**Data Dictionary for RuFaS Economic Module Inputs**

*Files:*

* cattle\_calves-price-received\_dollar-per-cwt.csv
* cattle\_cows-milk-price-received\_dollar-per-head.csv
* cattle\_cows-price-received\_dollar-per-cwt.csv
* cattle\_GE-500-price-received\_dollar-per-cwt.csv
* cattle\_steers-and-heifers-GE-500-price-received\_dollar-per-cwt.csv
* crops\_corn-grain-price-recieved\_dollar-per-bushel.csv
* crops\_corn-silage-price-recieved\_dollar-per-ton.csv
* crops\_hay-alfalfa-price-recieved\_dollar-per-ton.csv
* crops\_hay-excluding-alfalfa-price-recieved\_dollar-per-ton.csv
* crops\_hay-price-recieved\_dollar-per-ton.csv
* crops\_rye-price-recieved\_dollar-per-bushel.csv
* crops\_soybean-meal-price-recieved\_dollar-per-ton.csv
* crops\_soybean-price-recieved\_dollar-per-bushel.csv
* crops\_winter-wheat-price-recieved\_dollar-per-bushel.csv
* diesel\_retail\_dollar-per-gallon.csv
* electricity\_commercial\_dollar-per-kwh.csv
* electricity\_industrial\_dollar-per-kwh.csv
* electricity\_residential\_dollar-per-kwh.csv
* feeds\_alfalfa-silage\_dollar-per-ton.csv
* feeds\_almond-hulls\_dollar-per-ton.csv
* feeds\_barley-silage\_dollar-per-ton.csv
* feeds\_limestone\_dollar-per-kg.csv
* feeds\_milk-price-received\_dollar-per-CWT.csv
* feeds\_milk-whole\_dollar-per-gallon.csv
* feeds\_sudan-silage\_dollar-per-ton.csv
* fertilizer\_ammonium-nitrate\_dollar-per-shortton.csv
* fertilizer\_anhydrous-ammonia\_dollar-per-shortton.csv
* fertilizer\_diammonium-phosphate-18-46-0\_dollar-per-shortton.csv
* fertilizer\_nitrogen\_dollar-per-shortton.csv
* fertilizer\_nitrogen-solutions-30pct\_dollar-per-shortton.csv
* fertilizer\_phosphorus\_dollar-per-shortton.csv
* fertilizer\_potassium\_dollar-per-shortton.csv
* fertilizer\_potassium-chloride-60pct-potassium\_dollar-per-shortton.csv
* fertilizer\_sulfate-of-ammonium\_dollar-per-shortton.csv
* fertilizer\_super-phosphate-20pct-phosphate\_dollar-per-shortton.csv
* fertilizer\_super-phosphate-44to46pct-phosphate\_dollar-per-shortton.csv
* fertilizer\_urea-44to46pct-nitrogen\_dollar-per-shortton.csv
* gasoline\_retail\_dollar-per-gallon.csv
* labor\_hired-wage-rate\_dollar-per-hour.csv’
* natural-gas\_commercial\_dollar-per-mcf.csv
* natural-gas\_industrial\_dollar-per-mcf.csv
* natural-gas\_residential\_dollar-per-mcf.csv
* propane\_retail\_dollar-per-gallon.csv
* propane\_wholesale\_dollar-per-gallon.csv
* water\_irrigation\_dollar-per-acre-foot.csv
* water\_retail\_dollar-per-kgal.csv

CONTEXT:

The data included in this data dictionary includes the input data used for the RuFaS Economic Module developed by Sustainability Science.

All csv input files use the following format {data type}\_{data subtype}\_{units}.csv

* {data type} represents the primary data category (electricity, fertilizer, natural gas, etc.)
* {data subtype} represents the subcategory that the data falls into or the specific name of the input represented (retail, commercial, industrial, etc.)
* {units} represents the units used for the data. Typically, US dollar per functional unit for the data type.

Each input file follows the same format. The first column “fips” represents the Federal Information Processing Standard code which is a numeric code that uniquely identifies individual counties in the United States. The first row (fips = 01) is used to represent the U.S. mean value. Subsequent columns represent the years which the data represents (“2021” contains the prices for each county in the year 2021).

