AGEC321, Fall 2011

Exam 2: Review

Review Session: November 2, 2011. Linfield Hall 109 – 5:30 p.m. - 7:00 p.m.

Equilibrium Displacement Model Concepts

Consider the market for European barley, characterized by:

$$\begin{aligned} D_{barley}: \ P_b^D &= 250 - 5Q_b + 10P_{rice} + 50P_{corn} \\ S_{barley}: \ Q_b^S &= 120 + 0.5P_b - 0.5P_{wheat} - 2P_{corn} \end{aligned}$$

$$P_b = 10€ \qquad P_{rice} = 6€$$

$$P_{corn} = 5€ \qquad P_{wheat} = 10€$$

Recent news indicates that the demand for malting barley (used in production of beer) rose by 1.5% while the supply of malt barley dropped by 0.5%.

1. Analyzing only the malt barley market, determine the percentage change in the price and quantity of malt barley.

   (a) *The first step is to determine the elasticities. You do this by solving for the quantity of barley and then using the appropriate slopes to determine the associated elasticities.*

$$\begin{aligned} P_b^D &= 250 - 5Q_b + 10P_{rice} + 50P_{corn} \\ &\rightarrow \ Q_b^D = 50 - \tfrac{1}{5}P_b + 2P_{rice} + 10P_{corn} \\ Q_b^S &= 120 + 0.5P_b - 0.5P_{wheat} - 2P_{corn} \\ Q_{barley}^* &= 110 \\ \varepsilon_{barley}^D &= \tfrac{\Delta Q_b^D}{\Delta P_b} \times \tfrac{P_b}{Q_b^D} = -0.2 \times \tfrac{10}{110} = -0.02 \\ \varepsilon_{barley}^S &= \tfrac{\Delta Q_b^S}{\Delta P_b} \times \tfrac{P_b}{Q_b^S} = 0.5 \times \tfrac{10}{110} = 0.05 \end{aligned}$$

   Next, use the equilibrium displacement model to determine the percentage changes in prices and quantities.

$$
\begin{aligned}
\varepsilon_b^D \cdot \%\Delta P + S^D &= \varepsilon_b^S \cdot \%\Delta P + S^S \\
-0.02\%\Delta P + 1.5 &= 0.05\%\Delta P - 0.5 \\
-0.07\%\Delta P &= -2 \\
\%\Delta P &= 28.5\%. \\
\\
\%\Delta Q = 0.05 \times 28.5 - 0.5 &= 0.93\%
\end{aligned}
$$

2. You know that there is a relationship between the corn and barley market. A simple representation of the corn market is as follows:

$$
\begin{aligned}
D_{corn}: \; P_{corn}^D &= 15 - 0.5Q_{corn} + 3P_{barley} \\
S_{corn}: \; Q_{corn}^S &= 40 + 3P_{corn} - 0.5P_{barley}
\end{aligned}
$$

with prices as specified above. How would shocks to the malt barley market impact the barley market when feedback effects from the corn market are incorporated?

(a) *You must now find the own-price demand and supply elasticities in the corn market and the cross-price elasticities.*

$$
\begin{aligned}
P_{corn}^D &= 15 - 0.5Q_{corn} + 3P_{barley} \\
&\rightarrow \; Q_b^D = 30 - 2P_{corn} + 6P_{barley} \\
\\
Q_{corn}^* &= 80 \\
\\
\varepsilon_{corn}^D &= \frac{\Delta Q_c^D}{\Delta P_c} \times \frac{P_c}{Q_c^D} = -2 \times \frac{5}{80} = -0.125 \\
\varepsilon_{corn}^S &= \frac{\Delta Q_c^S}{\Delta P_c} \times \frac{P_c}{Q_c^S} = 3 \times \frac{5}{80} = 0.19 \\
\\
\varepsilon_{barley,corn} &= \frac{\Delta Q_b^D}{\Delta P_c} \times \frac{P_c}{Q_b^D} = 10 \times \frac{5}{110} = 0.45 \\
\varepsilon_{corn,barley} &= \frac{\Delta Q_c^S}{\Delta P_b} \times \frac{P_b}{Q_c^S} = 6 \times \frac{10}{80} = 0.75
\end{aligned}
$$

(b) *Now set up the EDM for a two commodity scenario and solve.*

$$\%\Delta QS_{barley} = \varepsilon^S_{barley} \cdot \%\Delta P_{barley} + S_{S,barley}$$

$$\%\Delta QD_{barley} = \varepsilon^D_{barley} \cdot \%\Delta P_{barley} + \varepsilon_{barley,corn} \cdot \%\Delta P_{corn} + S_{D,barley}$$

$$\%\Delta QS_{corn} = \varepsilon^S_{corn} \cdot \%\Delta P_{corn} + S_{S,corn}$$

$$\%\Delta QD_{corn} = \varepsilon^D_{corn} \cdot \%\Delta P_{corn} + \varepsilon_{corn,barley} \cdot \%\Delta P_{barley} + S_{D,corn}$$

(c) *Set* $\%\Delta QS_{barley} = \%\Delta QD_{barley}$ *and solve for* $\%\Delta P_{barley}$.

