

Take-home Practice Problems 2

Due date: October 18, 5:00 p.m.

La. seafood safety testing results go online

Posted: Oct 07, 2011 6:08 PM MDT

BATON ROUGE, La. (AP) - Louisiana officials want to wipe out the stereotype of tainted shrimp, crab and fish dirtied by oil and chemicals from last year's Gulf oil spill. So, they're putting reams of data and test results on a new web site they hope will prove to restaurants and consumers that the state's oysters, shrimp and fish are safe for consumption.

The web site is at www.gulfsource.org. It shows data collected by the Louisiana departments of wildlife and fisheries, environmental quality, health and hospitals, and agriculture and forestry. Wildlife and Fisheries Secretary Robert Barham says of more than 2,100 samples over the last year, no sample of seafood, water or sediment has tested near the federally-established "level of concern." The testing is paid through an \$18 million grant from BP after the oil spill.

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You wish to analyze the potential impacts that increased information to consumers can have on the shrimp and related markets. You know that the shrimp market is related to the market for mussels, oysters, grits, and income. The function characterizing the demand for shrimp is as follows:

$$D_{shrimp} : Q_{shrimp}^D = 1000 - 2.5P_{shrimp} + 0.25P_{mussels} + 1.2P_{oysters} - 4P_{grits} + 0.01I$$

Prices for these commodities and income are as follows:

$$\begin{aligned} P_{shrimp} &= \$700/\text{hundredweight} \\ P_{mussels} &= \$300/\text{hundredweight} \\ P_{oysters} &= \$1000/\text{hundredweight} \\ P_{grits} &= \$100/\text{hundredweight} \\ I &= \$30,000 \end{aligned}$$

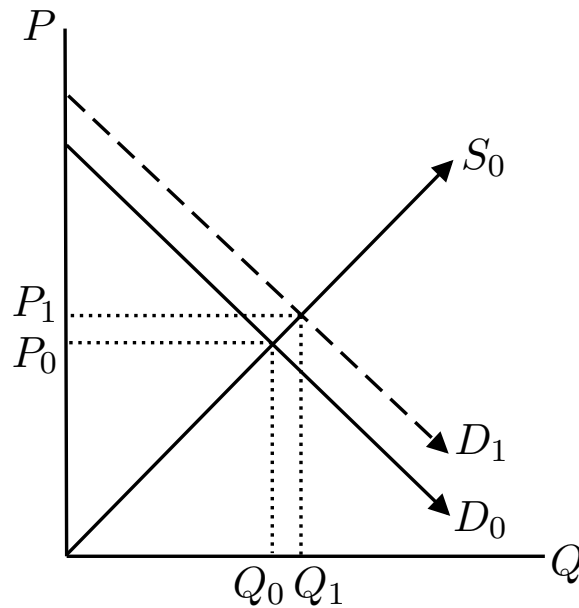
You also know that the price elasticity of shrimp supply is $\varepsilon_{shrimp}^S = 0.9$.

1. What is a likely outcome in the shrimp market from increased information about Louisiana shrimp? Why?

Increase in the information of shrimp quality would likely increase the demand for shrimp. Risk-averse consumers are no longer worries about contaminated seafood and are likely to purchase more shrimp.

2. Using a supply and demand diagram, illustrate the impacts.

Figure 1: Impacts of Louisiana shrimp quality website



3. Suppose that the market response that you described will happen in (1) is 10%. What will be the quantitative effect on the price, quantity demanded, and quantity supplied of shrimp? *Assume that you are only examining the shrimp market, disregarding the other factors.*

- (a) *The first thing that you must do is determine the own-price elasticity of shrimp demand. Plugging in the prices into the demand function yields:*

$$Q_{shrimp}^D = 1000 - 2.5(700) + 0.25(300) + 1.2(1000) - 4(100) + 0.01(30,000) = 425$$

Now, determine the elasticity: $\varepsilon_{shrimp}^D = -2.5 \cdot \frac{700}{425} = -4.12$.

