

Supply chains and marketing margins

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Lecture notes for Econ 235

Notes

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Notes

Notes

Definitions

- What is a *marketing margin*?
 - It is the difference between the price received by producers and the price paid by consumers.
- A similar measure is the *farm value share*:
 - It is the ratio of the price received by producers and the price paid by consumers.

Definitions

- Some refer to a marketing margin as the *price spread*.
- Why care about marketing margins?
 - Concerns by producers and consumers over the size of margins and changes in the size of margins;
 - Fear that the “middleman” is taking advantage of its position;
 - Are firms with market power capturing most of the value of a product?
 - Why do marketing margins vary across products?
- Marketing margins are most meaningful for products that do not go through much transformation.

The USDA publishes data on price spread

- Information about food prices is available at:
<http://www.ers.usda.gov/topics/food-markets-prices/food-prices-expenditures-costs.aspx>.
- Price spread data are available at: <http://www.ers.usda.gov/data-products/price-spreads-from-farm-to-consumer.aspx>.
- Food prices and spending at
<http://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/food-prices-and-spending.aspx>.

Marketing margins for milk and dairy across time

Table : Milk and dairy basket

Year	Retail cost	Farm value	Farm-to-retail spread	Farm value share
		2003=100		Percent
2000	96	97	95	28
2001	100	118	92	33
2002	100	95	102	27
2003	100	100	100	28
2004	107	128	99	33
2005	109	114	107	29
2006	108	101	111	26
2007	116	145	105	35
2008	125	145	118	32
2009	117	101	124	24
2010	119	127	115	30
2011	127	156	116	34
2012	129	143	124	31
2013	130	153	121	33
2014	134	185	115	38
2015	132	136	131	29
2016	129	130	129	28

Notes

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Marketing margins vary across commodities

- Have a look at these interactive charts <https://www.ers.usda.gov/data-products/price-spreads-from-farm-to-consumer/interactive-chart-price-spreads-and-food-markets/>.

Table : Marketing margins across commodities in 2015

Product	Farm-to-retail spread (2001=100)	Farm value share
Milk and dairy basket	131	29
Fresh fruit basket	117	38
Fresh vegetables basket	141	27
Flour, white, all purpose, per pound		18

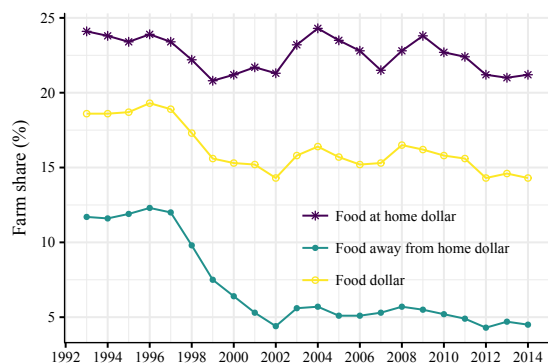
What explains the difference in marketing margins?

- For commodities that are expensive to farm, the marketing margin will tend to be relatively small and the farm value share higher.
- The marketing margin is large and the farm value share is small for product that are substantially transformed.

Marketing margins over time

- Reasons for changes in marketing margins over time:
 - Improvements in farming technologies has caused a decline in the cost of farming, thus causing a decline in the price of food commodities;
 - Consumers demand more transformed products (e.g. ready to eat meals, food away from home). Processing of food occurs less at home;
 - Marketing firms have been offering products that are increasingly more processed, thus increasing costs and the price paid by consumers. New technology facilitates the automation of the transformation of food.
- These three factors cause a decline in farm value share over time or equivalently, an increase in the marketing margin.

Farm value share over time (1993-2014)



Note: The data are from

<https://www.ers.usda.gov/data-products/food-dollar-series/download-the-data/>.