$$\varepsilon^S_{barley} \cdot \%\Delta P_{barley} + S_{S,barley} = \varepsilon^D_{barley} \cdot \%\Delta P_{barley} + \varepsilon_{barley,corn} \cdot \%\Delta P_{corn} + S_{D,barley}$$

$$0.05 \cdot \%\Delta P_{barley} - 0.5 = -0.02 \cdot \%\Delta P_{barley} + 0.45 \cdot \%\Delta P_{corn} + 1.5$$

$$0.07 \cdot \%\Delta P_{barley} = 0.45 \cdot \%\Delta P_{corn} + 2\%$$

$$\%\Delta P_{barley} = 6.42 \cdot \%\Delta P_{corn} + 28.5\%$$

(d) *Repeat for the corn market:*

$$\varepsilon^S_{corn} \cdot \%\Delta P_{corn} + S_{S,corn} = \varepsilon^D_{corn} \cdot \%\Delta P_{corn} + \varepsilon_{corn,barley} \cdot \%\Delta P_{barley} + S_{D,corn}$$

$$0.19 \cdot \%\Delta P_{corn} = -0.125 \cdot \%\Delta P_{corn} + 0.75 \cdot \%\Delta P_{barley}$$

$$0.315 \cdot \%\Delta P_{corn} = 0.75 \cdot \%\Delta P_{barley}$$

$$\%\Delta P_{corn} = 2.38 \cdot \%\Delta P_{barley}$$

(e) *Now you can plug in* $\%\Delta P_{corn}$ *into the equation for* $\%\Delta P_{barley}$*, and solve for* $\%\Delta P_{barley}$.

$$\begin{aligned}
\%\Delta P_{barley} &= 6.42 \cdot \%\Delta P_{corn} + 28.5\% \\
\%\Delta P_{barley} &= 6.42 \cdot (2.38 \cdot \%\Delta P_{barley}) + 28.5\% \\
\%\Delta P_{barley} &= 15.3 \cdot \%\Delta P_{barley} + 28.5\% \\
-14.3\%\Delta P_{barley} &= 28.5\%
\end{aligned}$$

$$\%\Delta P_{barley} = -2\%$$

(f) *Using the* $\%\Delta P_{barley}$*, you can now determine the* $\%\Delta P_{corn}$*.*

$$\%\Delta P_{corn} = -4.76\%$$

(g) *Plug in* $\%\Delta P_{barley}$ *into either the* $\%\Delta QS_{barley}$ *to solve for the changes in quantities:*

$$\%\Delta QS_{barley} = 0.05 \times -2 - 0.5 = -0.6\%$$

(h) *Plug in* $\%\Delta P_{corn}$ *into either the* $\%\Delta QS_{corn}$ *to solve for the changes in quantities:*

$$\%\Delta QS_{corn} = 0.19 \times -4.76 = -0.90\%$$

3. Explain the differences in results of (1) and (2).

   The impacts on price and quantity are much less pronounced because of corn market feedback effects.

4. After a recent World Agricultural Supply and Demand Estimates (WASDE) report, you find that European corn harvests are down by 5%. This decrease is expected to be in addition to the shocks in the malt barley market. How will the corn market change impact the percentage change in prices and quantities of malt barley?

   This problem requires that you repeat the steps in (2) after incorporating a negative supply shock into the corn market. The impacts are as follows:

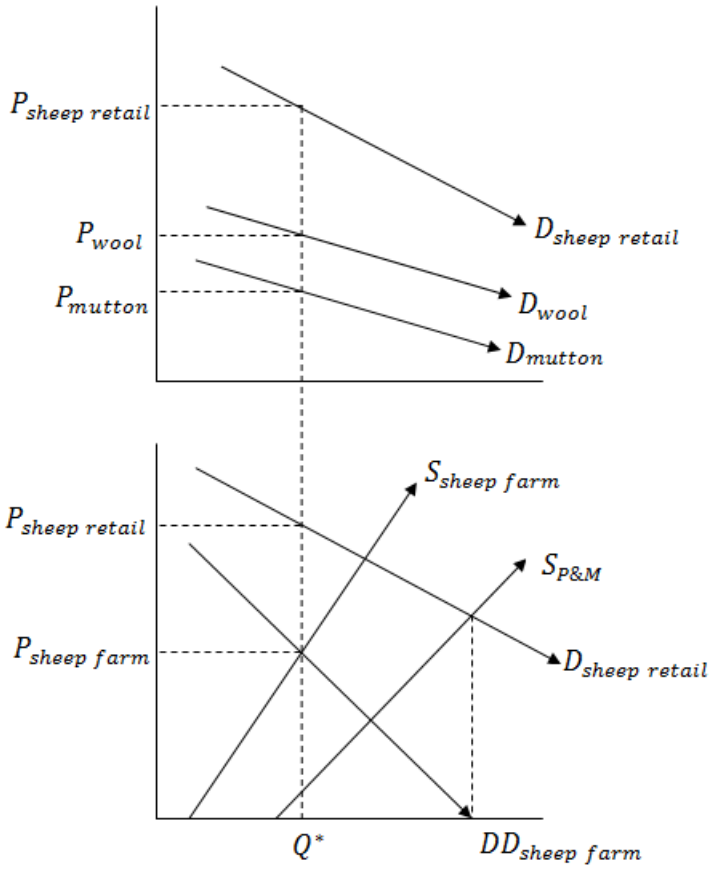
$$\begin{aligned} \%\Delta P_{barley} &= -9.13\% \\ \%\Delta P_{corn} &= -5.8\% \\ \%\Delta Q_{barley} &= -0.96\% \\ \%\Delta Q_{corn} &= -6.1\% \end{aligned}$$

Derived Demand Concepts

Graph the following in related retail and farm level markets. Label everything very carefully.

