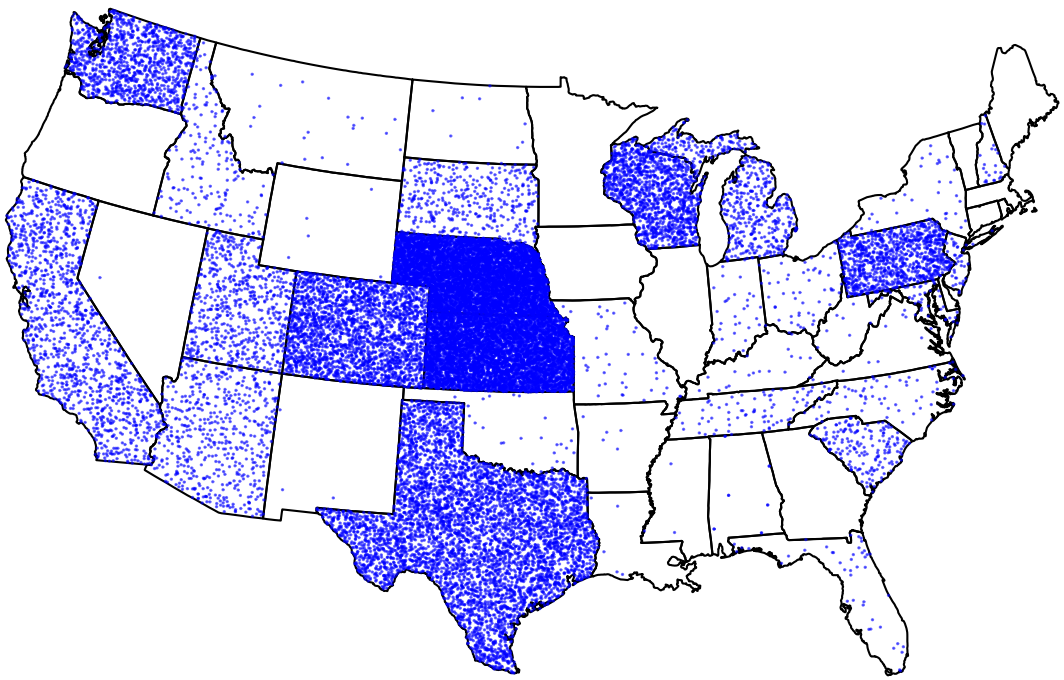
This is a density dot map. A dot does not represent the specific location of cattle. Rather, the number of dots within a state that represents the relative cattle inventory by state. Source: USDA - National Agricultural Statistics Service (2018).

Cattle on feed by state (January 1, 2018)



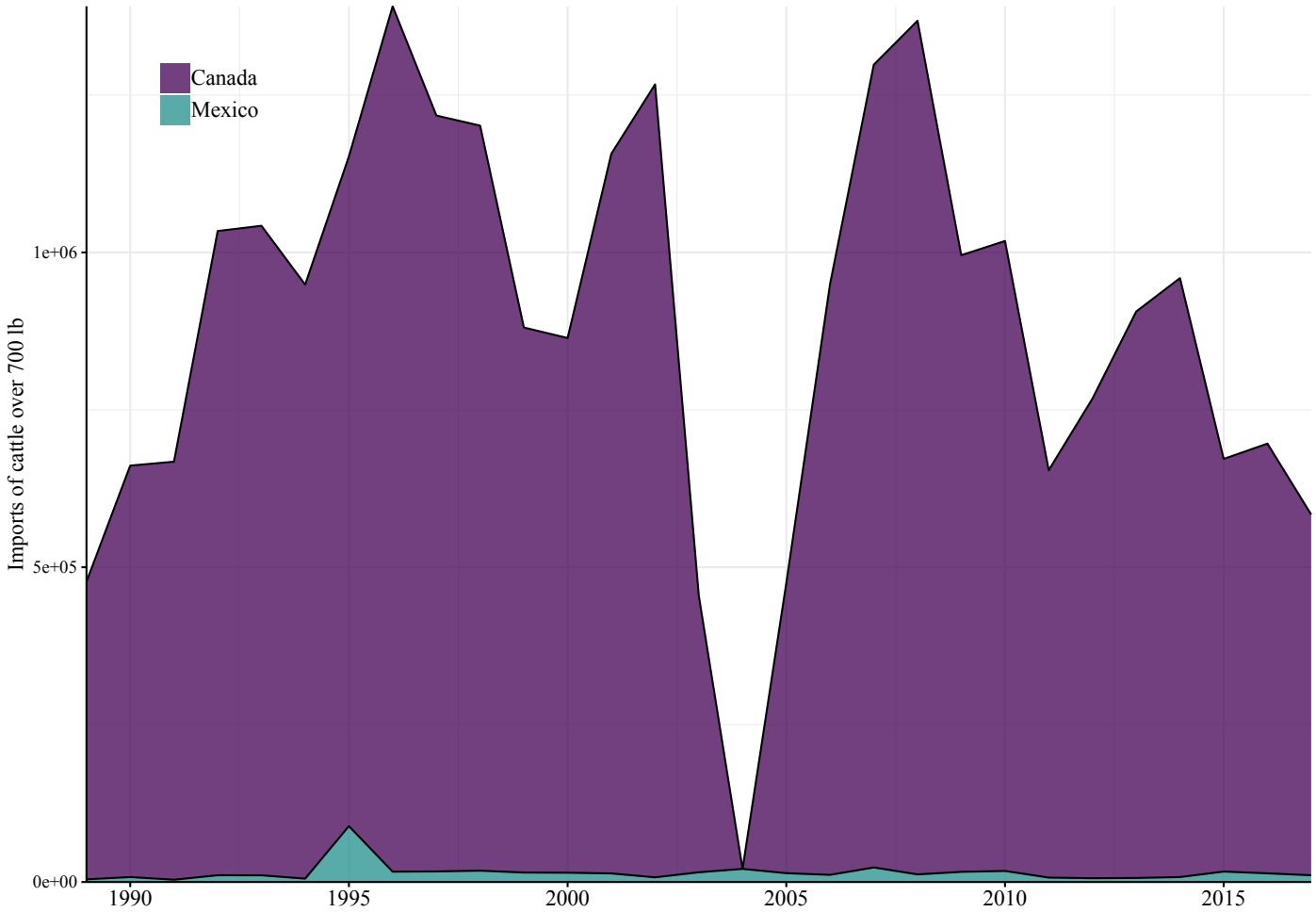
This is a density dot map. A dot does not represent the specific location of cattle. Rather, the number of dots within a state that represents the relative cattle on feed by state. Source: USDA - National Agricultural Statistics Service (2018).