Farm value share now

- The Economic Research Service (ERS) reports the *Food Dollar Series*, which measures annual expenditures by U.S. consumers on domestically produced food.
- The Food Dollar Series is available online at: <http://www.ers.usda.gov/data-products/food-dollar-series.aspx>.
- There are three series in the Food Dollar Series: *marketing bill series*, *the industry group series*, and *the primary factors series*.

Marketing Bill series (2015)



Source: Food Dollar Series, available at:

<http://www.ers.usda.gov/data-products/food-dollar-series.aspx>.

Industry Group series (2015)



Source: Food Dollar Series, available at:

<http://www.ers.usda.gov/data-products/food-dollar-series.aspx>.

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Primary Factors series (2015)

2015 Food dollar: Primary Factors (nominal)



Source: Food Dollar Series, available at:

<http://www.ers.usda.gov/data-products/food-dollar-series.aspx>.

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Fall 2017 13 / 38

Food prices and the 2012 drought

- The 2012 crop season started well for farmers in the Mid-West but the lack of rain quickly deteriorated growing conditions.
- Following the worst drought in 50 years, the 2012 harvest was disappointing, causing an increase in the price of agricultural commodities.
- What are the consequences of the drought on the price of food products?

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Fall 2017 14 / 38

How commodity prices affect the price of food?

- To see this, let's consider the example of a farrow-to-finish farm.
- We will use budgeting from Ag Decision Maker, prepared by extension economists here at Iowa State University: <http://www.extension.iastate.edu/agdm/livestock/html/b1-21.html>.
- On that webpage, open the decision aids excel file for [farrow-to-finish](#).

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Fall 2017 15 / 38

Farrow-to-finish production cost

- The excel sheet describes the cost of farrow-to-finish operation under reasonable assumptions about input quantities and their prices.
- The excel sheet differentiates between variable and fixed costs.
- Let's focus here on the variable cost. In particular, we will focus on the cost of corn feed, changing the value of the corn price and keeping everything else constant.
- As of November 16, 2017, the price of corn in the excel sheet is \$3.30 per bushel.
- At that price, the break-even selling price for all costs is \$43.71 per cwt.

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Fall 2017 16 / 38

Break-even selling price for all costs?

- What's the meaning of the break-even selling price for all costs?
- It is the price of hog at which a farrow-to-finish operation exactly covers its costs.
- If the price of hog is greater than the break-even selling price, then a farrow-to-finish operation earns a profit. Otherwise it incurs a loss.
- Finishing hogs is a competitive business. Remember that *economic profits* for competitive firms are zero in the long-run.
- The excel sheet shows a measure of *accounting profit*.

Notes

Economic vs accounting profits

- The difference between economic and accounting profits is that economic profits include opportunity costs.
- The opportunity cost is the cost for not doing something else. It could be, for example, the cost of owning a hog finishing operation instead of owning a cattle feeding operation.
- For simplicity here, assume that economic profits equal accounting profit. That is, there is no opportunity cost of own a hog finishing operation.

Notes

Entry, exit and input costs

- In the long-run, entry and exit of farrow-to-finish operations will occur until profits equal zero, that is when the break-even selling price equals the market price.
- One implication is that at market equilibrium, changes in costs are reflected through changes in prices.
- That means that we can use the accounting sheet to study how an increase in the price of corn will impact the price of finished hogs in the long-run.

Notes

Effect of an increase in the price of corn

- Recall that at \$3.30 per bushel, the break-even price is \$43.71 per cwt.
- Suppose a 100% increase in the price of corn, which thus increases to \$6.60 per bushel.
- At that new price of corn, the break-even price for all costs becomes \$59.96 per cwt.
- That is, for a 100% increase in the price of corn, the price of hog should increase by about $(59.96 - 43.71)/43.71 = 37\%$.
- Why does the price of hog increases relatively less than the price of corn?

