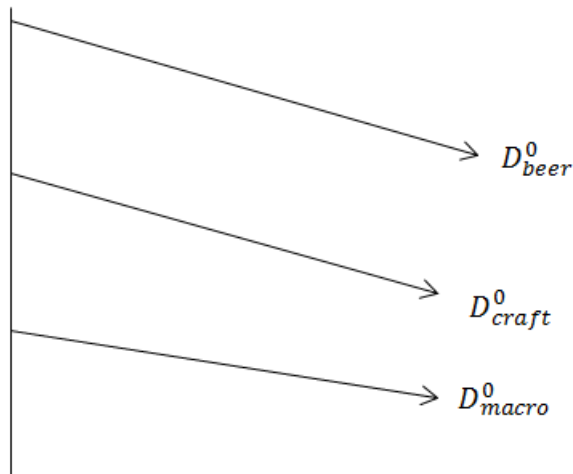


Problem Set 3—Solutions

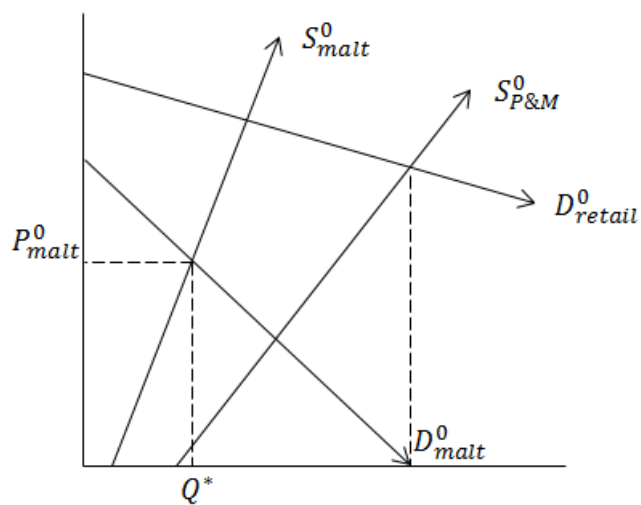
An increasing demand for locally grown and malted barley

1. Derived demand is evaluated on a case-by-case basis. In this case, the sum of demand for derived products at the retail level equals the overall product demand. Then, subtracting the supply of processing and marketing (P&M) from the overall product demand is equal to derived demand of the farm-level commodity.
2. Illustrating the marketing channel of beer markets:

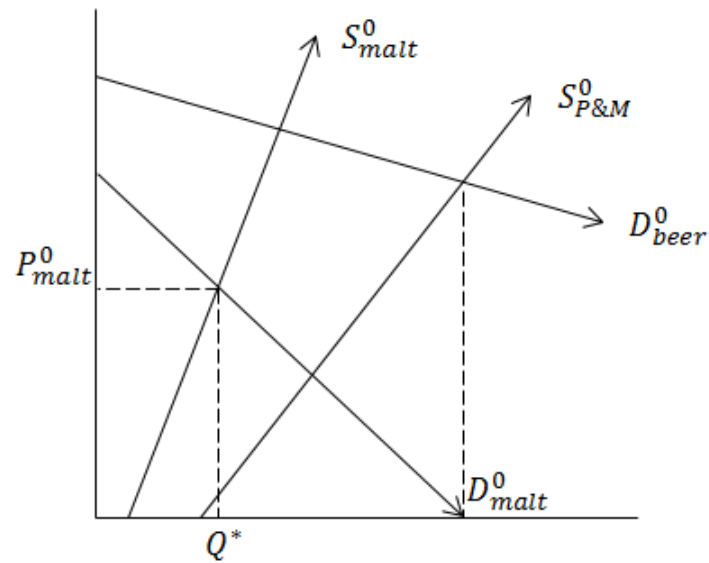
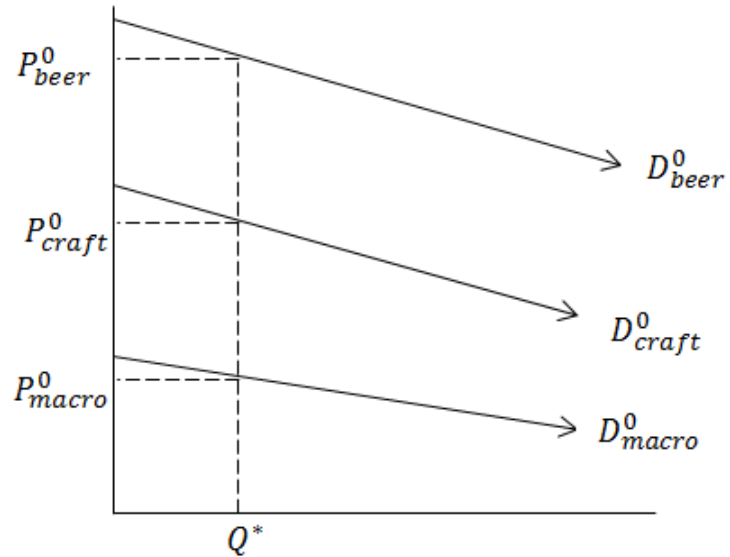
(a) Retail market