- (b) *Set $\% \Delta Q S_{shrimp} = \% \Delta Q D_{shrimp}$ and solve for $\% \Delta P$.*

$$\begin{aligned} \varepsilon_{shrimp}^D \% \Delta P + S^D &= \varepsilon_{shrimp}^S \% \Delta P + S^S \\ -4.12 \% \Delta P + 10 &= 0.9 \% \Delta P \end{aligned}$$

$$\% \Delta P = 1.99\%$$

(c) Plug in $\% \Delta P$ into either the $\% \Delta QS$ or $\% \Delta QD$ to solve for the changes in quantities:

$$\% \Delta Q = 0.9 \times 1.99 = 1.79\%$$

4. Suppose that simultaneously to the impact in (3), there is a major hurricane that causes Louisiana shrimp farmers to lose a quarter of their shrimping boat fleet. In response, there is a 15% shock to the shrimp market. What will be the quantitative effect on the price, quantity demanded, and quantity supplied of shrimp? Assume that you are only examining the shrimp market, disregarding the other factors.

All of the information is the same as in (2), but now we have to incorporate a 15% negative supply shock. This is as follows:

$$\begin{aligned} \varepsilon_{shrimp}^D \% \Delta P + S^D &= \varepsilon_{shrimp}^S \% \Delta P + S^S \\ -4.12 \% \Delta P + 10 &= 0.9 \% \Delta P - 15 \\ 5.02 \% \Delta P &= 25 \end{aligned}$$

$$\% \Delta P = 4.98\%$$

$$\% \Delta Q = 0.9 \times 4.98 - 15 = -10.52\%$$

5. You now wish to repeat the analysis in (3), but incorporate information about other commodities.

- (a) Suppose that you are using information about the relationship between *shrimp* and *mussels* markets. In addition to the information you can gather using the shrimp demand function, you discover the cross-price elasticity of mussels with respect to changes in the prices of shrimp is $\varepsilon_{mussels,shrimp}^D = 0.5$, the own-price supply elasticity of mussels is $\varepsilon_{mussels}^S = 0.75$, and the own-price demand elasticity of mussels is $\varepsilon_{mussels}^D = -2.25$. What will be the quantitative effect on the price, quantity demanded, and quantity supplied of shrimp and of mussels? Assume that you are only examining the shrimp and mussels markets, disregarding the other factors.

- i. Set up the four equations that characterize the two markets:

$$\% \Delta QS_{shrimp} = \varepsilon_{S,shrimp} \cdot \% \Delta P_{shrimp} + S_{S,shrimp}$$

$$\% \Delta QD_{shrimp} = \varepsilon_{D,shrimp} \cdot \% \Delta P_{shrimp} + \varepsilon_{shrimp,mussels} \cdot \% \Delta P_{mussels} + S_{D,shrimp}$$

$$\% \Delta QS_{mussels} = \varepsilon_{S,mussels} \cdot \% \Delta P_{mussels} + S_{S,mussels}$$

$$\% \Delta QD_{mussels} = \varepsilon_{D,mussels} \cdot \% \Delta P_{mussels} + \varepsilon_{mussels,shrimp} \cdot \% \Delta P_{shrimp} + S_{D,mussels}$$

ii. You see that in addition to the provided information, you will need to solve for the cross-price elasticity between shrimp and mussel prices.

$$\text{That is: } \varepsilon_{\text{shrimp,mussels}} = \frac{\Delta Q_{\text{shrimp}}}{\Delta P_{\text{mussels}}} \cdot \frac{P_{\text{mussels}}}{Q_{\text{shrimp}}} = 0.25 \cdot \frac{300}{425} = 0.18.$$

iii. As before, set $\% \Delta Q S_{\text{shrimp}} = \% \Delta Q D_{\text{shrimp}}$ and solve for $\% \Delta P_{\text{shrimp}}$.

