MERGER ANTITRUST LAW

LAWJ/G-1469-05
Georgetown University Law Center
Fall 2018

Tuesdays and Thursdays, 3:30-4:55 pm
Dale Collins
dale.collins@shearman.com
www.appliedantitrust.com

CLASS 18 WRITTEN ASSIGNMENT—INSTRUCTOR'S ANSWER

A NOTE ON CROSS-ELASTICITY

In my Instructor's Answer, I wrote:

> Apple juice has only a small following among adults. The own-price elasticity for orange juice is -1.1, with 55 out of 1000 customers switching away from orange juice in response to a 5% increase in price. Even if 100% of the diversion was to apple juice (as opposed to apple juice along with other products), the cross-elasticity of orange juice with apple juice would be relatively low at -1.1 (assuming customers switched gallon for gallon).

Several of you questioned how I got the cross-elasticity of orange juice to be -1.1. Good for you for raising the question! The cross-elasticity of -1.1 is wrong in at least one respect: the sign on the cross-elasticity should be positive, not negative. Depending on what cross-elasticity you are examining, it also could be wrong in magnitude. However, it is correct in the magnitude of interest. Let's take a look at why.

As you know, the cross-elasticity ε_{BA} of product A with respect to the price of Product B is defined as:

$$\varepsilon_{BA} = \frac{\frac{\Delta q_A}{q_A}}{\frac{\Delta p_B}{p_B}} \tag{1}$$

We have the information from the hypothetical to calculate the cross-elasticity when product A is apple juice and B is orange juice:

$$\varepsilon_{oa} = \frac{\frac{\Delta q_{apple}}{q_{apple}}}{\frac{\Delta p_{orange}}{p_{orange}}}. \tag{2}$$

To calculate this cross-elasticity, we first need to calculate Δq_{apple}. The hypothetical said that for a 5% increase in price, 55 out of 1000 customers would switch from orange juice to apple juice. Assuming that each customer purchased 1 gallon,[1] this would mean that orange juice would lose 35.64 million gallons (55/1000 times 648 gallons of orange juice) and that apple juice would gain an equivalent number of gallons. Keeping in mind that the total consumption of apple juice

[1] This is another element of sloppiness. I should have said that for every 1000 gallons sold at the original price, 55 gallons would switch to apple juice in the event of a 55 increase in the price of orange juice.

at the original prices was 183 million gallons, the cross-elasticity of apple juice with respect to the price of orange juice is:

$$\varepsilon_{oa} = \frac{\frac{\Delta q_{apple}}{q_{apple}}}{\frac{\Delta p_{orange}}{p_{orange}}} = \frac{\frac{35.64}{183}}{\frac{5}{100}} = 3.9. \quad (3)$$

This says that there is a relatively *high* cross-elasticity of apple juice with respect to the price of orange juice. This tells us that apple juice is sensitive to changes in the relative prices of orange juice, so that orange juice is a significant price-constraining force on apple juice.

The cross-elasticity of apple juice with respect to the price of orange juice, however, does not tell us whether apple juice is a significant price-constraining force on orange juice. Remember that the ability of a firm (or a hypothetical monopolist) to raise prices depends in part on the number of units the firm would lose by raising prices, not the number of unit a competitor would gain. In our case, the quantity variable of interest is Δq_{orange}, not Δq_{apple}, so the cross-elasticity of interest is the cross-elasticity of orange juice with respect to the price of apple juice:

$$\varepsilon_{ao} = \frac{\frac{\Delta q_{orange}}{q_{orange}}}{\frac{\Delta p_{apple}}{p_{apple}}}. \quad (4)$$

The hypothetical does not explicitly give us the data to calculate this cross-elasticity. However, given that the relevant demand curves are linear, we do know that that the number of units that would switch from orange juice to something else if the market price of orange juice was to increase by 5% is the same number of units orange juice would gain if the market price were decreased by 5%, that is:

$$\frac{\Delta q_{orange}}{\Delta p_{orange}} = \frac{-\Delta q_{orange}}{-\Delta p_{orange}}, \quad (5)$$

where the term on the right-hand side shows the change in the quantity of orange demanded for a reduction in price. So if a 5% increase in the price of orange juice causes orange juice to lose 55 out of every 1000 gallons demanded, then a 5% decrease in the price of orange juice causes orange juice to gain 55 out of every 1000 gallons demanded

Now, if what matters to consumers is not the absolute price of orange juice and apple juice but rather their relative prices, and if we assume that a 5% decrease in the price of orange juice (holding the price of apple juice constant) produces to the same change in consumption as a 5% increase in the price of apple juice (holding the price of orange juice constant), we can calculate the cross-elasticity of orange juice with respect to the price of apple juice:

$$\varepsilon_{ao} = \frac{\frac{\Delta q_{orange}}{q_{orange}}}{\frac{\Delta p_{apple}}{p_{apple}}} = \frac{\frac{55}{1000}}{\frac{5}{100}} = 1.1, \tag{6}$$

which is what the Instructor's Answer says (correcting for the sign). If the diversion from apple juice to orange juice is less than 100% (so that there is some leakage), then the number in Equation 7 would be less than 55/1000 and the cross-elasticity of cross-elasticity of orange juice with respect to the price of apple juice would be even lower.

That said, the hypothetical was incomplete because the symmetry in the change in consumption for the same relative percentage price changes was not stated explicitly. I should have been, since it is an empirical question and not a logical consequence of the model underlying the hypothetical. My apologies.