Details about the specific input files and their original data source is provided in the following sections.

FILE DESCRIPTIONS:

File: ‘cattle\_calves-price-received\_dollar-per-cwt.csv’

* **Primary Data Type** – Cattle
* **Data Subtype** – Price received for calves
* **Units** – U.S. dollars per CWT (100 lbs)
* **Data source** – Cattle prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Sector: Animals & Products, Group: Livestock, Commodity: Cattle, Category: Price Received, Data Item: CATTLE, CALVES - PRICE RECEIVED, MEASURED IN $ / CWT, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘cattle\_cows-milk-price-received\_dollar-per-head.csv’

* **Primary Data Type** – Cattle
* **Data Subtype** – Price received for Milk Cows
* **Units** – U.S. dollars per head of cattle
* **Data source** – Cattle prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Sector: Animals & Products, Group: Livestock, Commodity: Cattle, Category: Price Received, Data Item: CATTLE, COWS, MILK - PRICE RECEIVED, MEASURED IN $ / HEAD, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘cattle\_cows-price-received\_dollar-per-cwt.csv’

* **Primary Data Type** – Cattle
* **Data Subtype** – Price received for cows
* **Units** – U.S. dollars per CWT (100 lbs)
* **Data source** – Cattle prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Sector: Animals & Products, Group: Livestock, Commodity: Cattle, Category: Price Received, Data Item: CATTLE, COWS - PRICE RECEIVED, MEASURED IN $ / CWT, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘cattle\_GE-500-price-received\_dollar-per-cwt.csv’

* **Primary Data Type** – Cattle
* **Data Subtype** – Price received for cattle greater than or equal to 500 lbs
* **Units** – U.S. dollars per CWT (100 lbs)
* **Data source** – Cattle prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Sector: Animals & Products, Group: Livestock, Commodity: Cattle, Category: Price Received, Data Item: CATTLE, GE 500 LBS - PRICE RECEIVED, MEASURED IN $ / CWT, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘cattle\_steers-and-heifers-GE-500-price-received\_dollar-per-cwt.csv’

* **Primary Data Type** – Cattle
* **Data Subtype** – Price received for Steers and Heifers greater than or equal to 500 lbs
* **Units** – U.S. dollars per CWT (100 lbs)
* **Data source** – Cattle prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Sector: Animals & Products, Group: Livestock, Commodity: Cattle, Category: Price Received, Data Item: CATTLE, STEERS & HEIFERS, GE 500 LBS - PRICE RECEIVED, MEASURED IN $ / CWT, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_corn-grain-price-recieved\_dollar-per-bushel.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Corn grain price received by farmers
* **Units** – U.S. dollars per bushel of corn grain
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Corn, Category: Price Received, Data Item: Corn, Grain – Price Received, Measured in $ / BU, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_corn-silage-price-recieved\_dollar-per-ton.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Corn silage price received by farmers assuming the silage is already harvested and stored
* **Units** – U.S. dollars per ton of corn silage
* **Data source** – Economic data for corn silage prices were very limited. Therefore, the cost of corn silage was estimated based off the price of corn grain as reported by the USDA and estimates by the [Iowa State University Extension and Outreach Ag Decision Maker](https://www.extension.iastate.edu/agdm/crops/html/a1-65.html). They state “Corn silage that has already been harvested and stored is worth more, naturally, typically 10-12 times the price of a bushel of corn.” Therefore, a scaling factor of 11 was used to estimate corn silage pricing. The results of this scaling are in line with estimates by [The Ohio State University’s College of Food, Agricultural, and Environmental Sciences](https://u.osu.edu/farmandfieldshelby/2024/07/31/corn-silage-pricing/) and [University of Nebraska-Lincoln Institute of Agriculture and Natural Resources](https://www.morningagclips.com/corn-silage-pricing/).
* **Data Conversions** – The prices in ‘crops\_corn-grain-price-recieved\_dollar-per-bushel.csv’ were multiplied by 11 to achieve corn silage prices