(b) Malt market



- (c) Processing and marketing services include the packaging, marketing, and delivery of the malt barley to brewers.
- (d) Equilibrium in farm and retail markets

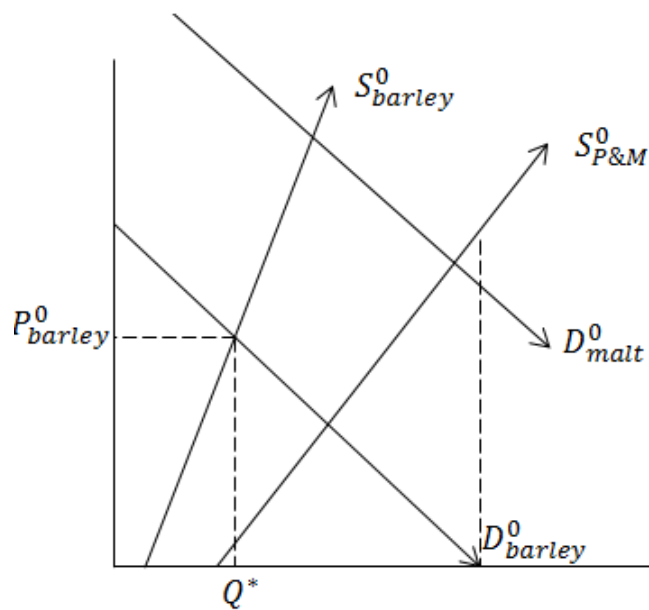
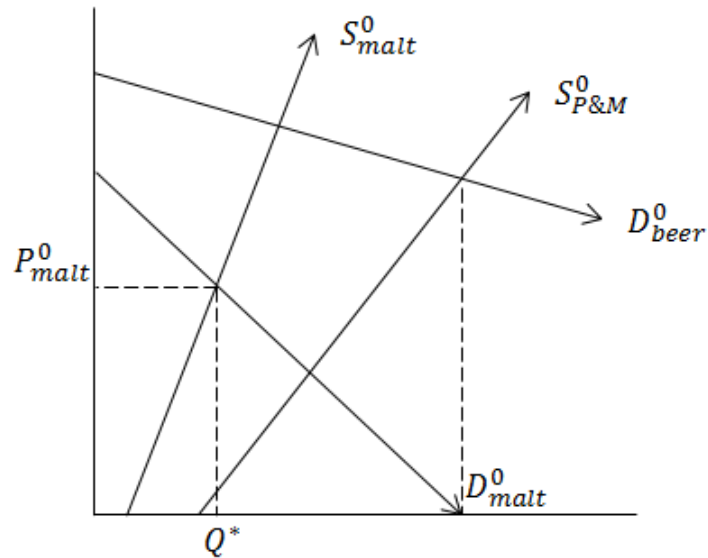


- (e) The malt market quantity can be used as a proxy for the quantity in the retail market, because retail goods are produced in proportion to the quantities produced in the malt market. For example, brewers cannot produce more beer than there is available malt from barley. Therefore, there is a relationship between the malt and retail beer markets.

3. Illustrating a lower level of the beer marketing channel.

- (a) This would be the derived demand for malt (from the malt market).

- (b) See response to (c).
 (c) Illustration of market effects:



