

COLORADO STATE UNIVERSITY
DEPARTMENT OF AGRICULTURAL AND RESOURCE ECONOMICS

Problem Set 3
Fall 2018

Agricultural and Resource Economics 412
Agricultural Commodities Marketing

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Fundamental Analysis Using Elasticities

This problem set is to be an independent effort by a team of two students. Write both names and student ID numbers in the top right-hand corner. Partial credit will be awarded only if you show your work and if the work communicates. Round percent calculations to the nearest tenth of a percent. Round hog and cattle prices (\$/cwt.) to the nearest cent per cwt., broiler prices (¢/lb.) to the tenth of a cent per pound, and income to the dollar. This problem set is worth 50 points.

The purpose of this problem set is to use information available from the USDA in an applied price forecasting exercise. Basic economic tools called elasticities are used with publicly available supply and demand information to forecast futures prices. This procedure is a good starting point for analyzing prices of any non-storable commodity. The focus in this problem set will be on forecasting hog prices.

Assume it is June 29, 2018. On June 28, the USDA released the June Hogs and Pigs report. This report contains information on current and future hog supplies as of June 1, 2018. You are interested in forecasting prices of the lean hog futures contracts expiring in late 2018 and early 2019. A producer might incorporate this information into decisions of whether or not to hedge expected hog marketings or a speculator might use it to decide whether to take a long or short position. The futures contracts you are to forecast prices for are the contracts which will expire during the months of OCT18, DEC18, and FEB19.

1. The first step involves interpreting supply information. Information on the following two pages are hog numbers taken from the USDA Hogs and Pigs report. You need to determine which weight groups will be arriving at market during the delivery period of the futures contracts. The following information is available on the hog production process. The average weight of a finished hog sold in the U.S. is 280 pounds. After a pig reaches 50 pounds, the average rate of gain for hogs on feed is 1.5 pounds per day. Further, there are typically 2 months (60 days) between farrowing (birth of a litter of pigs) and when pigs reach 50 pounds and are ready to go on feed. The USDA Hogs and Pigs report contains the following information. The Market Hogs and Pigs numbers are the numbers of hogs, by weight, which producers plan to market as slaughter hogs. The Sows Farrowing numbers list the number of sows which farrowed pigs during the quarters of the production year. A unique and interesting feature of this report is that in it is reported the number of sows which producers *intend* to farrow in the next two quarters. For example, the June report provides the number of sows producers intend to farrow during the June-August quarter, and during the September-November quarter. The market hogs which will be sold for the next year can be estimated from these groups.

After the Hogs and Pigs report data is one page from the June release of USDA Livestock Slaughter report. Assume that the percent change in slaughter hog weights in the future will be equal to the percent change in average dressed weight of barrows and gilts between May 2017 and May 2018.

Hogs and Pigs Inventory by Class, Weight Group, and Quarter - United States:
 2017 and 2018
 [May not add due to rounding. Blank data cells indicate estimation period has not yet begun]

Item	2017	2018	2018 as percent of 2017
	---- 1,000 head ----		percent
March 1 inventory			
All hogs and pigs	70,701	72,938	103
Kept for breeding	6,098	6,210	102
Market	64,603	66,728	103
Market hogs and pigs by weight groups			
Under 50 pounds	20,407	21,047	103
50-119 pounds	17,862	18,422	103
120-179 pounds	14,435	14,941	104
180 pounds and over	11,899	12,317	104
June 1 inventory			
All hogs and pigs	71,010	73,451	103
Kept for breeding	6,109	6,320	103
Market	64,901	67,131	103
Market hogs and pigs by weight groups			
Under 50 pounds	20,647	21,387	104
50-119 pounds	18,741	19,388	103
120-179 pounds	13,646	14,198	104
180 pounds and over	11,867	12,157	102
September 1 inventory			
All hogs and pigs	73,559		
Kept for breeding	6,117		
Market	67,442		
Market hogs and pigs by weight groups			
Under 50 pounds	21,673		
50-119 pounds	19,781		
120-179 pounds	13,919		
180 pounds and over	12,069		
December 1 inventory			
All hogs and pigs	73,695		
Kept for breeding	6,179		
Market	67,516		
Market hogs and pigs by weight groups			
Under 50 pounds	21,582		
50-119 pounds	18,694		
120-179 pounds	14,030		
180 pounds and over	13,209		

Sows Farrowing, Pig Crop, and Pigs per Litter - United States: 2016-2018
 [December preceding year. Blank data cells indicate estimation period has not yet begun]