File: ‘crops\_hay-alfalfa-price-recieved\_dollar-per-ton.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Alfalfa hay price received by farmers
* **Units** – U.S. dollars per ton of alfalfa hay
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Hay, Category: Price Received, Data Item: Hay, Alfalfa – Price Received, Measured in $ / Ton, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_hay-excluding-alfalfa-price-recieved\_dollar-per-ton.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Hay excluding alfalfa price received by farmers
* **Units** – U.S. dollars per ton of hay which excludes alfalfa
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Hay, Category: Price Received, Data Item: Hay, (Excl Alfalfa) – Price Received, Measured in $ / Ton, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_hay-price-recieved\_dollar-per-ton.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Hay price received by farmers
* **Units** – U.S. dollars per ton of hay
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Hay, Category: Price Received, Data Item: Hay – Price Received, Measured in $ / Ton, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_rye-price-recieved\_dollar-per-bushel.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Rye price received by farmers
* **Units** – U.S. dollars per bushel of rye
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Rye, Category: Price Received, Data Item: Rye – Price Received, Measured in $ / BU, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_soybean-meal-price-recieved\_dollar-per-ton.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Soybean meal commodity price
* **Units** – U.S. dollars per ton of soybean meal
* **Data source** – Daily soybean meal commodity prices were gathered from Business Insider. Data was reported for the high and low market prices for each data. The daily mean soybean meal commodity price was found by taking the mean of the high and low market prices. The yearly mean commodity prices were found by taking the mean of the daily mean prices in each year while excluding days which reported zero values.
* **Data Conversions** – No conversions were made to this data were made as the prices were kept in dollars per ton of soybean meal.

File: ‘crops\_soybean-price-recieved\_dollar-per-bushel.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Soybean price received by farmers
* **Units** – U.S. dollars per bushel of soybeans
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Soybeans, Category: Price Received, Data Item: Soybeans – Price Received, Measured in $ / BU, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘crops\_winter-wheat-price-recieved\_dollar-per-bushel.csv’

* **Primary Data Type** – Crops
* **Data Subtype** – Winter wheat price received by farmers
* **Units** – U.S. dollars per bushel of winter wheat
* **Data source** – Crop prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Field Crops, Commodity: Wheat, Category: Price Received, Data Item: Wheat, Winter – Price Received, Measured in $ / BU, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘diesel\_retail\_dollar-per-gallon.csv’

* **Primary Data Type** – Diesel fuel
* **Data Subtype** – Retail prices
* **Units** – U.S. dollars per gallon of diesel fuel
* **Data source** - Diesel prices were used from the U.S. Energy Information Administration at the state level when available and the Petroleum Administration for Defense District (PADD) region level when state level data was unavailable. [[Original Data](https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm)] PADD region values were uniformly assigned to each state within that region based on the [definition of PADD regions](https://www.eia.gov/tools/glossary/index.php) from the U.S. Energy Information Administration. State level values were then assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘electricity\_commercial\_dollar-per-kwh.csv’

* **Primary Data Type** – Electricity prices
* **Data Subtype** – Commercial rates
* **Units** – U.S. dollars per kilowatt of electricity
* **Data source** - Historical state level electricity prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/electricity/data/browser/#/topic/7?agg=1,0&geo=vvvvvvvvvvvvo&endsec=4&freq=M&start=200101&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0)] State level electricity prices were assigned uniformly to each county within the state. When state data was unavailable, the U.S. mean value was used.
* **Data Conversions** – Values received from the EIA were divided by 100 to convert the units from cents per kWh to dollars per kWh.

File: ‘electricity\_industrial\_dollar-per-kwh.csv’

* **Primary Data Type** – Electricity prices
* **Data Subtype** – Industrial rates
* **Units** – U.S. dollars per kilowatt of electricity
* **Data source** - Historical state level electricity prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/electricity/data/browser/#/topic/7?agg=1,0&geo=vvvvvvvvvvvvo&endsec=2&freq=M&start=200101&ctype=linechart&ltype=pin&rtype=s&maptype=0&rse=0&pin=)] State level electricity prices were assigned uniformly to each county within the state. When state data was unavailable, the U.S. mean value was used.
* **Data Conversions** – Values received from the EIA were divided by 100 to convert the units from cents per kWh to dollars per kWh.