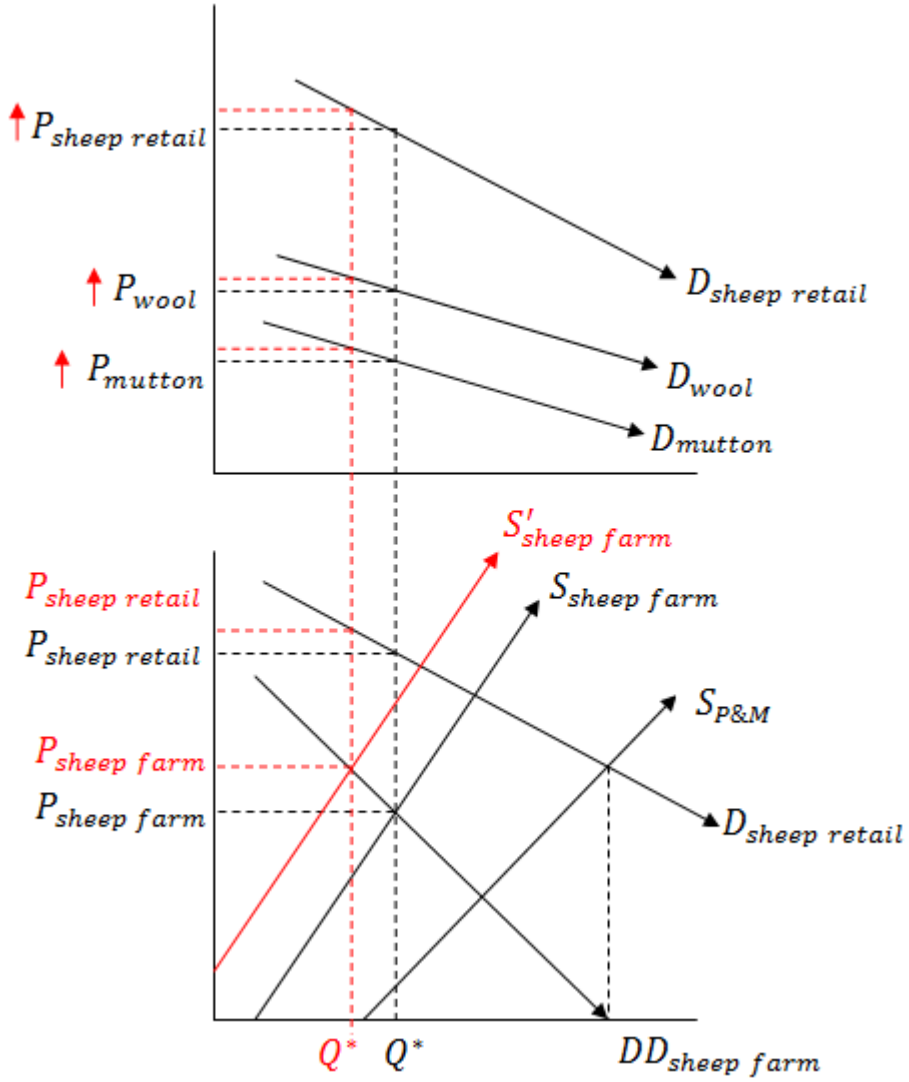
Consider the market for products derived from sheep. Suppose that one sheep can yield a fixed proportion of mutton (meat) and wool. Mutton is not very popular among U.S. consumers, but wool is highly prized.

1. Illustrate an initial equilibrium condition that exists in the retail and related farm markets. Identify the equilibrium quantity and prices in **each** market.



2. In each of the following scenarios, illustrate the effects of a market change and describe the changes in quantities and prices.

   (a) Input costs increase at the farm level.



(b) The price of goat meat (a substitute to mutton) has dropped.

A summary of the outcomes inferred from drawing the illustrations is as follows:

D_{mutton}	→ Shift down	D_{wool}	→ No change
$D_{sheep\ retail}$	→ Shift down	$D_{sheep\ farm}$	→ Shift down
S_{MP}	→ No change	$S_{sheep\ farm}$	→ No change
$P_{sheep\ farm}$	→ Decreased	$Q_{sheep\ farm}$	→ Decreased
$P_{sheep\ retail}$	→ Decreased	$Q_{sheep\ retail}$	→ Decreased
P_{mutton}	→ Decreased	P_{wool}	→ Increased
$P_{sheep\ retail}$	→ Decreased		

(c) A natural disaster destroyed several large sheep processing facilities.

A summary of the outcomes inferred from drawing the illustrations is as follows:

D_{mutton}	$\rightarrow$ No change	D_{wool}	$\rightarrow$ No change
$D_{sheep\ retail}$	$\rightarrow$ No change	$D_{sheep\ farm}$	$\rightarrow$ Shift back
S_{MP}	$\rightarrow$ Shift back	$S_{sheep\ farm}$	$\rightarrow$ No change
$P_{sheep\ farm}$	$\rightarrow$ Decreased	$Q_{sheep\ farm}$	$\rightarrow$ Decreased
$P_{sheep\ retail}$	$\rightarrow$ Increased	$Q_{sheep\ retail}$	$\rightarrow$ Decreased
P_{mutton}	$\rightarrow$ Increased	P_{wool}	$\rightarrow$ Increased
$P_{sheep\ retail}$	$\rightarrow$ Increased		

3. Use the following information to solve for the equilibrium quantity and prices of both **farm level** and **retail level** sheep products. Furthermore, solve for the total value added by processing sheep into retail-level products.

Retail Market

$$D_{mutton}: \quad P_{mutton} = \quad 2050 - 2Q$$

$$D_{wool}: \quad P_{wool} = \quad 2750 - 2Q$$

Processing and Marketing

$$S_{mutton}: \quad P_{P\&M} = \quad -400 + Q$$

Farm-level Sheep Production

In producing sheep, farmers are required to purchase feed and labor/maintenance services. Feed is \$100 per sheep, and labor is supplied according to the function: $P_L^S = -1900 + 2Q$.

The following is a summary of analytical results:

$$\begin{array}{rcl@{\qquad\qquad}rcl} Q^*_{sheep\ farm} & = & 1000 & Q^*_{sheep\ retail} & = & 1000 \\ P^*_{sheep\ farm} & = & \$200 & P^*_{sheep\ retail} & = & \$800 \\ P^*_{mutton} & = & \$50 & P^*_{wool} & = & \$750 \end{array}$$

4. Using the markets defined in (3), analyze the market changes if labor costs increase and the new labor supply function is: $P^S_L = -1600 + 2Q$. Solve for the new equilibrium quantities and prices in both the farm and retail markets. Furthermore, solve for the new total value added by processing sheep into retail-level products.