Notes

Effect of an increase in the price of corn

- The price of finished hogs increases proportionally less than the price of corn because the cost of corn is a fraction of the total cost of finishing hogs.
- From the excel sheet, the estimated cost of corn per litter when priced at \$3.30 per bushel is \$346.50.
- The total cost per litter is \$1,001.57.
- This means that at a price of \$3.30 per bushel, the cost share of corn is 34.6% of the cost of finishing hogs.
- Thus, a 100% increase in the price of corn causes roughly a $100\% \times 0.346 = 34.6\%$ increase in the price of hogs, close to the 37% calculated before.

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Is this change in the price of finished hogs correct?

- It understates the effect of an increase in the price of corn because:
 - Corn is also an input in the production of gilts and boars;
 - As soybean meal and DDGS are substitutes to corn, then an increase in the price of corn will cause increases in the prices of soybean meal and DDGS.
- It overstates the effect of an increase in the price of corn because:
 - Farms can find substitutes to corn to use as a feed (candy?);
 - Farms can adapt their production methods.

Going all the way up the supply chain

- Even if the numbers calculated in the previous slides are not exactly accurate, what we learn from them is that an increase in the price of one input will tend to have a small impact on the price of an output because the cost of a single input is typically a small share of the total costs.
- Going all the way up the supply chain to pork purchased by consumer, the cost share of corn will become very small.
- Suppose that the cost share of live hogs to packing houses is 0.5 and that the cost share of marketing pork meat all the way up to sales at retail is 0.5, then this means that in total, corn represents about $34.6\% \times 0.5 \times 0.5 = 8.65\%$ of the cost of pork at retail.

Going all the way up the supply chain

- With these numbers, it means that an increase in the price of corn by 100%, would cause an increase in the price of pork by only 8.65%.
- Farm commodity prices account for only a small fraction of the cost of food at retail.
- This is also true for many products other than pork.
- Any change in commodity prices has a small impact on food prices at retail.
- This is true only for food products and are transformed. For instance, an orange is the same at the farm and at the consumer level.

In practice, the effect is even smaller...

- The examples in the previous slide assume that the commodities enter in a fixed proportion in the food product.
- For many food products, the assumption that a commodity enters in a fixed proportion in the production of a food product is not true.
- For producers and manufacturers, it is often possible to substitute one input by another.
- For example, [cash-strapped farmers feed candy to cows](#).
- Another example is the use of high-fructose corn syrup instead of cane sugar in the production of soda (pop!) in the United States.

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In practice, the effect is even smaller...

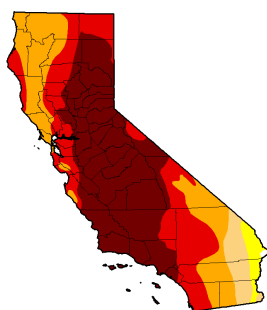
- Thus, unless food-makers are constrained by a recipe, they will substitute expensive ingredients (inputs) with less expensive ingredients as much as they can.
- In economics, the ability to substitute an input by another is measured by the elasticity of substitute σ .
- If $\sigma = 0$, then firms are not able to substitute one input for another.
- For $\sigma > 0$, then firms are able substitute inputs.
- For $\sigma \rightarrow \infty$, inputs are perfect substitute. High-fructose corn syrup and cane sugar are close to being perfect substitutes.

About the 2012 drought and food prices

- Huge increase in the price of commodities.
- What happened to the price of food? Not much!
- USDA predicts price for food.
- [Drought Affecting Food Prices In 2013 - USDA video on YouTube](#).
- Consistent with the previous discussion, USDA predicted a small impact of the drought on food prices.

Drought in California

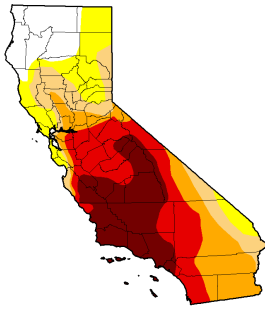
Figure : U.S. drought monitor for California in November 2015



Source: <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>.

Drought in California

Figure : U.S. drought monitor for California in November 2016



Source: <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>.