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



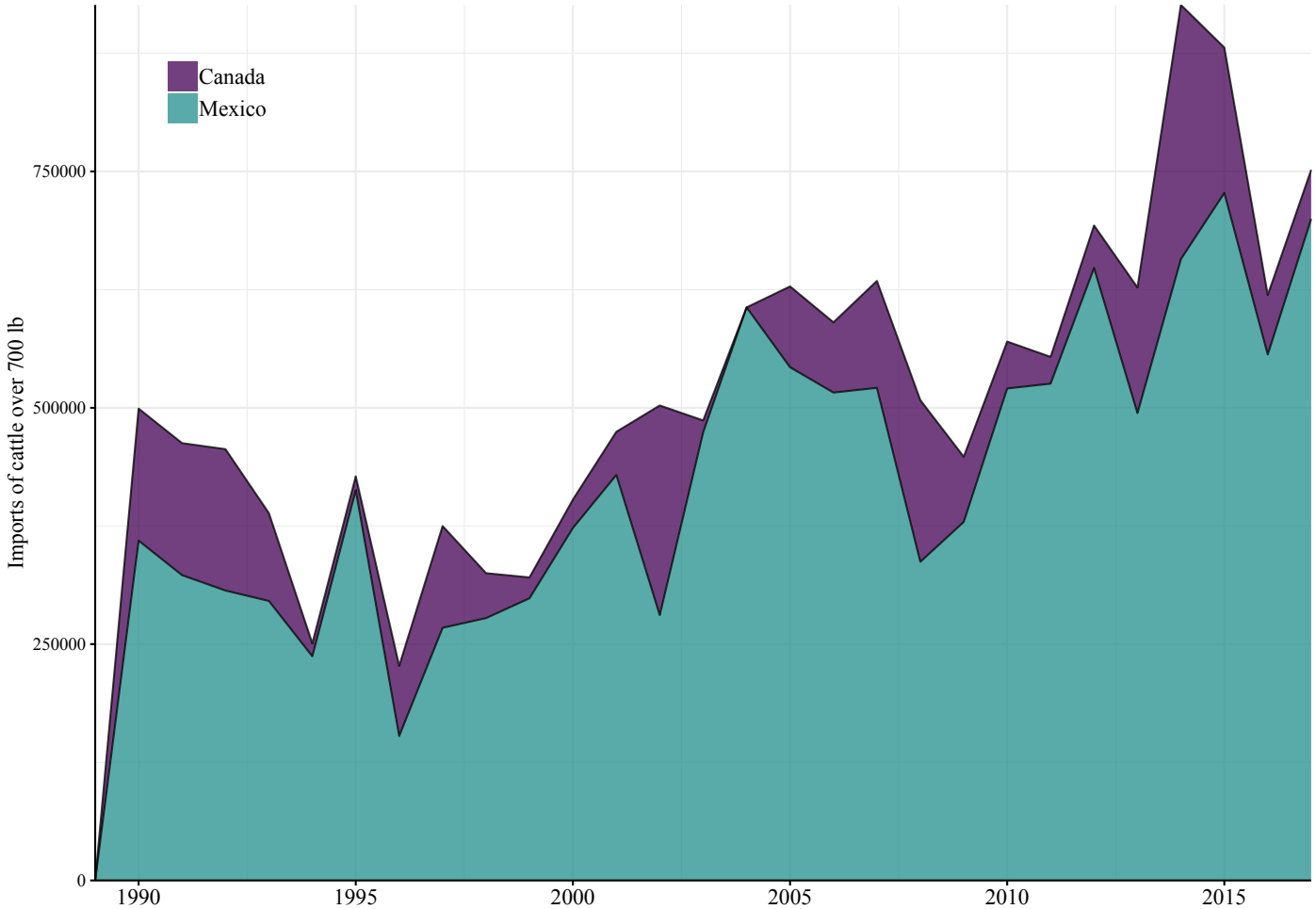
This is a density dot map. A dot does not represent the specific location of cattle. Rather, the number of dots within a state that represents the relative cattle slaughter by state. Source: USDA - National Agricultural Statistics Service (2018).

