Final Project part 2 - Experiment Write-up

How does grain production and oil price affect beef and pork prices between 1975 and 2015?

Project Problem and Hypothesis:

This project aims to analyze historical grain production in the US between 1975 and 2015, and the price-per-barrel of crude oil, and compare it with the average retail, wholesale, and farm price-per-pound of beef and pork during the same time period.

The hypothesis (H1) is that as grain production and oil price increases, there will be a linear increase in prices of meat, after controlling for inflation and seasonality.

Hopefully, this model will be able to explain the relationship between a large set of data (40 years) and determine a mathematical relationship between the elements of grain production, oil price and meat price. I believe that grain production will have the most impact, as it directly affects the volume of meat produced, while oil prices will have a lesser impact, affecting the cost of transportation of animals from farm to feedlots and slaughterhouses, and retail stores.

This could impact the meat business by providing a way to predict future prices of meat based on current data. The time it takes to raise livestock is typically several years, and ranchers must decide how many to sell to market for meat, and how many to keep for breed stock. Having an estimated price point could help ranchers determine the optimum number of cattle and swine to raise and sell for meat.

Datasets

This data comes from www.data.gov, from the agriculture and commodities sections that track historical prices of meat, oil and grain production. This is time-series data, from the years 1975-2015. All of the values listed in dollars are unadjusted for inflation, therefore, all of the figures will need an inflation coefficient applied in order to be able to compare them across the time-frame. The meat price data includes respective columns for retail price, wholesale (slaughterhouse) price, and farm (rancher) price.

An example of the dataset:

Choice beef values and spreads and the all-fresh retail value1											next update March 16, 2016
						Beef price spreads					
Date	Retail value	Wholesale value	Gross farm value	Byprod. allow.	Net farm value	Total	Whl. to retail	Farm to whl.	Farmers' share	5 market steer price	All fresh beef retail value2
	Cents per pound of retail equivalent								Percent	$/cwt	cents/lb.
	Annual averages										
2010	438.4	241.1	230.8	26.9	203.9	234.5	197.3	37.2	46.5	96.15	402.1
2011	480.7	275.7	274.8	34.0	240.8	239.9	205.0	34.9	50.1	114.51	444.0
2012	498.6	290.6	295.1	35.0	260.1	238.5	208.0	30.5	52.2	122.96	469.3
2013	528.9	298.3	302.6	36.7	265.9	263.0	230.6	32.4	50.3	126.09	493.7
2014	597.1	364.7	370.5	41.0	329.5	267.6	232.4	35.2	55.2	154.39	560.1
2015	628.9	362.1	356.1	32.2	323.9	305.0	266.8	38.2	51.5	148.36	603.8
	Quarterly averages										
2013 I.	521.5	289.5	301.0	36.7	264.3	257.2	232.0	25.2	50.7	125.41	491.3
2013 II.	524.2	302.4	304.4	36.9	267.5	256.7	221.8	34.9	51.0	126.84	488.5
2013 III.	532.5	293.3	291.1	36.1	255.0	277.5	239.2	38.3	47.9	121.30	494.6
2013 IV.	537.5	307.9	314.1	37.4	276.7	260.8	229.6	31.2	51.5	130.86	500.6
2014 I.	554.1	342.8	349.8	40.9	308.9	245.2	211.3	33.9	55.7	145.73	521.6
2014 II.	590.0	352.0	352.2	40.3	311.9	278.1	238.0	40.1	52.9	146.74	548.6
2014 III.	615.1	383.1	381.0	40.8	340.2	274.9	232.0	42.9	55.3	158.76	575.5
2014 IV.	628.5	380.0	399.0	42.1	356.9	271.6	248.5	23.1	56.8	166.27	594.2
2105 I.	630.4	378.7	389.3	38.1	351.2	279.2	251.7	27.5	55.7	162.22	602.0
2105 II.	640.7	391.4	378.6	33.4	345.2	295.5	249.3	46.2	53.9	157.76	606.5
2105 III.	630.7	360.8	347.4	30.2	317.2	313.5	269.9	43.6	50.3	144.73	609.6
2105 IV.	613.9	319.0	309.1	26.8	282.3	331.6	294.9	36.7	46.0	128.81	596.8
	Monthly values										

Domain Knowledge

I worked as a butcher and meat manager in a retail supermarket for 5 years, and am familiar with the fluctuations of meat costs and retail prices. Part of my training for management included familiarization with the beef production process, learning from company trainers who met with ranchers and wholesalers to discuss the factors that affected their business, and a general understanding of commodity to retail production process as it relates to meat. I drew upon this knowledge to select what I believe to be the two main predictors to meat price: feed grain production and oil prices.

The Fletcher School at Tufts University published a paper on the relationship between food and fuel, analyzing historical data related to grain prices, meat prices and fuel prices, paying strong attention to the commodity price spike in 2007-2008. Their conclusions found that grain and meat prices are highly correlated, with additional correlation to energy prices of fossil fuels. The article is here**.**

Project Concerns

Some concerns of the project would be adjusting prices over the historical data set, in order to better compare current and past prices to grain production. This could be done by adding in an inflation coefficient to any of the values. Additionally, seasonality could affect meat prices, generally along the trend of meat being more expensive during summer months when demand is higher due to grilling/barbecuing season. This impact could be minimal, however larger weather issues like drought could affect grain production in certain years. In more recent years, the use of biofuels like ethanol effectively remove feed grains from production and replace crude oil, having a two-fold impact on the any meat-feed-fuel relationship. This is due to the limited amount of arable land that can be used for corn and grain production.

Outcomes

I expect the outcome of this model to demonstrate a high positive correlation between meat prices and grain production. I expect a secondary correlation between oil prices and meat prices to exist, but not to be as strong. I believe that a regression model of this data could provide predictive power for meat prices given any changes in grain production or fuel prices. This model would be successful if the p-value is less than 0.05.