File: ‘electricity\_residential\_dollar-per-kwh.csv’

* **Primary Data Type** – Electricity prices
* **Data Subtype** – Residential rates
* **Units** – U.S. dollars per kilowatt of electricity
* **Data source** - Historical state level electricity prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/electricity/data/browser/#/topic/7?agg=1,0&geo=vvvvvvvvvvvvo&endsec=8&freq=M&start=200101&ctype=linechart&ltype=pin&rtype=s&pin=&rse=0&maptype=0)] State level electricity prices were assigned uniformly to each county within the state. When state data was unavailable, the U.S. mean value was used.
* **Data Conversions** – Values received from the EIA were divided by 100 to convert the units from cents per kWh to dollars per kWh.

File: ‘feeds\_alfalfa-silage\_dollar-per-ton.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Alfalfa Silage
* **Units** – U.S. dollars per ton of alfalfa silage
* **Data source** – Historical prices for alfalfa silage could not be found. Therefore, alfalfa silage prices were scaled based off corn silage prices calculated for the “crops\_corn-silage-price-recieved\_dollar-per-ton.csv” inputs sheet. Based on the [“Costs of Forage Production” by Rotz and Harrigan](https://www.ars.usda.gov/ARSUserFiles/50901500/research_summaries/RS96_pdfs/RS96-14.pdf), they estimate that alfalfa silage mean price is $85/ton DM vs $74/ton DM for corn silage. Therefore, a scaling factor of 1.149 was used (85/74) to scale corn silage prices to alfalfa silage. The years between 2020-2023 were kept for data purposes.
* **Data Conversions** – Prices for alfalfa silage were scaled by a factor of 1.149 from corn silage pricing.

File: ‘feeds\_almond-hulls\_dollar-per-ton.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Almond Hulls
* **Units** – U.S. dollars per ton of almond hulls
* **Data source** – Historical prices for almond hulls were gathered from the [UDSA’s Agricultural Marketing Service](https://mymarketnews.ams.usda.gov/public_data). Data is provided weekly using the parameters for “Commodities” as “Almond Hulls” and “Report” as “National Mill-Feeds and Miscellaneous Feedstuff Report” then selecting the appropriate date. Reported weekly data is provided for multiple locations in California. As such, the mean of the individual weekly prices was taken to get an overall mean for the week. The annual mean almond hull price was then taken as the average of the calculated weekly prices. Since data was only provided for locations in California, these values were assumed to be representative of the nation average.
* **Data Conversions** – The historical pricing data was provided for multiple locations weekly. The average weekly price was calculated from the weekly reported values. The annual average price was taken from the calculated weekly averages.

File: ‘feeds\_barley-silage\_dollar-per-ton.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Barley Silage
* **Units** – U.S. dollars per ton of barley silage
* **Data source** – Historical prices for barley silage could not be found. Therefore, barley silage prices were scaled based off corn silage prices calculated for the “crops\_corn-silage-price-recieved\_dollar-per-ton.csv” inputs sheet. Based on the [“Silage Cost of Production” by the Beef Cattle Research Council](https://www.beefresearch.ca/blog/silage-cost-of-production/) they estimate that barley silage mean price is $104/ton DM vs $109/ton DM for corn silage. Therefore, a scaling factor of 0.954 was used (104/109) to scale corn silage prices to alfalfa silage. The years between 2020-2023 were kept for data purposes.
* **Data Conversions** – Prices for barley silage were scaled by a factor of 0.954 from corn silage pricing.

File: ‘feeds\_calcium-phosphate-di\_dollar-per-kg.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Calcium Phosphate (di)
* **Units** – U.S. dollars per kilogram of Calcium Phosphate (di)
* **Data source** – No historical prices could be found for calcium phosphate. Therefore, this file only features one economic price for calcium phosphate in 2024. The cost was gathered from [AgCare Product, Inc.](https://www.agcareproducts.com/products/dical-feed-phos?variant=41431333699699) for a 50 pound (22.68 kilogram) feed grade bag of Dicalcium Phosphate plus shipping to Utah.
* **Data Conversions** – Current price of $41.00 for the 50 lb bag plus $136.24 for shipping was divided by 22.68 kilograms to get the per kilogram price of $7.81.