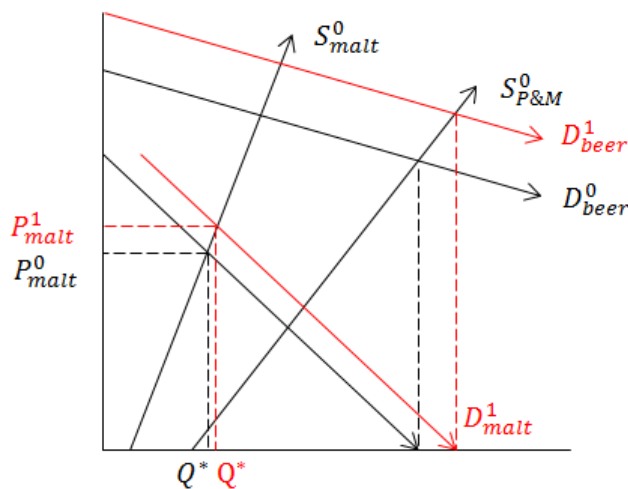
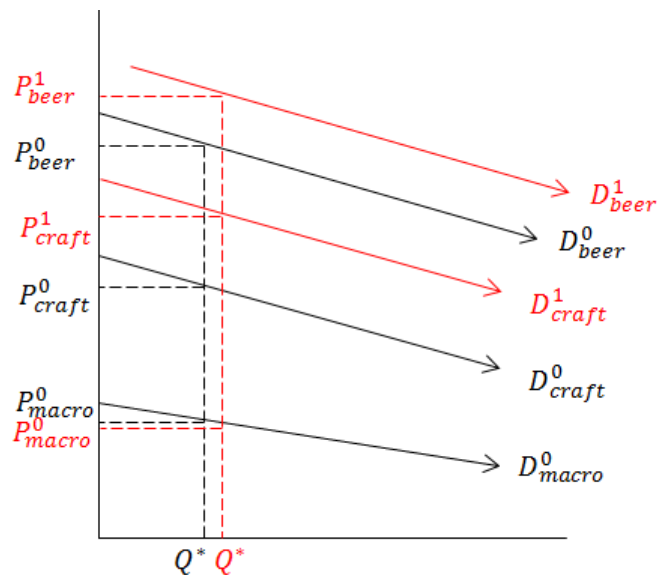
- (d) Similar to the response to problem 2(e), the barley market quantity can be used as a proxy for the quantity in the malt market, because malt will be produced in proportion to the quantities of barley produced at the farm level. For example, maltsters cannot produce more malt than there is available barley.

4. Illustrating the effects of craft brewery growth.

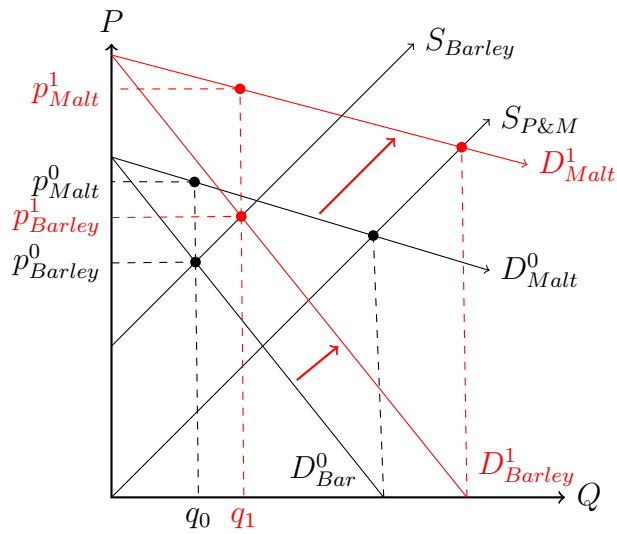
- (a) First, let's discuss the dynamics:
 i. The demand curve for craft beers shifts outward.

- ii. The outward demand for craft beers results in an outward shift of total retail beer demand.
- iii. The outward demand shift in total retail beer is observed in the malt market and leads to an outward shift of the derived demand for malt.
- iv. The shift in the malt derived demand results in a new, higher equilibrium price and quantity of malt.
- v. A higher quantity of malt can be proportionally related to a higher quantity of beer available at the retail market.
- vi. The new quantity will intersect the new demand curve for retail craft beer at a higher level (higher prices for craft beer). However, because the demand curve for macrobeer did not shift, the beer will have lower price.

(b) Illustration of market effects:



The Barley Market



- (c) Changes in prices and quantities follow from the figure.
- (d) It is likely that barley farmers and craft brewers are unambiguously better off. However, it is unclear whether macrobrewers are better or worse off; this depends on the elasticity of macrobeer demand.