   The following is a summary of analytical results:

$$\begin{array}{rcl@{\qquad\qquad}rcl} Q^*_{sheep\ farm} & = & 957 & Q^*_{sheep\ retail} & = & 957 \\ P^*_{sheep\ farm} & = & \$415 & P^*_{sheep\ retail} & = & \$972 \\ P^*_{mutton} & = & \$136 & P^*_{wool} & = & \$836 \end{array}$$

5. Using the markets defined in (3) and (4), analyze the market changes if there is a drop in the demand for mutton, causing the new retail-level mutton demand function to be: $D_{mutton}: \ P_{mutton} = 1950 - 2Q$. Solve for the new equilibrium quantities and prices in both the farm and retail markets. Furthermore, solve for the new total value added by processing sheep into retail-level products.

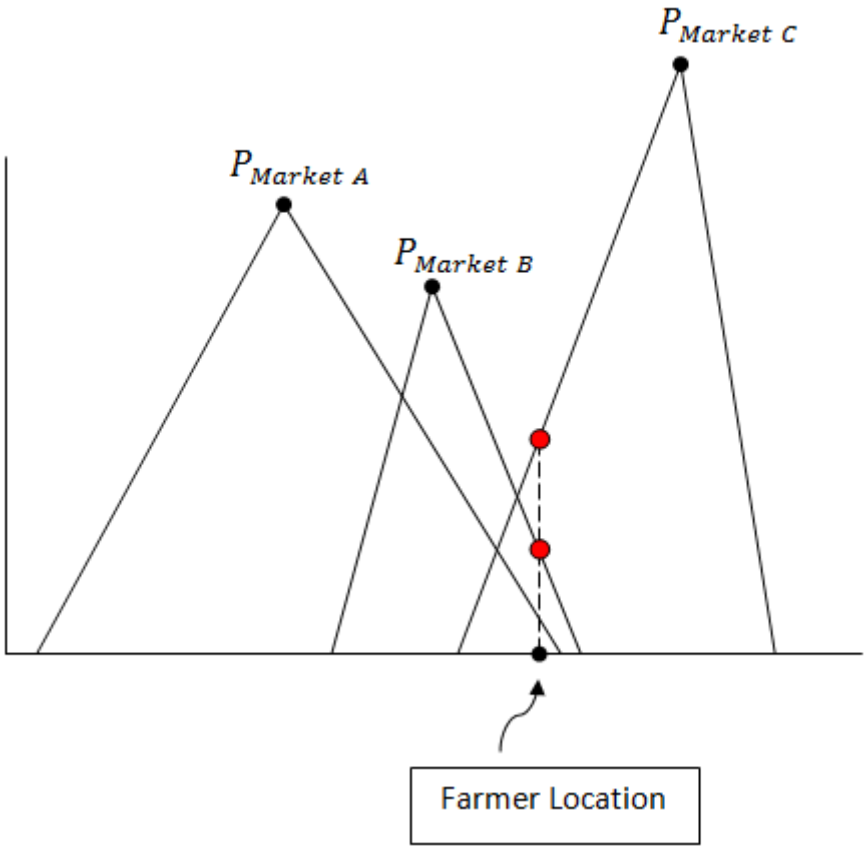
   Assuming $P^S_L = -1600 + 2Q$, the following is a summary of analytical results:

$$\begin{array}{rcl@{\qquad\qquad}rcl} Q^*_{sheep\ farm} & = & 942 & Q^*_{sheep\ retail} & = & 942 \\ P^*_{sheep\ farm} & = & \$390 & P^*_{sheep\ retail} & = & \$932 \\ P^*_{mutton} & = & \$66 & P^*_{wool} & = & \$866 \end{array}$$

Spatial Concepts

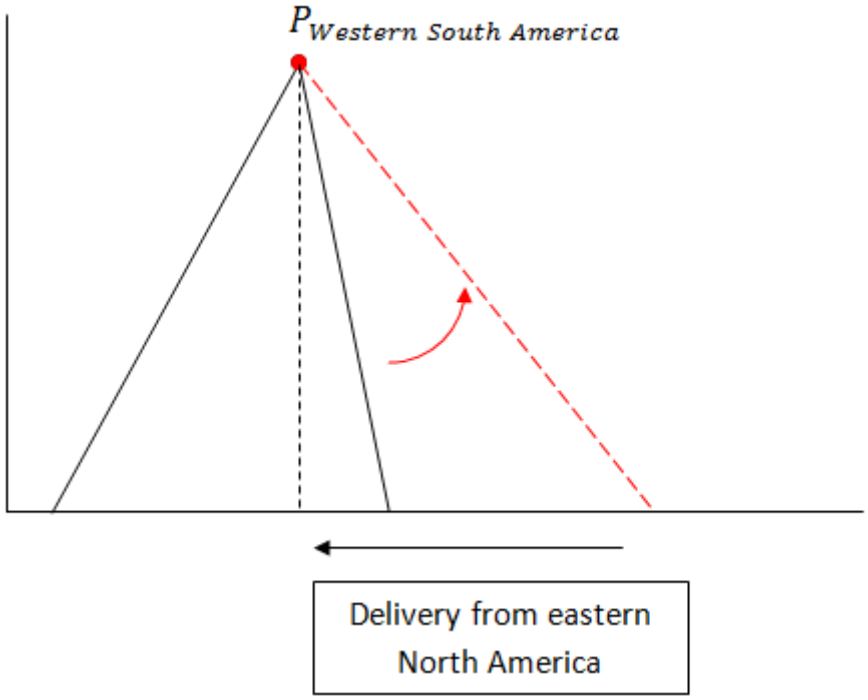
Use spatial net price diagrams to model the following scenarios:

1. A farmer can deliver to three elevators, which are located in three different locations. However, the farmer only has time to deliver to two of these elevators. Each location offer different prices. Model this scenario to show which two locations the farmer will choose to deliver.