Annual imports of cattle over 700 lb



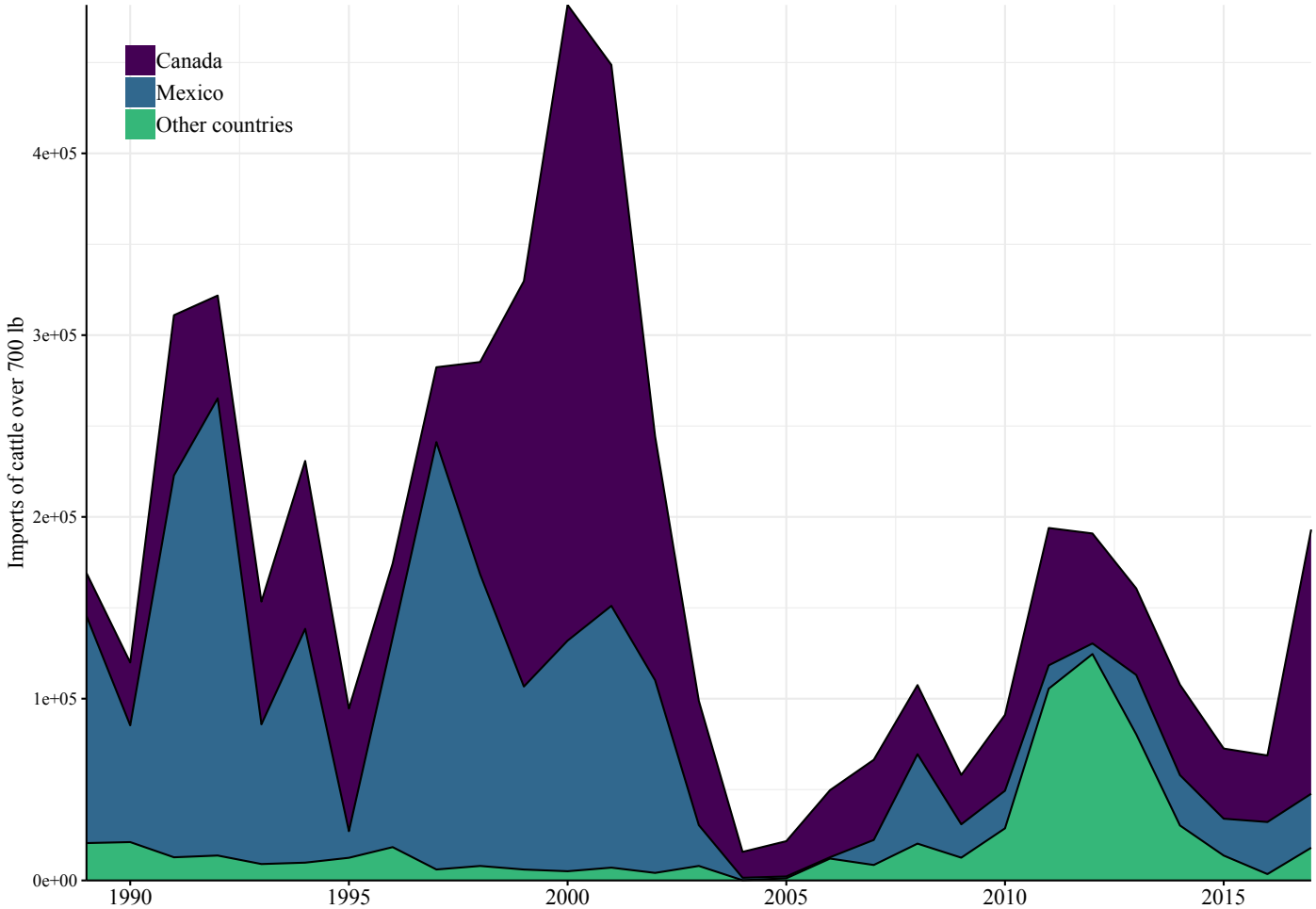
Most are fed cattle for slaughter. Source: USDA - Economic Research Service (2018c).

Annual imports of feeder cattle (400 to 700 lb)