Item	2016	2017	2018	:2018 as percent of	
				2016	2017
	----- 1,000 head -----			-- percent --	
Sows farrowing					
December-February	2,927	2,986	3,057	104	102
March-May	2,968	3,014	3,121	105	104
December-May 1/	5,896	5,999	6,178	105	103
June-August 2/	3,057	3,121	3,170	104	102
September-November 2/ ..	3,046	3,130	3,180	104	102
June-November 1/ 2/ ..	6,103	6,251	6,350	104	102
Pig crop					
December-February	30,139	31,146	32,341	107	104
March-May	31,097	31,790	33,167	107	104
December-May 1/	61,236	62,935	65,508	107	104
June-August	32,331	33,244			
September-November ...	32,372	33,624			
June-November 1/	64,703	66,867			
	----- number -----			-- percent --	
Pigs per litter					
December-February	10.30	10.43	10.58	103	101
March-May	10.48	10.55	10.63	101	101
December-May	10.39	10.49	10.60	102	101
June-August	10.58	10.65			
September-November ...	10.63	10.74			
June-November	10.60	10.70			

1/ May not add due to rounding

2/ Intentions for 2018.

Class	May	April	May	January to May	
	2017	2018	2018	2017	2018
				pounds	
Cattle	789	806	797	810	815
Steers 1/	836	860	848	865	872
Heifers 1/	771	798	786	806	814
All cows 1/	647	658	647	650	659
Bulls 1/	907	893	900	894	896
Calves and vealers ...	161	142	137	145	138
Hogs	211	215	213	212	214
Barrows and gilts 2/	208	212	211	210	212
Sows 2/	310	305	308	308	305
Boars 2/	202	198	201	204	196
Sheep	67	71	70	70	72
Mature sheep 3/	70	67	68	68	68
Lambs and yearlings 3/ ...	67	71	70	70	72

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Calculate which group will be arriving in the slaughter market during each contract expiration month and determine the percent change in supply from the previous year. You should determine when the typical hog that is on the border of two groups will come to market. Lighter hogs will be marketed later and heavier hogs will be marketed earlier. You may need to use sow farrowing intention numbers. If you do then observe the change in pigs per litter. Calculate the average percent change with the two most recent quarters and include that with your change in sow numbers. Show your calculations clearly below. Use the production information given above, not any personal knowledge. We are analyzing market prices which are influenced by the behavior of all producers, and the average of the U.S. is lower than the better management practices or the targets of efficient producers. Remember, the report information is as of June 1. Do not use the percent changes in the table. Round the percent changes that you calculate to the nearest tenth of a percent.

Lean Hog Contract	Report Group	% Change in Numbers	% Change in Weight	Total % Change
OCT18	_____	_____	_____	_____
DEC18	_____	_____	_____	_____
FEB19	_____	_____	_____	_____

Use the time line below to support your work.

May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

2. The second step is to incorporate the supply information with the demand curve for pork. This will be done in three steps. The first step, (a) below, is to examine the own-price effect of the supply change on hog prices, examining a movement along the demand curve. The second step, (b) below, will be to examine how the demand curve for pork may shift in response to changing income, broiler chicken and fed cattle prices. The third step, (c) below, is to incorporate the demand shifts with the movements along the demand curve (supply changes) for a total effect hog price forecast.

Use the following elasticities:

Own-Price Elasticity of Hog Demand = -0.65,
 Cross-Price Elasticity between Hog Demand and Broiler Prices = 0.10,
 Cross-Price Elasticity between Hog Demand and Cattle Prices = 0.15,
 Income Elasticity of Hog Demand = 0.40.

You should use the appropriate month of the previous year as the base when making your projected percent changes. Information on inflation, and past and projected prices and income are as follows.

Hog Prices:

Over the previous year, lean hog futures contracts entered the delivery months at the following prices:

JUL17	AUG	OCT	DEC	FEB18	APR	MAY	JUN
92.00	82.00	60.00	64.50	74.00	53.00	66.00	77.00

Broiler Prices:

Industry sources and an article in the USDA publication Livestock, Dairy and Poultry Outlook suggest there will be changes in broiler production and exports for 2018 and 2019. Production is expected to be down and exports are expected to be up. The USDA publication reports that price forecasts for the broiler price (cents/lb.) will be at the following levels over the coming year:

Jul-Sep18	Oct-Dec	Jan-Mar19
99-105	93-101	96-104

The national composite broiler prices last year were at the following levels:

Jun17	Jul	Aug	Sep	Oct	Nov	Dec	Jan18	Feb	Mar	Apr	May
109.0	103.8	92.5	88.4	84.8	86.0	87.3	94.0	91.1	102.0	108.7	117.6

(Use the midpoint of the forecasted price range for a forecast in the middle of the quarter. However, use a well-known fact about the seasonality of broiler production and the impact on price. Broilers are grown in the southern U.S., are grown in largely open-air facilities, and are most impacted by summer heat. Production is lowest relative to demand in the summer and higher in the fall, winter, and spring.) So use one end of the range for a forecast at the ends of each quarter.)