File: ‘feeds\_calf-starter-18CP\_dollar-per-kg.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Calf Feed 18% Crude Protein
* **Units** – U.S. dollars per kilogram of calf feed
* **Data source** – No historical prices could be found for calf feed. Therefore, this file only features one economic price for calf feed in 2024. The cost was gathered from [Huber’s Animal Health](https://www.hubersanimalhealth.com/product/calf-feed-starter-weavers-18-50-lb/) for a 50 pound (22.68 kilogram) bag of calf starter 18% crude protien plus shipping to Utah.
* **Data Conversions** – Current price of $17.65 for the 50 lb bag plus $89.23 for shipping was divided by 22.68 kilograms to get the per kilogram price of $4.71.

File: ‘feeds\_limestone\_dollar-per-kg.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Limestone
* **Units** – U.S. dollars per kilogram of limestone
* **Data source** – No historical prices could be found for limestone. Therefore, this file only features one economic price for limestone in 2024. The cost was gathered from [Huber’s Animal Health](https://www.hubersanimalhealth.com/product/limestone-calcium-feed-grade-50-lb/) for a 50 pound (22.68 kilogram) feed grade bag of limestone plus shipping to Utah.
* **Data Conversions** – Current price of $7.95 for the 50 lb bag plus $89.23 for shipping was divided by 22.68 kilograms to get the per kilogram price of $4.28.

File: ‘feeds\_milk-price-received\_dollar-per-CWT.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** –Milk
* **Units** – U.S. dollars per 100 pounds of milk
* **Data source** – Milk prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Dairy, Commodity: Milk, Category: Price Received, Data Item: Milk – Price Received, Measured in $ / CWT, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Marketing Year. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal. Values were only kept for years 1980 and newer.

File: ‘feeds\_milk-whole\_dollar-per-gallon.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Whole Milk
* **Units** – U.S. dollars per gallon of milk
* **Data source** - Historical national monthly whole milk prices were gathered from the Federal Reserve Bank of St. Louis FRED Economic Data for “Average Price: Milk, Fresh, Whole, Fortified (Cost per Gallon/3.8 Liters) in U.S. City Average”. [[Original Data](https://fred.stlouisfed.org/series/APU0000709112)] National level milk prices were assigned uniformly to each county within the United States. The annual value was calculated from the individual monthly reported values. Note this price data is for retail milk prices, most likely higher than the price farmers would pay to feed their calves.
* **Data Conversions** – Values received from FRED were already in dollars per gallon so no conversions were made.

File: ‘feeds\_sudan-silage\_dollar-per-ton.csv’

* **Primary Data Type** – Feed prices
* **Data Subtype** – Sudangrass Silage
* **Units** – U.S. dollars per ton of sudangrass silage
* **Data source** – Historical prices for sudangrass silage was not found. The only sudangrass silage estimate that could be find was provided by [“2009 Sample Costs to Produce Sudan Silage for San Joaquin Valley – South” by Wright et al. produced by the University of California Cooperative Extension](https://coststudyfiles.ucdavis.edu/uploads/cs_public/f8/b1/f8b125ac-f70c-42ff-97d2-4caa93121510/sudansilagevs09.pdf). They estimate the cost of sudangrass silage for sudangrass yields between 9.5 to 18.5 tons per acre. For the purposes of this data, the cost of $53/ton sudangrass silage was used for all counties which is associated with the middle sudangrass yield of 14 tons per acre. Since the report was produced in 2009, a scaling factor of 1.4614 was used to convert from 2009 dollars to 2024 dollars. Therefore a final value of $77.45 per ton of sudangrass silage was used for all counties.
* **Data Conversions** – A scaling factor of 1.4614 was used to convert the prices from 2009 dollars to 2024 dollars using [CPR inflation factors](https://www.in2013dollars.com/us/inflation/2009?endYear=2024&amount=1).