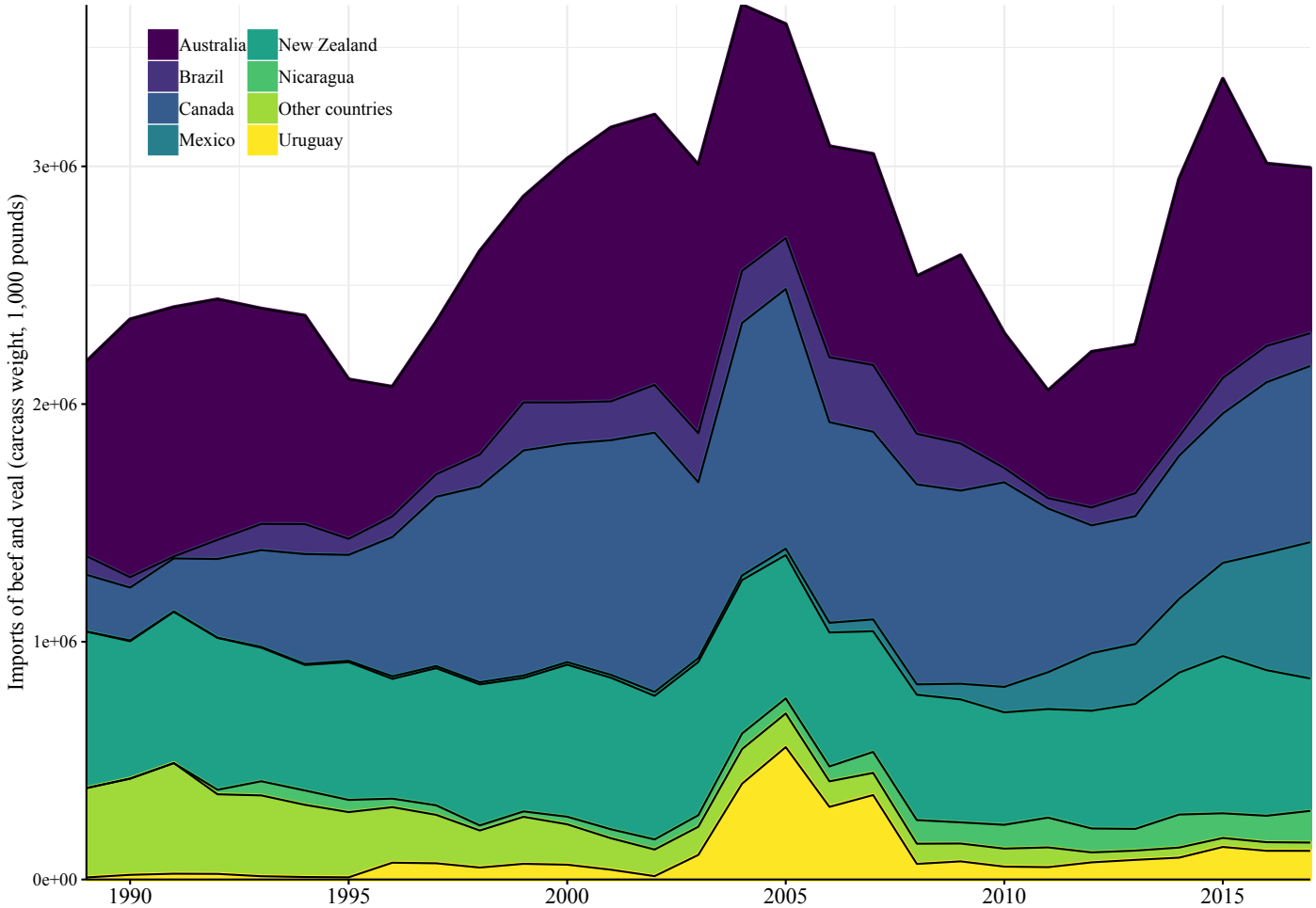
Most are feeder cattle for placement. Source: USDA - Economic Research Service (2018c).

Annual exports of cattle (all weight)



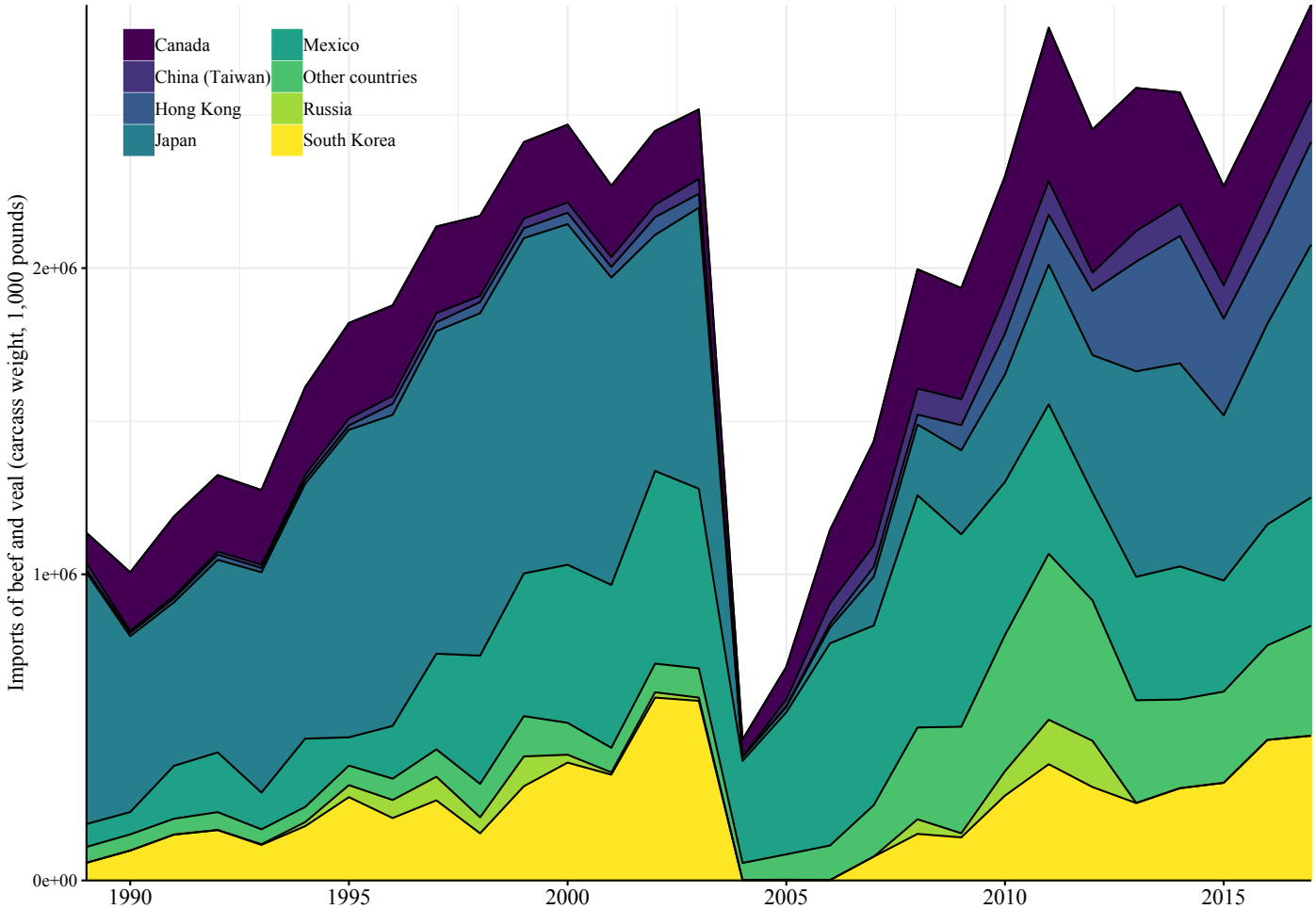
Source: USDA - Economic Research Service (2018c).

