

Problem Set 2

Big Beer dresses up in craft brewers' clothing
(November 15, 2012; Denis Wilson, CNNMoney.com)

Perhaps you've ordered a beer at a restaurant recently. Maybe you even perused the craft beer list, looking for something different. If you're like me, your decision was based on something other than price – otherwise you could've ordered a Coors Light or Budweiser for two or three bucks less. So what was it? Was it the possibility of finding a unique, even superior flavor? Or was your decision based on the idea that a craft beer is one that's made by a small, independently owned brewery and not by the same makers of Coors or Bud? If it was the latter, you may want to find out who's really making your beer before your next round.

Big, global breweries have taken notice of the craft beer movement—mostly because that's where actual growth exists in the otherwise stagnant beer industry. In 2011, craft brewing saw growth of 13% by volume while overall U.S. beer sales were down an estimated 1.3% by volume. And even though craft beer still accounts for less than 6% of all beer sales, anyone remotely connected to the business knows it will play a big part in the industry's future. Craft beer delivers higher profit margins, it attracts consumer spending, sought-after clientele for bars and restaurants, and many people are passionate about craft beer, similar to the same way people are passionate about wine.

Everybody wants in. And so the macro-breweries have launched beers that approximate the craft taste profile (the popular Coors brand, Blue Moon), purchased stakes in some craft breweries (southeastern Terrapin Beer Company by MillerCoors), and snatched up others entirely (such as the recent acquisition of Goose Island Brewing by Anheuser-Busch). What's noteworthy about these forays into the craft segment is the way these brands are purposely distanced from their Big Beer parents. You won't find the Coors name on a bottle of Blue Moon. Rather, you see the name Blue Moon Brewing Company. The same goes for a bottle of Anheuser-Busch's Shock Top. To distance their craft products from their billion-dollar household brands, the big brewers have gone so far as to create separate divisions to house their specialty brands: MillerCoors has created Tenth & Blake Beer Company while Anheuser Busch (BUD) has the Green Valley Brewery.

In many industries, this wouldn't raise an eyebrow. But craft beer is defined as much by its underdog culture and at-times contentious relationship to the greater beer market as its actual products. Some craft brewers and drinkers see these beers as imitators, donning a craft beer costume—bold label designs and quirky names—in an attempt to deceive customers. On craft beer forums and blogs, the debate rages on. Consumers in general have grown increasingly concerned with who makes the products they buy

and how products are made. More and more, our purchases have come to feel like endorsements of a company's practices. "There are two types of consumers," says Anat Baron, the director of the documentary Beer Wars, which explores the battle between micro- and macro-breweries. "Consumers who shop by price and just don't care who makes the stuff that they buy, and other consumers, which are a minority, but I think a growing minority, that actually care about who makes what they buy."

In the following problems, you will need to solve for elasticities and changes in market conditions. In interpreting the elasticities, please provide a response such as, "For a ___% change in price (or quantity), there is a ___% change in quantity (or price)."

1. Consider the following demand functions for craft beer. Determine the own-price elasticity of demand when $P = 5$. Then interpret what each elasticity implies.

(a) $P = 80 - 4Q$

(b) $Q = 9 - 0.2P$

2. For each of the following macrobrew beer demand functions, find the own-price flexibility of demand when $Q = 5$. Interpret what the flexibility implies.

(a) $5Q = 100 - 5P$

(b) $P = 100 - 10Q$

3. Consider these supply functions and determine the *own-price* and *cross-price* elasticities of supply. For each of the then, interpret what the elasticity implies.

(a) $Q_{beer} = 500 + 4P_{beer} - 5P_{hops} - 2P_{barley}$
 $P_{beer} = 5 \quad P_{hops} = 20 \quad P_{barley} = 10$

(b) $P_{barley} = 10 + 0.25Q_{barley} - 2P_{wheat}$
 $P_{barley} = 10 \quad P_{wheat} = 7$

4. Consider the following demand function describing the potential interaction between the craft and macrobrewery markets.

$$Q_D^{craft\ beer} = 4000 - 4P_{craft\ beer} + 5P_{wine} - 0.25Q_{macro_beer} + 2Q_{farmers\ markets}$$

You know that $P_{craft_beer} = \$5$, $P_{wine} = \$10$, $Q_{macro_beer} = 10000$, $Q_{farmers\ markets} = 500$.

Determine/respond to the following:

- (a) Quantity of craft beer.
- (b) Own-price demand elasticity of craft breweries.
- (c) Cross elasticities of breweries and (i) wine prices, (ii) macrobeer production (in 1,000 units), and (iii) number of farmers markets where craft brewers can advertise.
- (d) Given your findings in part (c), are craft beer producers more responsive to changes in macrobrewery beer production or advertisements at local farmers' markets? Why?

5. You wish to analyze how macrobreweries' expansion of craft beer brands may impact the prices and quantities of Montana barley. Suppose that the demand and supply functions of Montana barley are as follows:

$$D^{\text{barley}} : Q_D^{\text{barley}} = 140 - 5P^{\text{barley}} + 4P^{\text{craft_beer}} + 10P^{\text{macro_beer}}$$

The supply of barley is a function of its market price, the wheat, and the price of fertilizer (f).

$$S^{\text{barley}} : Q_S^{\text{barley}} = 310 + 10P^{\text{barley}} - 5P^{\text{wheat}} - 0.25P^f$$

Prices for these commodities and income are as follows:

P^{barley}	=	\$10/bushel
$P^{\text{craft_beer}}$	=	\$35/gallon
$P^{\text{macro_beer}}$	=	\$7/gallon
P^{wheat}	=	\$7/bushel
P^f	=	\$300/ton

- (a) Calculate the own- and cross-price elasticities of demand and supply. Interpret the cross price elasticity between barley supply and the price of wheat. Why is wheat in the supply function of barley?
- (b) Assume that the increased demand for barley through the macrobreweries' product line expansion will alter the demand for barley by 5%. Quantitatively determine the impacts on the percent change in the price, quantity demanded, and quantity supplied of barley. Neatly outline the steps and logic of solving the problem.
- (c) Now assume that the change is more modest—a 2.5% increase. Recalculate the impact on the percent change in price and quantities.