File: ‘fertilizer\_ammonium-nitrate\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Ammonium Nitrate prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_anhydrous-ammonia\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Anhydrous Ammonia prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_diammonium-phosphate-18-46-0\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Diammonium Phosphate 18-46-0 prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Phosphatic Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325312325312A)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_nitrogen\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Nitrogen prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since data was not provided for pure nitrogen, the mean price of nitrogen was gathered from all of the fertilizers which were nitrogen based (Anhydrous ammonia, Nitrogen solutions (30%), Urea 44-46% nitrogen, Ammonium nitrate, Sulfate of ammonium) by dividing the price of the nitrogen-based fertilizer by the percent nitrogen in the fertilizer. Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_nitrogen-solutions-30pct\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Nitrogen Solutions (30% nitrogen) prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_phosphorus\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Phosphorus prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since data was not provided for pure phosphorus, the mean price of phosphorus was gathered from all of the fertilizers which were phosphorus based (Super-phosphate 20% phosphate, Super-phosphate 44-46% phosphate, Diammonium phosphate [18-46-0]) by dividing the price of the phosphorus-based fertilizer by the percent phosphorus in the fertilizer. Since historical fertilizer prices were only provided up until 2014, the price index for “[Phosphatic Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325312325312A)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_potassium\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Potassium prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since data was not provided for pure potassium, the mean price of potassium was gathered from all of the fertilizers which were potassium based (Potassium chloride 60% potassium) by dividing the price of the potassium-based fertilizer by the percent potassium in the fertilizer. Since historical fertilizer prices were only provided up until 2014, the price index for “[Potash, Soda, and Borate Mineral Mining](https://fred.stlouisfed.org/series/PCU212391212391)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_potassium-chloride-60pct-potassium\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Potassium Chloride (60pct potassium) prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Potash, Soda, and Borate Mineral Mining](https://fred.stlouisfed.org/series/PCU212391212391)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_sulfate-of-ammonium\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Sulfate of Ammonium prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_super-phosphate-20pct-phosphate\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Super Phosphate (20% phosphate) prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Phosphatic Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325312325312A)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_super-phosphate-44to46pct-phosphate\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Super Phosphate (44-46% phosphate) prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Phosphatic Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325312325312A)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘fertilizer\_urea-44to46pct-nitrogen\_dollar-per-shortton.csv’

* **Primary Data Type** – Fertilizer
* **Data Subtype** – Urea (44-46% nitrogen) prices
* **Units** – U.S. dollars per short ton of fertilizer
* **Data source** – National average fertilizer prices were gathered from historical fertilizer prices as reported by the USDA’s Economic Research Service on table 7 of their data product titled “Fertilizer Use and Price”. [[Original Data](https://www.ers.usda.gov/data-products/fertilizer-use-and-price.aspx)] Since historical fertilizer prices were only provided up until 2014, the price index for “[Nitrogenous Fertilizer Manufacturing](https://fred.stlouisfed.org/series/PCU325311325311)” as provided by the U.S. Bureau of Labor Statistics via FRED from the Federal Reserve Bank of St. Louis was used to expand pricing data to years after 2014.
* **Data Conversions** – No conversions were made to this data from that received from the USDA-ERS.

File: ‘gasoline\_retail\_dollar-per-gallon.csv’

* **Primary Data Type** – Gasoline fuel
* **Data Subtype** – Retail prices
* **Units** – U.S. dollars per gallon of gasoline fuel
* **Data source** - Gasoline prices were used from the U.S. Energy Information Administration at the state level when available and the Petroleum Administration for Defense District (PADD) region level when state level data was unavailable. [[Original Data](https://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_nus_a.htm)] PADD region values were uniformly assigned to each state within that region based on the [definition of PADD regions](https://www.eia.gov/tools/glossary/index.php) from the U.S. Energy Information Administration. State level values were then assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘labor\_hired-wage-rate\_dollar-per-hour.csv’

* **Primary Data Type** – Labor
* **Data Subtype** – Hired wages
* **Units** – U.S. dollars per hour
* **Data source** – Labor prices were gathered from the United States Department of Agriculture’s (USDA’s) [National Agricultural Statistics Service Quickstats web portal](https://quickstats.nass.usda.gov/). This data can be obtained by selecting Group: Expenses, Commodity: Labor, Category: Wage Rate, Data Item: Labor, Hired – Wage Rate, Measured in $ / Hour, Geographic Level: National + State, Year: All, Period Type: Annual, Period: Annual. State level values were then assigned uniformly to each county within the state. When state or data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA’s Quickstats web portal.