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



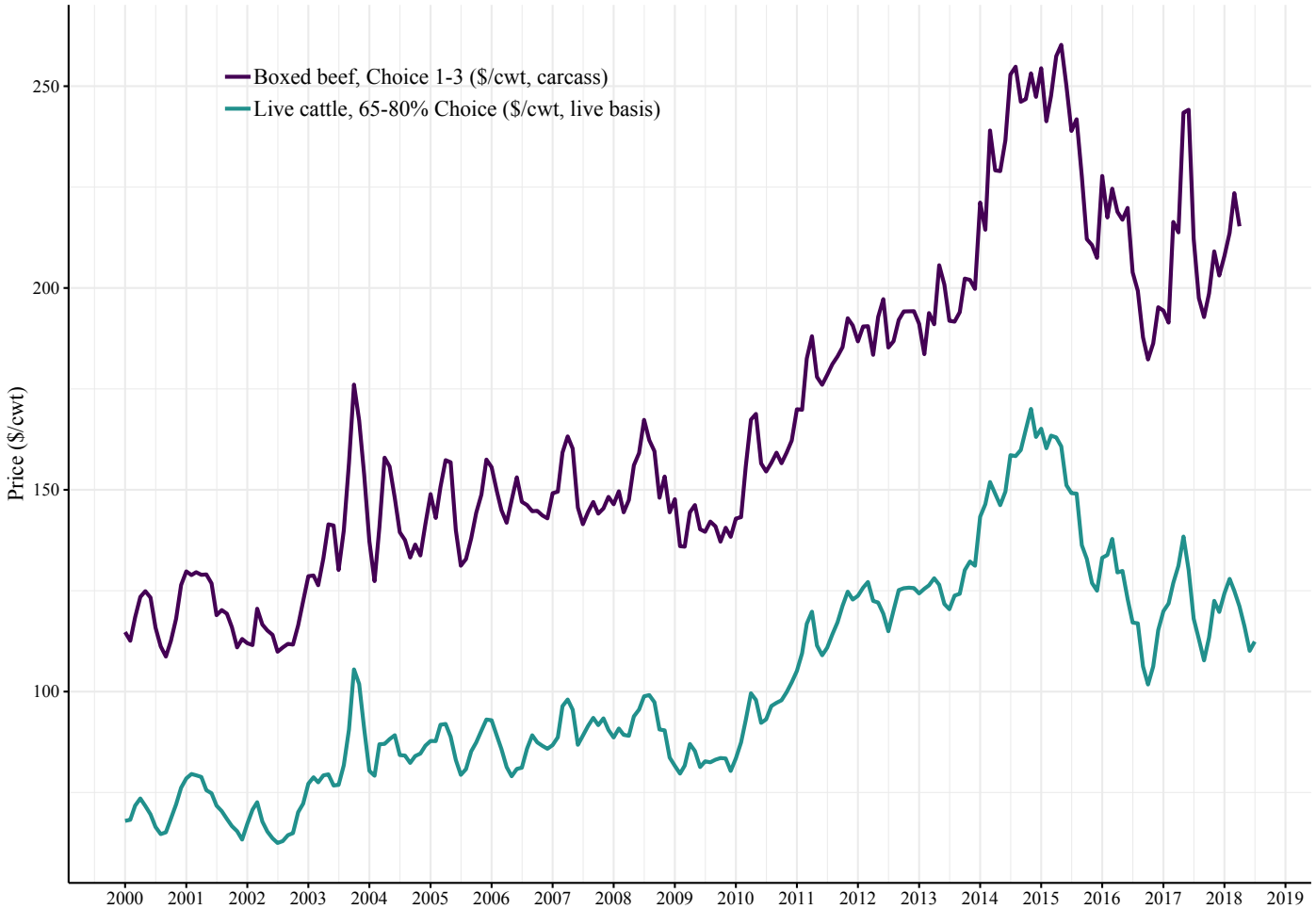
Source: USDA - Economic Research Service (2018b).