$$\varepsilon_{S,\text{shrimp}} \cdot \% \Delta P_{\text{shrimp}} + S_{S,\text{shrimp}} = \varepsilon_{D,\text{shrimp}} \cdot \% \Delta P_{\text{shrimp}} + \varepsilon_{\text{shrimp,mussels}} \cdot \% \Delta P_{\text{mussels}} + S_{D,\text{shrimp}}$$

$$09 \cdot \% \Delta P_{\text{shrimp}} = -4.12 \cdot \% \Delta P_{\text{shrimp}} + 0.18 \cdot \% \Delta P_{\text{mussels}} + 10$$

$$5.02 \cdot \% \Delta P_{\text{shrimp}} = 0.18 \cdot \% \Delta P_{\text{mussels}} + 10\%$$

$$\% \Delta P_{\text{shrimp}} = 0.036 \cdot \% \Delta P_{\text{mussels}} + 1.99\%$$

iv. Repeat for the mussels market:

$$\varepsilon_{S,\text{mussels}} \cdot \% \Delta P_{\text{mussels}} + S_{S,\text{mussels}} = \varepsilon_{D,\text{mussels}} \cdot \% \Delta P_{\text{mussels}} + \varepsilon_{\text{mussels,shrimp}} \cdot \% \Delta P_{\text{shrimp}} + S_{D,\text{mussels}}$$

$$0.75 \cdot \% \Delta P_{\text{mussels}} = -2.25 \cdot \% \Delta P_{\text{mussels}} + 0.5 \cdot \% \Delta P_{\text{shrimp}}$$

$$3 \cdot \% \Delta P_{\text{mussels}} = 0.5 \cdot \% \Delta P_{\text{shrimp}}$$

$$\% \Delta P_{\text{mussels}} = 0.17 \cdot \% \Delta P_{\text{shrimp}}$$

v. Now you can plug in $\% \Delta P_{\text{mussels}}$ into the equation for $\% \Delta P_{\text{shrimp}}$, and solve for $\% \Delta P_{\text{shrimp}}$.

$$\% \Delta P_{\text{shrimp}} = 2\%$$

vi. Using the $\% \Delta P_{\text{shrimp}}$, you can now determine the $\% \Delta P_{\text{mussels}}$.

$$\% \Delta P_{\text{mussels}} = 0.34\%$$

vii. Plug in $\% \Delta P_{\text{shrimp}}$ into either the $\% \Delta Q S_{\text{shrimp}}$ to solve for the changes in quantities:

$$\% \Delta Q S_{\text{shrimp}} = 0.9 \times 2 = 1.8\%$$

viii. Plug in $\% \Delta P_{\text{mussels}}$ into either the $\% \Delta Q S_{\text{mussels}}$ to solve for the changes in quantities:

$$\% \Delta Q S_{\text{mussels}} = 0.75 \times 0.34 = 0.26\%$$

(b) Are the results in (5a) different than the results in (3)? What new information are you incorporating by in (5a) relative to (3)?

After incorporating the effects in the other, mussels, market, we see that changes in both prices and quantities are only slightly larger. This is due to the dynamic responses between the two markets.

- (c) Suppose that you are using information about the relationship between *shrimp* and *grits* markets. In addition to the information you can gather using the shrimp demand function, you discover the cross-price elasticity of grits with respect to changes in the prices of shrimp is $\varepsilon_{grits,shrimp}^D = 1.25$, the own-price supply elasticity of grits is $\varepsilon_{grits}^S = 3$, and the own-price demand elasticity of grits is $\varepsilon_{grits}^D = -5$. What will be the quantitative effect on the price, quantity demanded, and quantity supplied of shrimp and of grits? Assume that you are only examining the shrimp and grits markets, disregarding the other factors.

Repeat steps in (5a).

$$\varepsilon_{shrimp,mussels} = \frac{\Delta Q_{shrimp}}{\Delta P_{grits}} \cdot \frac{P_{grits}}{Q_{shrimp}} = -4 \cdot \frac{100}{425} = -0.94$$

$$\% \Delta P_{shrimp} = 1.93\%$$

$$\% \Delta P_{grits} = -0.31\%$$

$$\% \Delta Q_{shrimp} = 1.74\%$$

$$\% \Delta Q_{grits} = -0.93\%$$