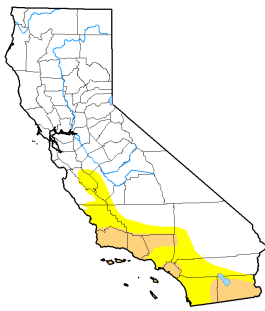
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Fall 2017 29 / 38

Drought in California

Figure : U.S. drought monitor for California in November 2017



Source: <http://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CA>.

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Fall 2017 30 / 38

What about the effect of the current drought

- California is a large producer of fruits, vegetables, tree nuts and dairy.
- [Factors that impact U.S. food prices](#) on C-SPAN. The video is a bit long but very informative.
- The idea is the same as before, if the cost of an input represents a small share of the cost at retail, then an increase in the price at the farm has a small impact on the price at retail.
- For those less processed products, the change in prices will occur faster.
- For fresh fruits and vegetables, imports helped buffer the effect of the California drought.
- More information available at:
<http://usda.proworks.com/topics/in-the-news/california-drought-farm-and-food-impacts/california-drought-food-prices-and-consumers/>.

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Fall 2017 31 / 38

What about eggs?

- Iowa and other US States have been affected by an outbreak of avian influenza in the spring of 2015.
- This caused a significant decline in the production of eggs in Iowa and in other states.
- Eggs produced in Iowa are mostly for breaking to make liquid and powdered eggs.
- Still, the events associated with avian influenza outbreak impact shell eggs at retail because of demand and supply substitution.

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Fall 2017 32 / 38

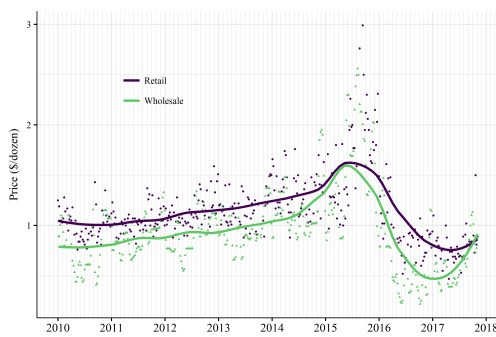
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Figure : Large white egg prices in \$ per dozen



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Are eggs sold at a loss?

- The margin between retail and wholesale was on average pretty stable until Spring 2015.
- The margin was reduced significantly with the increase in the price of eggs caused by the avian flu.
- It is possible that eggs are retail are sold at a loss over a short period of time, especially during holidays.
- The margin returned to its normal value but seems to have been very small recently, possibly negative.

Notes

From consumers to farms

- What about asking the question the other way around?
- How does a change in the demand (e.g. the demand shifts out) for a food product affect the price of agricultural commodities?

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From consumers to farms

- As there are many factors of production (inputs) in a supply chain (e.g. agricultural commodity, trucking, refrigeration, storage, labor...), a change in the price of a food product will affect the price of all of these factors of production.
- Only when the supply of a factor of production is perfectly elastic that its price does not change.
- The sign of the change in the price of other inputs is the same as the change in the price of the output.
- For inputs that are inelastically supplied:
 - Large changes in prices;
 - Small changes in quantities.
- For inputs that are elastically supplied:
 - Small changes in prices;
 - Large changes in quantities.

Notes

- The value shares of inputs also matter:
 - The prices and the quantities of inputs that have small value share change by less.
- The elasticity of substitutions also matter:
 - Stronger effect on prices and quantities of inputs that do not have substitutes.
- Thus, the effect of a change in the demand for a food product is distributed through a supply chain according to the supply elasticities of inputs, the elasticities of substitution and the values shares.
- This means that the farm price may see only a small effect of an increase in the demand for a food product.

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Other information

- If you want to learn the complexity of the food supply chain, you can look at data from the input-output matrix from the [Bureau of Economic Analysis](#).
- People at Tuft University have a prepared a [tool](#) to visualize those data