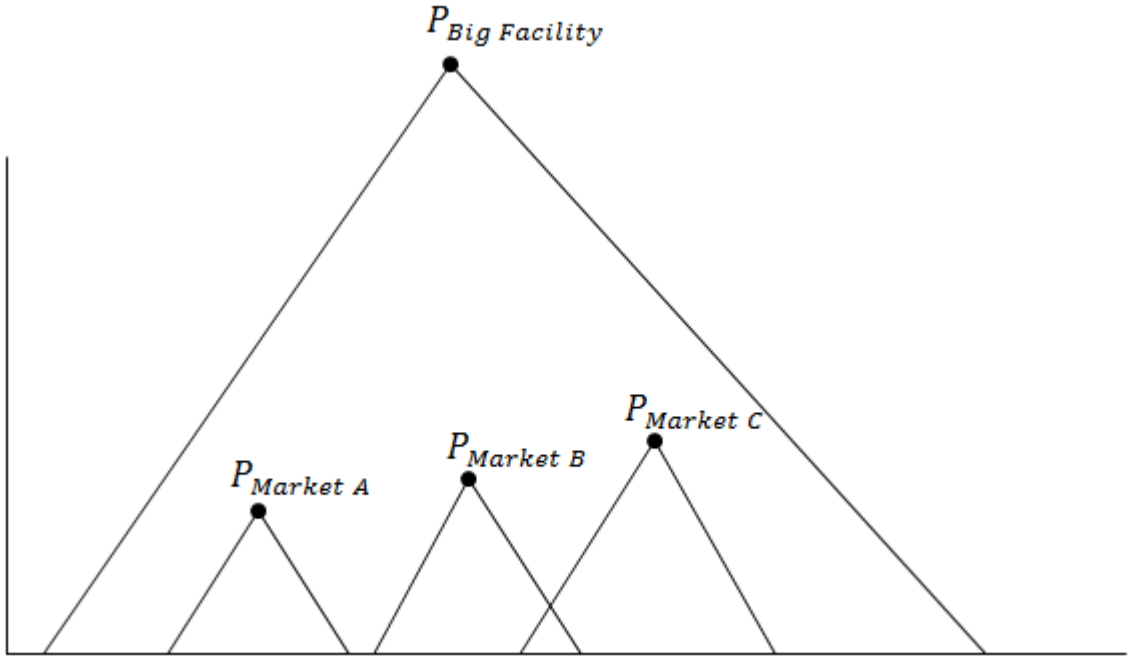
The farmer will choose to deliver to markets B and C because he/she gets the highest net price in those markets.

2. Prior to the Panama canal, if North American agricultural producers wanted to deliver to western South America, the products had to be transported by boat all the way around the southern tip of South America. Opening of the Panama canal has opened a much more direct route to ship products from eastern North America to western South America. Illustrate and explain how the Panama canal affected the profitability region of eastern North American agricultural producers.



The Panama canal had substantially decreased transportation costs for shipping to western South America from eastern North America, thus expanding the profitability region of farmers in eastern North America.

3. In the early to mid 20th century, there were very many small processing facilities through the mid-west and Great Plains agricultural regions. However, as technological advances continued to evolve, new, much larger processing plants were established. There much less of these large plants, but they used economies of scale to offer a much higher price for agricultural commodities then smaller processing facilities. Using a spatial diagram, illustrate several small processing plants offering low prices to farmers and one large facility location that offers a much higher price, such that the profitability regions of all of the small facilities is encompassed by the singe large facility. What will farmers do? What will happen to the small facilities?

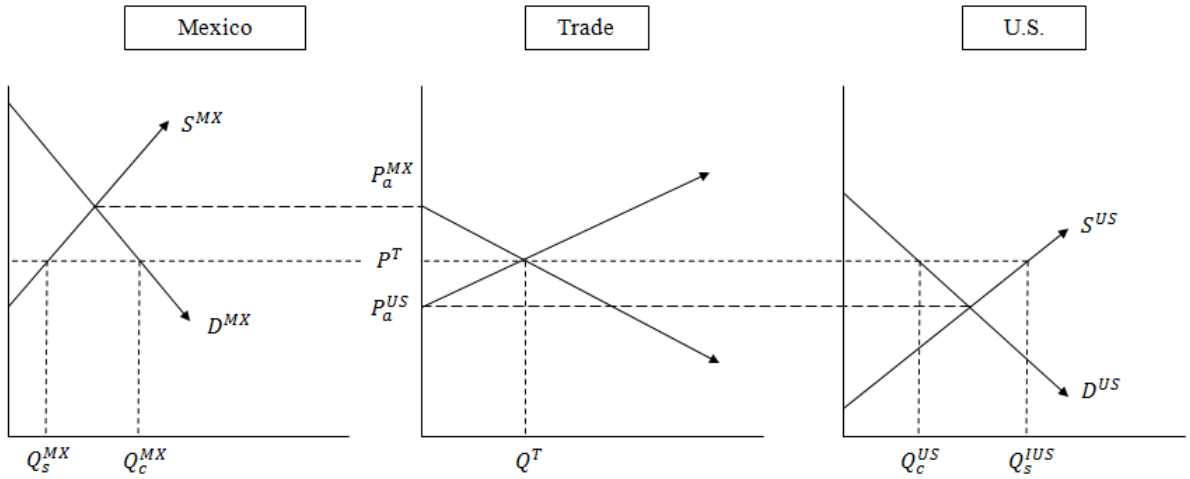


The large market encompasses all of the small markets. All farmers who delivered to small markets now are better off delivering to the single large facility. Therefore, small market facilities will likely terminate their operations.