While Montana does not currently have a large dairy production market, the United States produces a significant amount of dairy products. Major dairy production areas include Wisconsin, New York, California, Oregon, and Arizona, among others. The dairy sector is interesting, because cow milk can be used to produce a number of commodities, based on the fat level of the milk. For example, Class I milk—the highest quality—is used for direct consumption (the milk you pour on your cereal). Class II is an input in the production of various yogurts and ice creams. Classes III and IV are used to produce cheeses and butter, respectively. Furthermore, there are by-products of dairy products. For example, whey (and dry whey) are a by-product of cheese production from Class III milk. Furthermore, dairy products are often combined with other inputs in order to produce a final good.

The numerous interactions make the dairy market interesting to study. Primarily, this is because shocks and changes to one part of the market may have significant ripple effects throughout the numerous other portions of this market. Throughout the 20th and 21st centuries, a number of large changes to the U.S. dairy markets resulted from the enactment of various policies to protect dairy farmers from adverse market conditions. These policies have at times led to unexpected economic implications, which ultimately affected many more than just a single, “intended” market.

6. Consider first the markets for cream (Class II milk) and corn syrup, which are combined by manufacturers to make ice cream. This implies that changes in one of these markets (Class II milk and/or corn syrup) will likely have impacts on the other market.
 - (a) Describe how the Class II milk and corn syrup markets are related (i.e., Do you expect there to be substitution effects? Complementarity effects? Neither?) and why you believe this relationship between the markets to hold.
 - (b) Suppose that a dairy policy change decreases the incentives for the production of Class II milk, therefore reducing its supply. Using your response in 1(a) about the relationship between Class II milk and corn syrup, illustrate the impacts on both the Class II milk and corn syrup markets. If you do assume that there is a relationship between these two products, make sure to illustrate any feedback effects that may occur.

Please ensure that all axes, curves, and points of equilibrium are labeled and that you specify the market that you’re illustrating.

7. Suppose that you analytically examine the market for ice cream (IC). Assume that the demand for ice cream is a function of the price of ice cream and the price of frozen yogurt (froyo). The supply is a function of Class II milk and corn syrup. These are described as follows.

$$Q_{IC}^D = 575 - 10P_{IC} + 5P_{Froyo}$$

$$Q_{IC}^S = 510 + 5P_{IC} - 15P_{Milk} - 6P_{Corn\ syrup}$$

The associated prices for these markets are in hundredweights (cwt):

$$P_{IC} = \$50, \quad P_{Froyo} = \$35, \quad P_{Milk} = \$20, \quad P_{Corn\ syrup} = \$35$$

- (a) Determine the cross-price elasticity of demand between ice cream and frozen yogurt. Interpret and describe whether the goods are substitutes or complements.
- (b) Determine the cross-price elasticity of supply between ice cream and milk. Interpret and describe why an increase in the price of milk leads to the calculated change.
8. Assume that the ice cream market is independent of all other markets. Suppose that there is a 2% supply increase and 3% demand increase in the ice cream. While we know that the equilibrium quantity in this market will increase, the effect on price is ambiguous. Using the functions and information from the previous problem, determine the $\% \Delta P_{IC}$ and $\% \Delta Q_{IC}$ between the original and the new equilibriums.
9. For the previous problem, you assumed that the ice cream market was independent of all other markets and solved for changes in that market as a result of a 2% supply increase and 3% demand increase in the ice cream. However, we know that the market independence assumption is not likely to be realistic. That is, it is likely that the impacts of changes in the ice cream market will have an effect on the frozen yogurt market, which will lead to a series of feedback effects in both markets.

As before, the demand for ice cream is assumed to be a function of the price of ice cream and the price of frozen yogurt (froyo). The supply is a function of Class II milk and corn syrup. These are described as follows.

$$Q_{IC}^D = 575 - 10P_{IC} + 5P_{Froyo}$$

$$Q_{IC}^S = 510 + 5P_{IC} - 15P_{Milk} - 6P_{Corn\ syrup}$$

The demand of frozen yogurt is assumed to be a function of the price of frozen yogurt and the price of ice cream. The supply is a function of Class II milk, natural cultures (NC), and beet sugar (S). These are characterized as follows.

$$Q_{Froyo}^D = 210 - 16P_{Froyo} + 10P_{IC}$$

$$Q_{Froyo}^S = 385 + 15P_{Froyo} - 8P_{Milk} - 10P_{NC} - 4P_S$$

The associated prices for these markets are in hundredweights (cwt):

$$P_{IC} = \$50, \quad P_{Froyo} = \$35, \quad P_{Milk} = \$20, \quad P_{Corn\ syrup} = \$35$$

$$P_{NC} = \$40, \quad P_S = \$50$$

Your objective is to determine changes in both the ice cream and frozen yogurt markets as a result of the changes in the ice cream market. That is, determine the $\% \Delta P_{IC}$, $\% \Delta Q_{IC}$, $\% \Delta P_{Froyo}$, $\% \Delta Q_{Froyo}$.