Cattle Prices:

Because cattle prices are relatively difficult to forecast, you use futures prices as your projections of cattle prices. You read the following live cattle futures prices out of the Wall Street Journal:

AUG18	OCT	DEC	FEB19	APR	JUN
106.75	110.00	113.70	116.30	117.30	107.00

Over the previous year, live cattle futures contracts entered the delivery months at the following prices:

AUG17	OCT	DEC	FEB18	APR	JUN
113.00	112.00	116.00	127.00	116.00	108.00

Inflation and Consumer Income:

After reading information the Federal Reserve Bank, Wall Street Journal, and USDA Agricultural Outlook publication, you find the outlook for the economy strengthening and that it most likely will grow strong during 2018 and 2019. Inflation has been low but increasing lately. The most recent month for which you have the consumer price index (CPI) is May 2018 and it is 250.5. The CPI in May 2017 was 243.9. Calculate the current annual inflation rate and assume this rate will continue through 2018 and into 2019. Use this rate to deflate and inflate as needed.

Below are listed the most recent six quarters of per capita disposable income:

2017:I	2017:II	2017:III	2017:IV	2018:I
44907	45163	45503	45983	46696

You need to forecast nominal income for the quarters of 2018 and 2019 in which the futures contracts expire. (Nominal income has inflation in it.) Calculate the annual percentage growth in nominal income based on most recent quarter with which you have information – use income from the most recent quarter and compare that to income in the same quarter of the previous year. Assume nominal income will grow at this amount. Next, use the nominal income levels from the different quarters of 2017 and 2018 and that percentage growth rate, and forecast nominal income. You are assuming that the most recent current nominal growth rate will continue into the next year. Show your inflation and income work below.

a. Calculate the own-price effect of the expected changes in future supplies on the futures prices for lean hogs. Use just the own price elasticity.

Futures Contract Month	% Supply Change	% Hog Price Change	Last Year's Hog Price	Hog Price Forecast (real)	Hog Price Forecast (nominal)
OCT18	_____	_____	_____	_____	_____
DEC18	_____	_____	_____	_____	_____
FEB19	_____	_____	_____	_____	_____

Show the % Hog Price Changes and Hog Price Forecasts (real) clearly. You need not show the inflation calculations.

b. The next step is to calculate the extent of the demand curve shifts over the next year. Use the cross price and the income elasticities to calculate how much the demand curves are expected to shift given the projected changes in broiler price, cattle price, and income. Notice, all the work necessary can be done on the table provided below, i.e., % Change multiplied by the Elasticity yields the % Shift in Hog Demand. Be sure to express numbers in the % Change column as changes, i.e., small positive or negative percentages, and not numbers close to 100.

OCT18 Contract	10/18 Forecast	10/18 Forecast Deflated	10/17 Actual	% Change	Elast- icity	%Shift in Hog Demand
Broiler Price	_____	_____	_____	_____	_____	_____
Cattle Price	_____	_____	_____	_____	_____	_____
Income	_____	_____	_____	_____	_____	_____
Total Demand Curve Shift						_____
DEC18 Contract	12/18 Forecast	12/18 Forecast Deflated	12/17 Actual	% Change	Elast- icity	%Shift in Hog Demand
Broiler Price	_____	_____	_____	_____	_____	_____
Cattle Price	_____	_____	_____	_____	_____	_____
Income	_____	_____	_____	_____	_____	_____
Total Demand Curve Shift						_____
FEB19 Contract	2/19 Forecast	2/19 Forecast Deflated	2/18 Actual	% Change	Elast- icity	%Shift in Hog Demand
Broiler Price	_____	_____	_____	_____	_____	_____
Cattle Price	_____	_____	_____	_____	_____	_____
Income	_____	_____	_____	_____	_____	_____
Total Demand Curve Shift						_____

c. Combine the projected changes in supply with the total shifts in demand to calculate the net change in pork quantity which will affect the lean hog price. Use the following formula:

$$\text{Net \% Change in Quantity} = \% \text{ Change in Supply} - \text{Total \% in Shift in Pork Demand.}$$

Futures Contract Month	% Change in Supply	Total %Shift in Pork Demand	Net Change in Quantity
OCT18	_____	_____	_____
DEC18	_____	_____	_____
FEB19	_____	_____	_____

Next, use the Net Change in Quantity and the own-price elasticity to project the prices of the futures contracts.