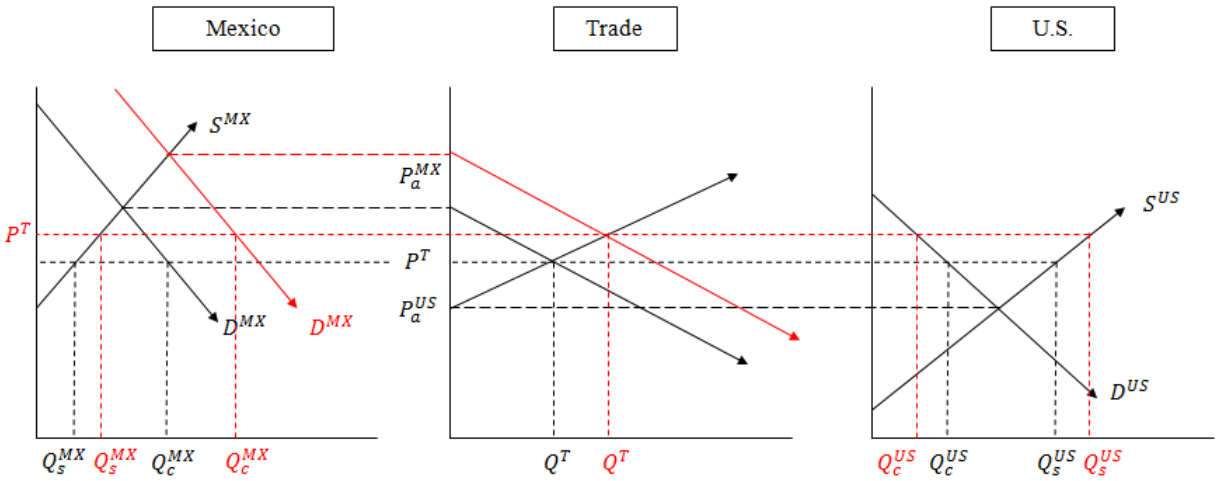
Trade Concepts

Consider an international market for pork. Mexican consumers have a high preference for pork products, but Mexican producers provide an insufficient quantity of pork to meet the demand of domestic consumers. Therefore, the U.S. exports pork to Mexico.

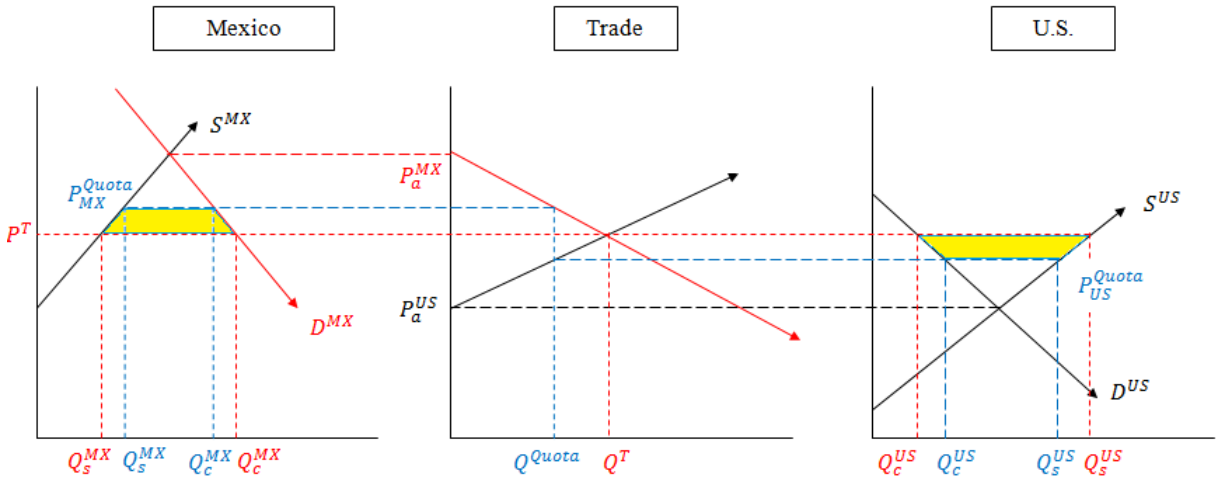
1. Using a three-diagram trade model, illustrate the trade market between U.S. and Mexico. As usual, label carefully.



2. Now, consider that in the past 20 years, Mexico has seen a rapid expansion of its middle class (prior to this time, there was a substantial dichotomy, in which a small portion of the Mexican population had a lot of money, and a large portion of the population was very poor.) Illustrate how the expansion of the Mexican middle class impacts the trade market. Show the changes in the trade, Mexican domestic, and U.S. domestic markets.



3. Suppose that the Mexican government believes that the U.S. is flooding their market with pork and artificially low prices, which is hurting the Mexican pork producers. In response, Mexico institutes a quota on U.S. pork imports. Show how the quota will affect the trade and domestic markets, and point out the change in consumer and/or producer surpluses in each market.