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



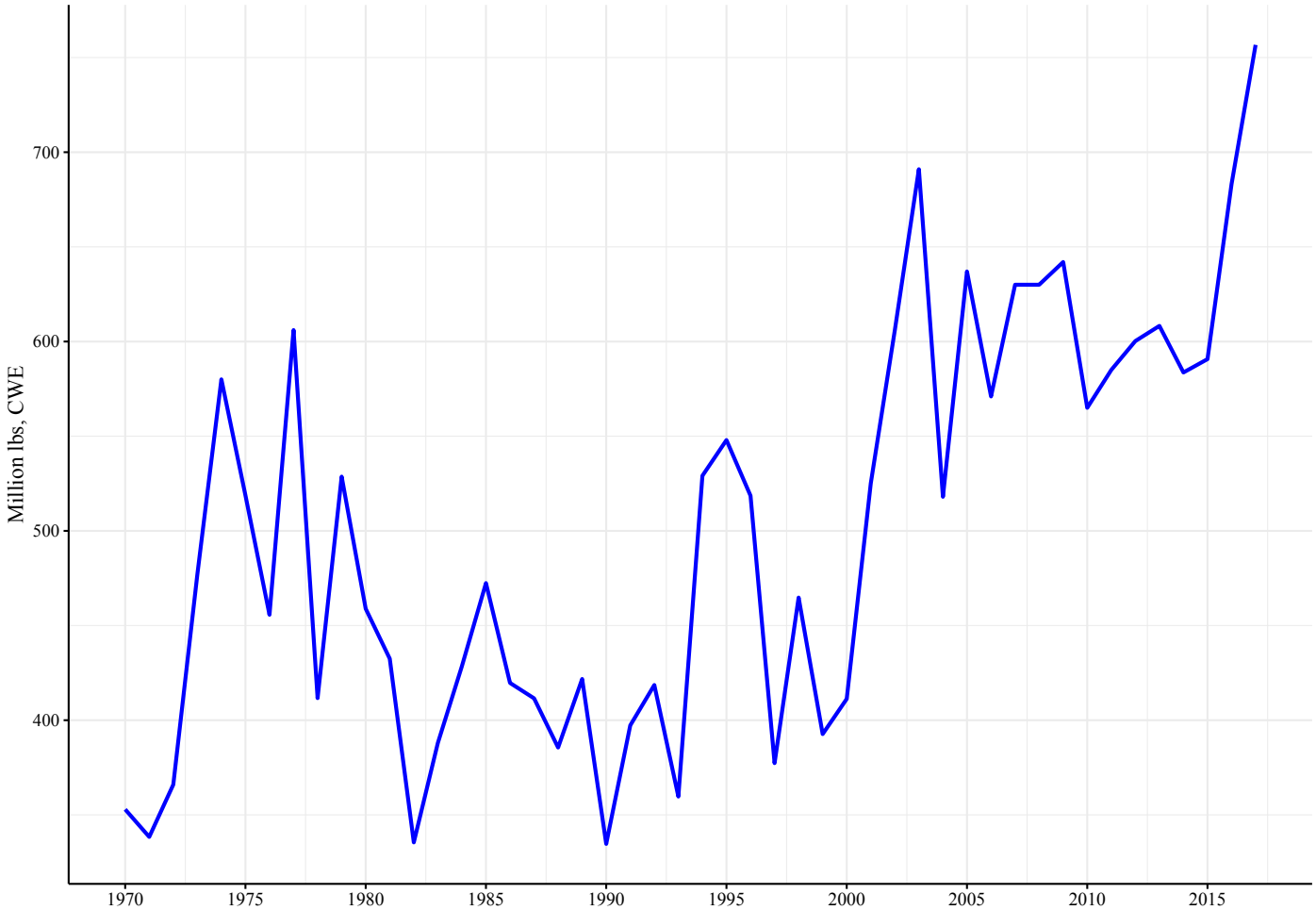
Source: USDA - Economic Research Service (2018b).

Live cattle price and boxed beef prices



Source: USDA - Economic Research Service (2018b).

Beginning stocks of beef (Million lbs, CWE)



CWE means Carcass Weight Equivalent. Source: USDA - Economic Research Service (2018b).

Cattle cycles

- Cattle cycles are expansion and contraction of cattle inventories at regular intervals (see cattle inventory figure above).
- 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.