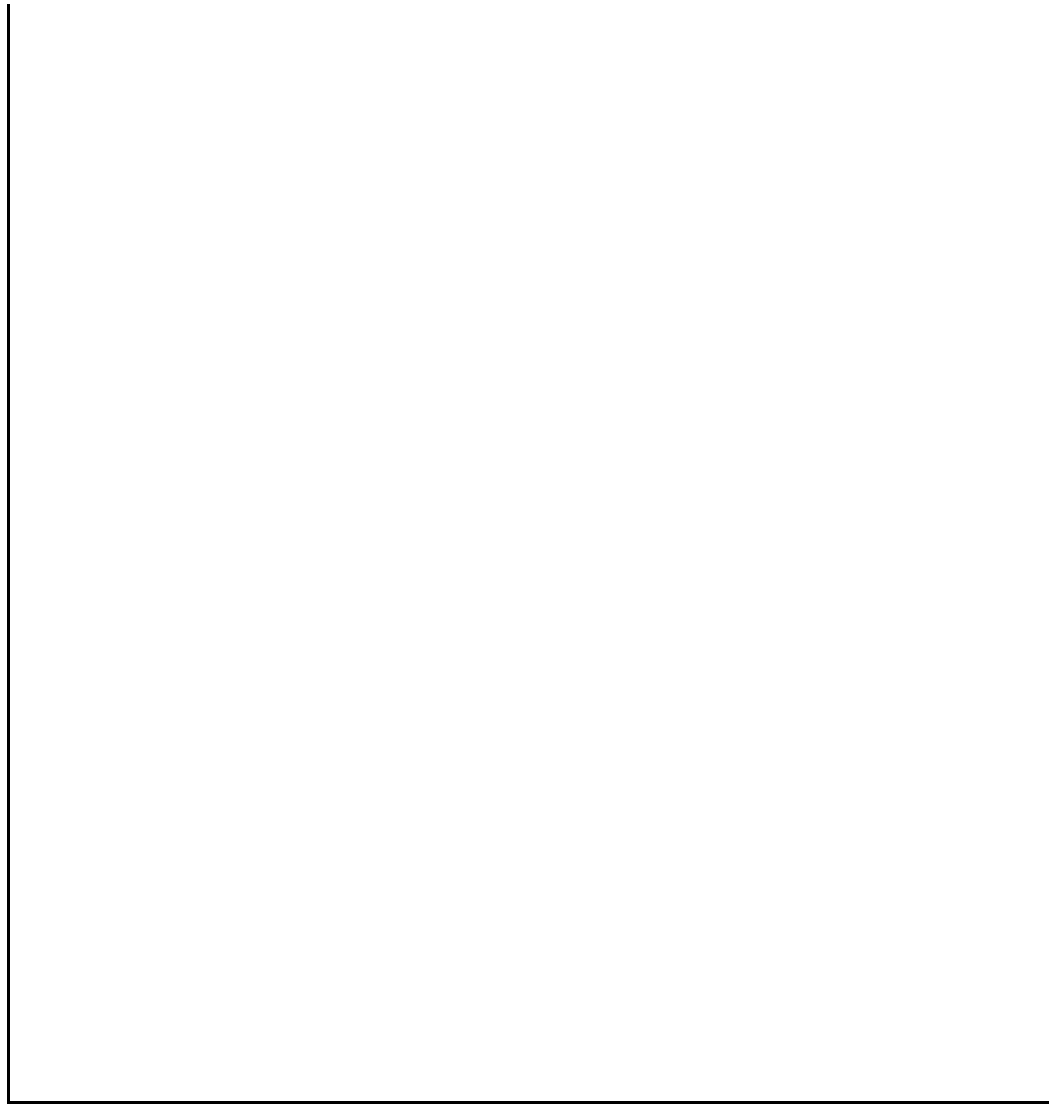
Futures Contract Month	Net Change in Quantity	% Hog Price Change	Last Year's Hog Price	Hog Price Forecast (real \$)	Hog Price Forecast (nominal \$)
OCT18	_____	_____	_____	_____	_____
DEC18	_____	_____	_____	_____	_____
FEB19	_____	_____	_____	_____	_____

Show your % Hog Price Changes and Hog Price Forecasts (real).

3. Identify and draw the listed features of your price projection for the contract with the largest supply shift. Make sure the figure communicates. Draw the following:
- Last year's demand curve, supply curve, and price.
 - The new supply curve, percent change in quantity supplied, and forecasted price (real \$).
 - The new demand curve, percent change in demand, the net quantity based on shifted supply and demand, and the forecasted price (real \$).

Contract Month:

Price



Quantity

4. Compare your price forecasts to the actual closing futures prices June 29, 2018.

	Actual Prices	Forecast Prices
JUL	\$82.88/cwt.	
AUG	\$76.45	
OCT	\$59.78	_____
DEC	\$54.55	_____
FEB19	\$59.75	_____
APR	\$64.68	
MAY	\$70.32	
JUN	\$73.85	

If you were involved in hog production and had some hogs to sell in this marketing window, how might this information influence your hedging decisions? What about if you are a speculator?

Why might your forecast not be correct? Evaluate the procedures that you followed. What information might you want to use to qualify your quantitative forecast? (Write down the list and discuss one important thing on the list based on some independent research.)