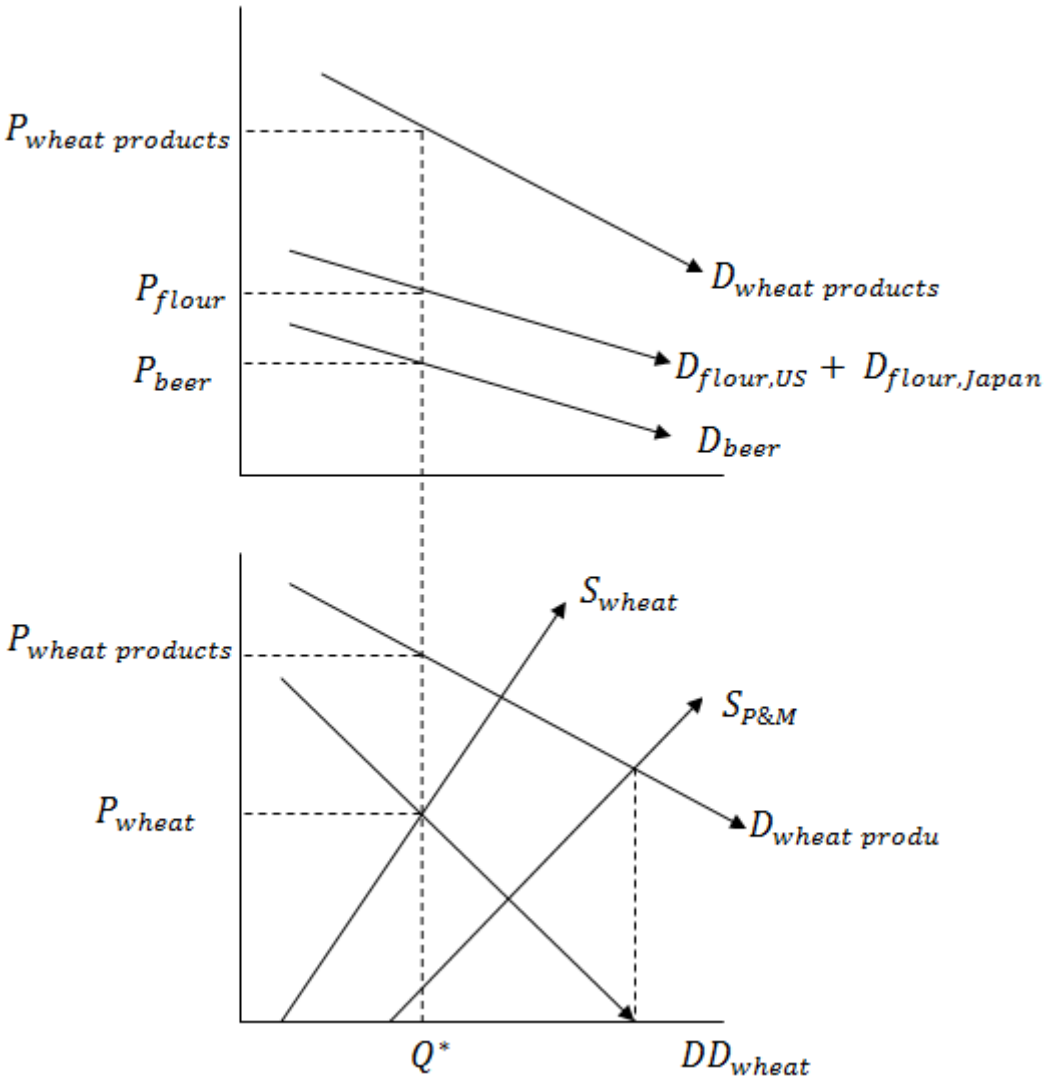


The areas in yellow illustrate the lost surplus in each of the domestic markets. In Mexico, the loss is in consumer surplus, and in the U.S. the loss is in producer surplus.

Putting it all together

Consider modeling the economics of wheat marketing. First, consider the retail and farm level markets. Wheat can be processed flour or used to brew beer. The demand for beer is domestic only. However, the demand for flour consists of U.S. demand and the demand for flour by Japan. therefore, also there is a trade market for flour between the U.S. and Japan, in which Japan imports U.S. flour.

1. Illustrate the retail level market for products that are derived from wheat and the associated farm-level wheat market. When labeling the demand for flour, make sure that you indicate that this demand is a sum of domestic (U.S.) and foreign (Japanese) demands. Label carefully.



2. Use the following information to solve for the equilibrium values of quantity and prices or wheat, flour, and beer.

   Retail Market

$$D_{beer}: \quad P_{beer} = 55 - Q$$

$$D_{flour,\ U.S.}: \quad P_{flour,\ U.S.} = 70 - Q$$

$$D_{flour,\ Japan}: \quad P_{flour,\ Japan} = 80 - Q$$

Processing and Marketing

$$S_{mutton}: \quad P_{P\&M} = \quad 160 + Q$$

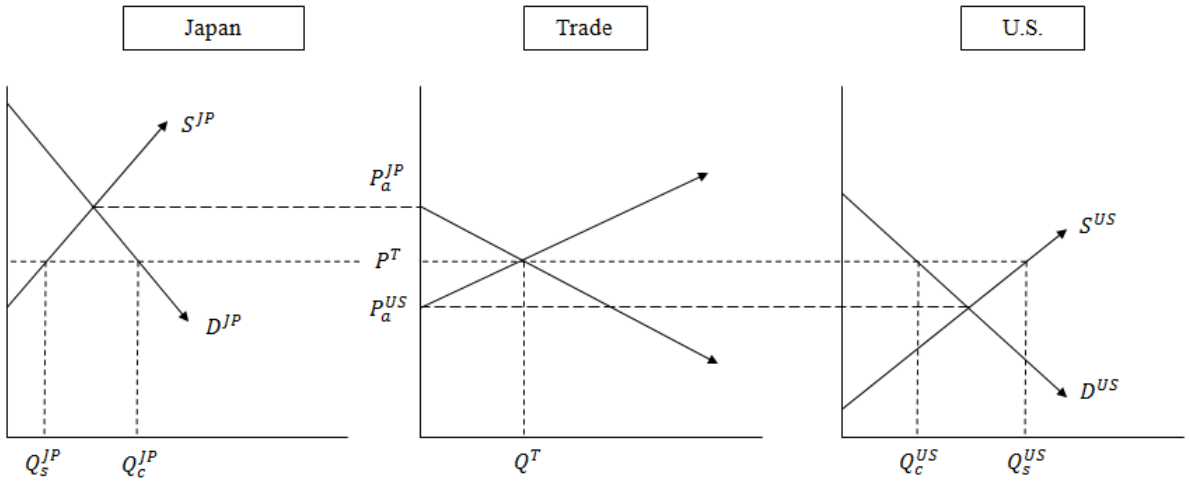
Farm-level Wheat Production

In producing wheat, farmers are required to purchase fertilizer and labor/maintenance services. Fertilizer is \$50, and labor is supplied according to the function: $P_L^S = -55 + Q$.