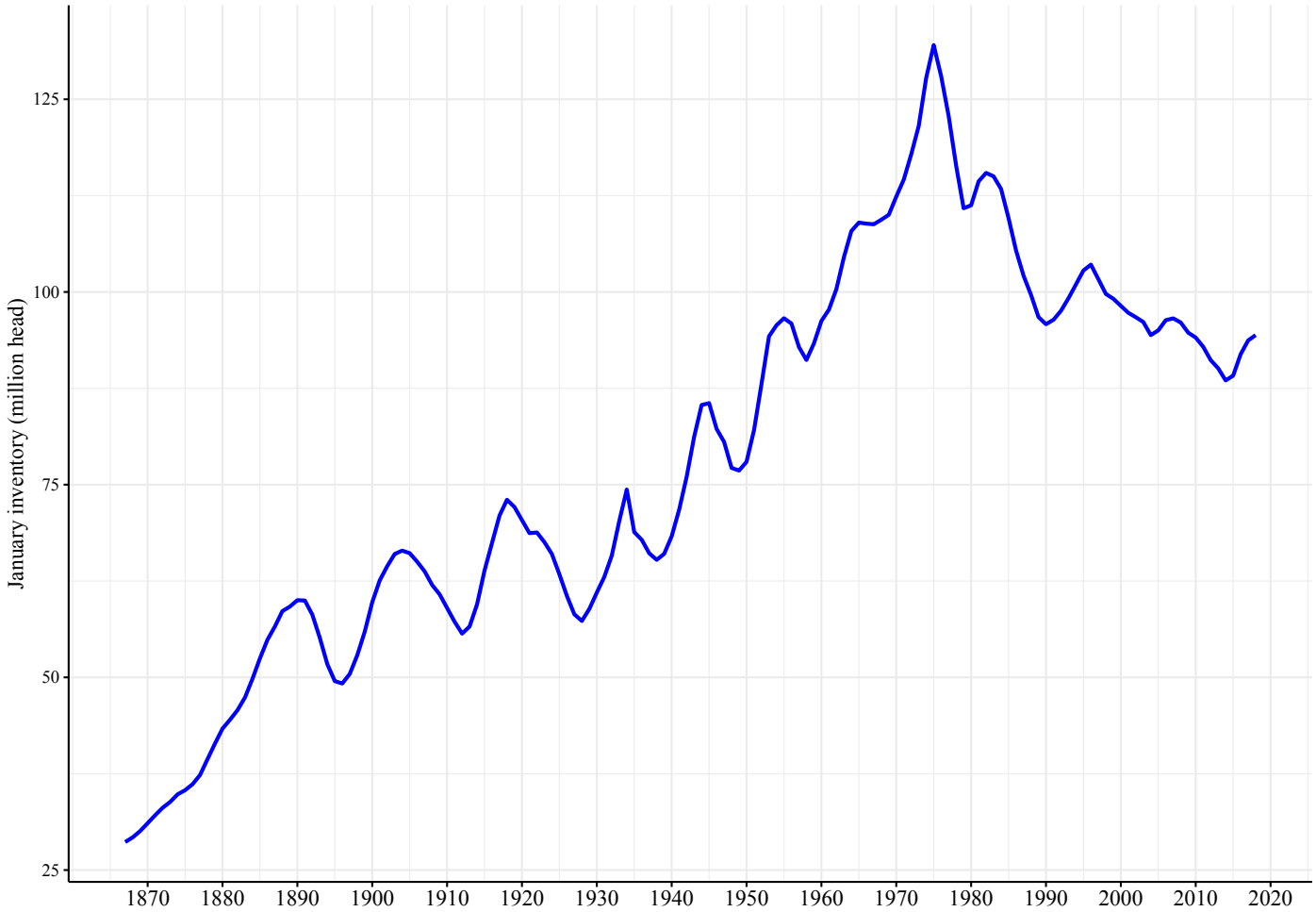
Cattle cycles

- Biological lags cause a delayed response between an increase in the price and an increase in production.
  - 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.
  - It takes at least three and a half years from the time a cow-calf operation decides to expand and the time its production actually expands.
  - 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

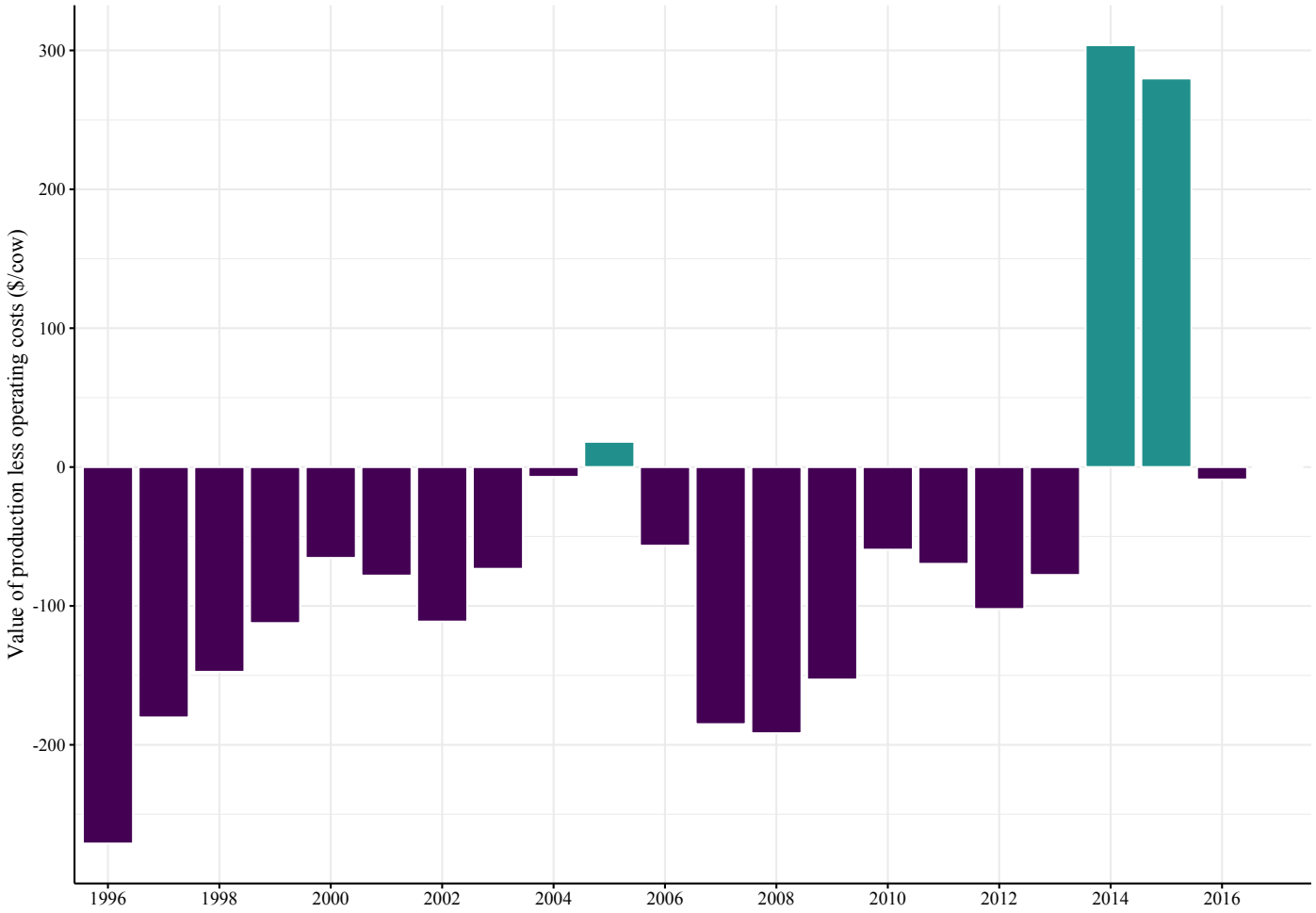
- Cycles contribute to periods of prosperity followed by periods of losses to cattle farmers.
- See for example historial returns in the cattle sector at https://agmanager.info/livestock-meat/cattle-finishing-historical-and-projected-returns or at https://www.ers.usda.gov/data-products/commodity-costs-and-returns/commodity-costs-and-returns/

US January cattle inventory (including calves)



Source: USDA - National Agricultural Statistics Service (2018).