File: ‘natural-gas\_commercial\_dollar-per-mcf.csv’

* **Primary Data Type** – Natural Gas
* **Data Subtype** – Commercial prices
* **Units** – U.S. dollars per thousand cubic feet of natural gas
* **Data source** - Historical state-level natural gas prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/dnav/ng/ng_sum_lsum_a_EPG0_PCS_DMcf_a.htm)] State level natural gas costs were assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘natural-gas\_industrial\_dollar-per-mcf.csv’

* **Primary Data Type** – Natural Gas
* **Data Subtype** – Industrial prices
* **Units** – U.S. dollars per thousand cubic feet of natural gas
* **Data source** - Historical state-level natural gas prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/dnav/ng/ng_sum_lsum_a_EPG0_PIN_DMcf_a.htm)] State level natural gas costs were assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘natural-gas\_residential\_dollar-per-mcf.csv’

* **Primary Data Type** – Natural Gas
* **Data Subtype** – Residential prices
* **Units** – U.S. dollars per thousand cubic feet of natural gas
* **Data source** - Historical state-level natural gas prices were used from the U.S. Energy Information Administration. [[Original Data](https://www.eia.gov/dnav/ng/ng_sum_lsum_a_EPG0_PRS_DMcf_a.htm)] State level natural gas costs were assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘propane\_residential\_dollar-per-gallon.csv’

* **Primary Data Type** – Propane
* **Data Subtype** – Residential prices
* **Units** – U.S. dollars per gallon of propane
* **Data source** - Historical propane prices were used from the U.S. Energy Information Administration at the state level when available and the PADD region level when state level data was unavailable. [[Original Data](https://www.eia.gov/dnav/pet/pet_pri_wfr_a_EPLLPA_PRS_dpgal_m.htm)] PADD region values were uniformly assigned to each state within that region based on the [definition of PADD regions](https://www.eia.gov/tools/glossary/index.php) from the U.S. Energy Information Administration. State level values were then assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘propane\_wholesale\_dollar-per-gallon.csv’

* **Primary Data Type** – Propane
* **Data Subtype** – Wholesale prices
* **Units** – U.S. dollars per gallon of propane
* **Data source** - Historical propane prices were used from the U.S. Energy Information Administration at the state level when available and the PADD region level when state level data was unavailable. [[Original Data](https://www.eia.gov/dnav/pet/pet_pri_wfr_a_EPLLPA_PWR_dpgal_m.htm)] PADD region values were uniformly assigned to each state within that region based on the [definition of PADD regions](https://www.eia.gov/tools/glossary/index.php) from the U.S. Energy Information Administration. State level values were then assigned uniformly to each county within the state. When state or PADD region data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the EIA.

File: ‘water\_irrigation\_dollar-per-acre-foot.csv’

* **Primary Data Type** – Water
* **Data Subtype** – Irrigation prices
* **Units** – U.S. dollars per acre foot of water
* **Data source** – State-level historical irrigation rates provided by USDA census data was used for irrigation water. [[Original Data](https://quickstats.nass.usda.gov/#5140700B-188C-320D-A302-F621608AFCC1)] State level values were then assigned uniformly to each county within the state. When state data was unavailable, the U.S. mean value was used.
* **Data Conversions** – No conversions were made to this data from that received from the USDA.

File: ‘water\_retail\_dollar-per-kgal.csv’

* **Primary Data Type** – Water
* **Data Subtype** – Retail prices
* **Units** – U.S. dollars per thousand gallons of water
* **Data source** – Historical retail water rates were obtained from a [2023 report by Unger et al. at Pacific Northwest National Laboratory](https://www.osti.gov/biblio/1975260/). This report provided retail water prices from water utilities across the U.S with a first year rate, final year rate, and escalation rate found in their survey. Therefore, annual water prices were obtained for each year between 2008 and 2023 using the provided water rates and associated escalation rate for price scaling. Counties were assigned the prices of the utility within their county if available. If a utility did not fall within a county, the mean price of water utilities in the state was used for that county. If no utilities provided data within a state, the mean price from all the utilities within the water region were used for the county.
* **Data Conversions** – No conversions were made to this data from that received from the PNNL report.