The following is a summary of the analytical results:

Q^*_{wheat}	=	10 million	$Q^*_{wheat\ products}$	=	10 million
P^*_{wheat}	=	\$5	$P^*_{wheat\ products}$	=	\$175
P^*_{flour}	=	\$130	P^*_{beer}	=	\$45

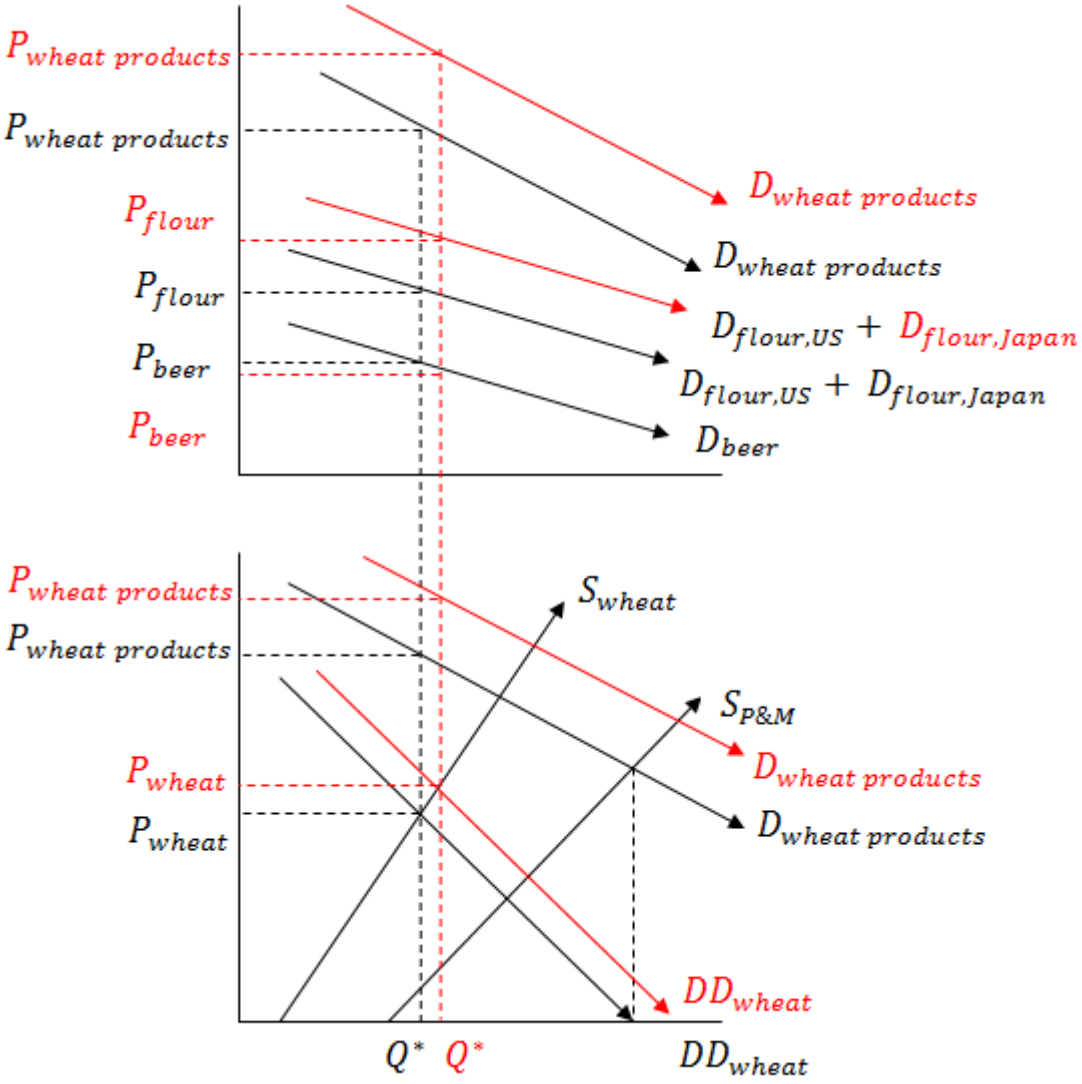
3. Using a three-diagram trade model, illustrate the trade market for wheat.



4. Suppose that the Japanese demand for flour increases. Using the trade model, illustrate what will happen to quantities and prices in each of the domestic markets and the trade market.

Please see the question 2 in the Trade Concepts section as an illustration of the market changes.

5. Recall that the demand for U.S. flour is a combination of the demands by U.S. and Japanese consumers. Illustrate the effect of a Japanese demand increase on the retail and farm markets.



6. Suppose that the Japanese increase in demand is reflected by the new flour demand function: $D_{flour,\ Japan} : P_{flour,\ Japan} = 100 - Q$. Solve for the new equilibrium prices and quantities in the retail and farm markets.

The following is a summary of the analytical results:

Q^*_{wheat}	=	14 million	$Q^*_{wheat\ products}$	=	14 million
P^*_{wheat}	=	\$9	$P^*_{wheat\ products}$	=	\$183
P^*_{flour}	=	\$142	P^*_{beer}	=	\$41

7. Does your illustration in the trade market *match* what you've illustrated in the retail/farm level markets and the changes that you see in the equilibrium quantities and prices?

   Yes. Intuition matches the analytics.