Return to a cow-calf operation in the Heartland



Source: USDA - Economic Research Service (2018a).

Selling methods

- It is possible to use different methods to sell feeder cattle and fed cattle.
- Quality must be observed or controlled for in the pricing method through contract arrangement.
- Each method has its advantages and disadvantages.
- Underneath all selling method, the futures market helps with price discovery.

Selling methods: 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.

Selling methods: public markets

- Auction markets:
  - Common sale method with many auction facilities;
  - 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.

Selling methods: direct sales

- In 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 (see below).

Selling methods: 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 feeder 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 other than direct sales are live weight.

Pricing fed cattle in direct sales

1. Live weight:
   - Only considers live weight (on the hoof);
   - Price 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 (discount compared to other selling methods?).

Pricing fed cattle in direct sales

2. Carcass weight
   - The price is based on carcass weight;
   - Price negotiated before delivery;
   - Seller assumes yield risk;
   - Buyer (packer) assumes quality risk.

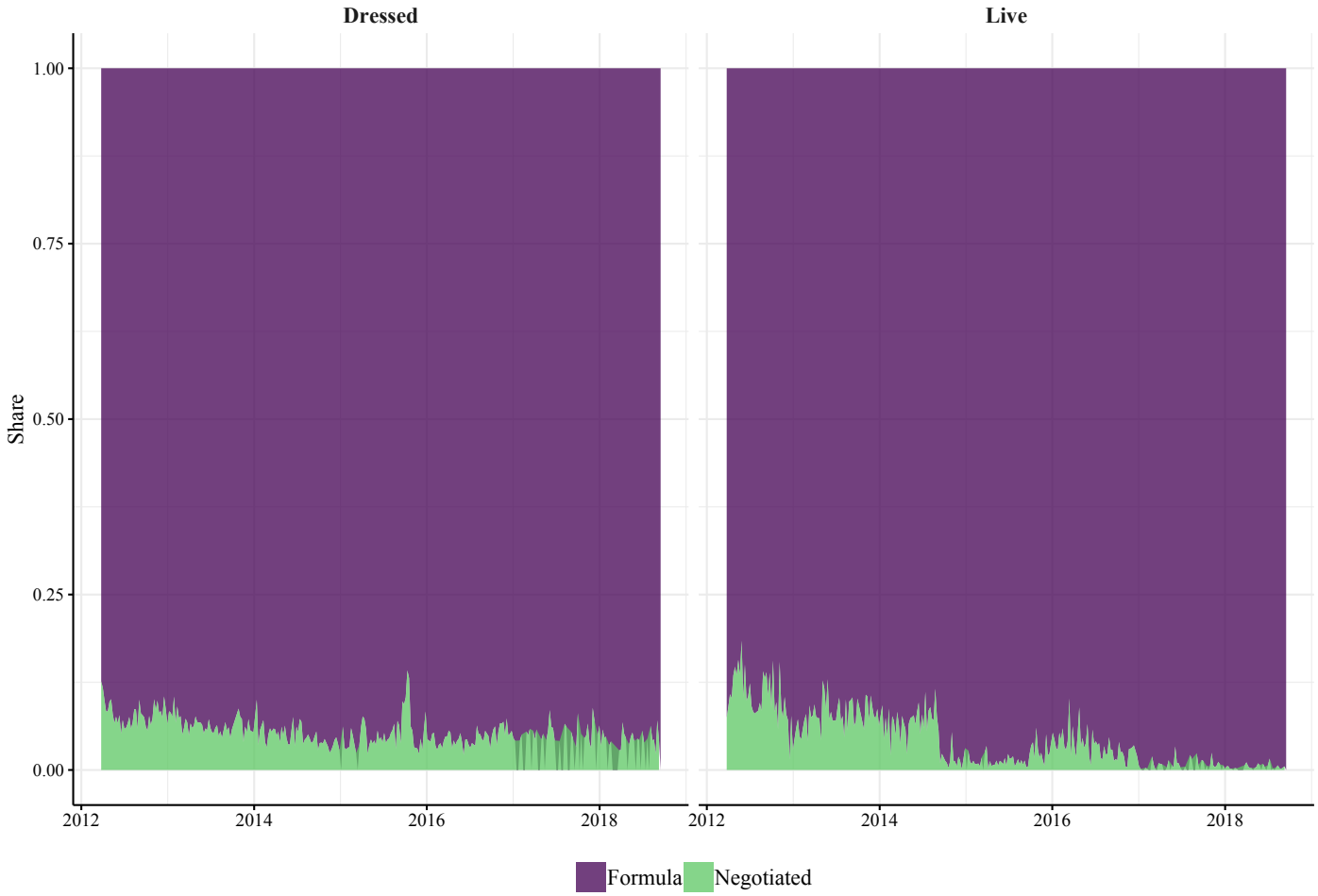
Pricing fed cattle in direct sales

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, futures market prices or negotiated prices.
   - Seller assumes yield and quality risk;
   - Buyer (packer) assumes quality risk.

5 area markets - live versus dressed weight

- The 5 markets are 1) Texas & Oklahoma, 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 concern 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).
- Jr. et al. (2015) shows the impact of MPR on markets.
- MPR data are available at https://mpr.datamart.ams.usda.gov/.

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