5. Quantitative model

(a) $D_{beer} : P_{beer}^D = 150 - Q$

(b) $D_{malt} : P_{barley}^D = 450 - 5Q$

(c) $Q_{malt}^* = 50$

(d) $P_{malt}^* = \$200/\text{ton}$

(e) $P_{craft}^* = \$80/\text{gallon}$

$P_{macro}^* = \$20/\text{gallon}$

6. Quantitative model with unknown barley supply function

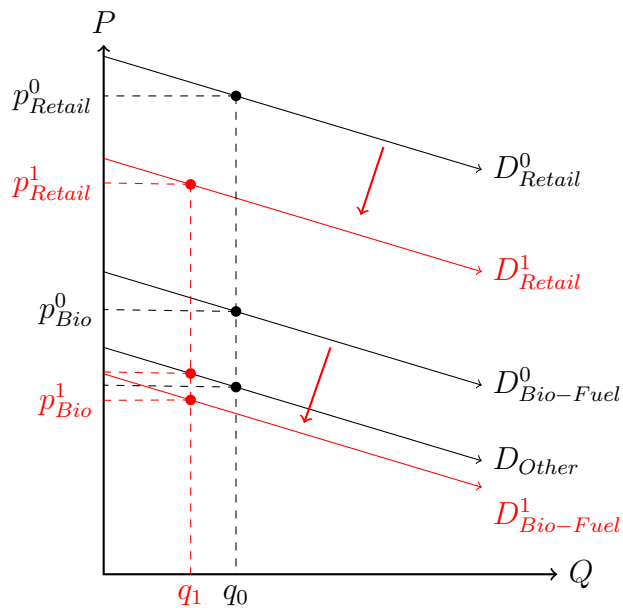
- (a) $D_{beer} : P_{beer}^D = 150 - Q$
- (b) $D_{malt} : P_{malt}^D = 450 - 5Q$
- (c) $S_{malt} : 200 + Q$
- (d) $Q_{malt}^* = 42$
- (e) $P_{malt}^* = \$242/\text{ton}$
- (f) $P_{craft}^* = \$83/\text{gallon}$
- $P_{macro}^* = \$25/\text{gallon}$

7. Quantitative model with an increase in craft beer demand

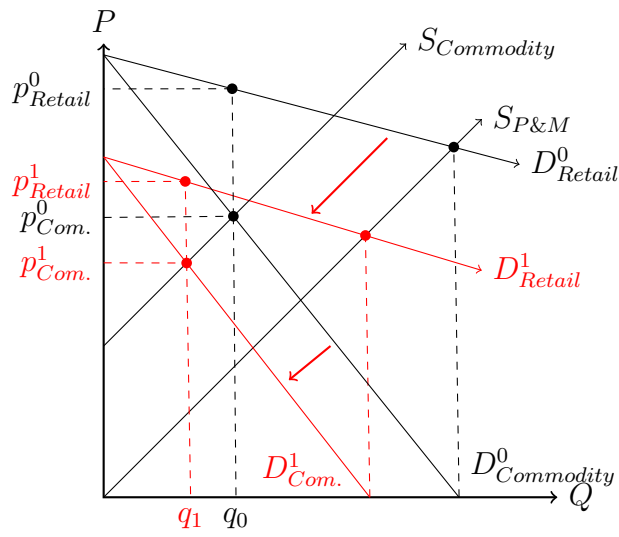
- (a) $D_{beer} : P_{beer}^D = 160 - Q$
- (b) $D_{malt} : P_{malt}^D = 460 - 5Q$
- (c) $S_{malt} : 200 + Q$
- (d) $Q_{malt}^* = 43$
- (e) $P_{malt}^* = \$243/\text{ton}$
- (f) $P_{craft}^* = \$93/\text{gallon}$
- $P_{macro}^* = \$24/\text{gallon}$

8. (a) Corn retail and farm-level market impacts of a removal of RFS:

Retail-Level Corn Market



Farm-Level Corn Market



(b) See answer to question (a).

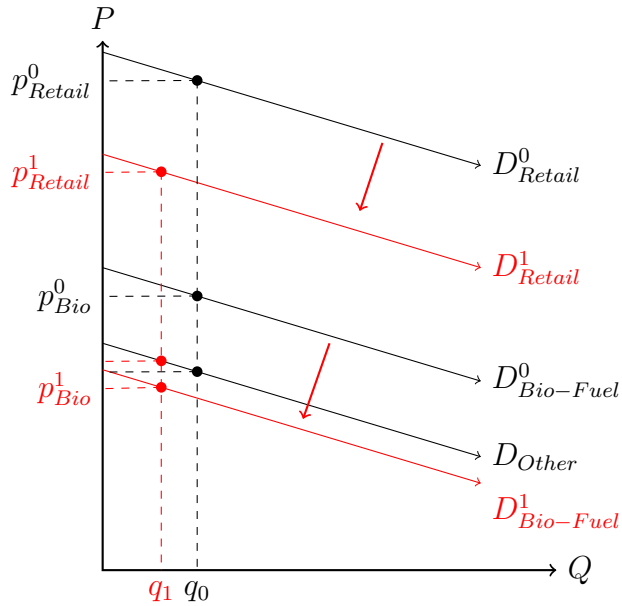
| Corn Product | Price | Quantity |
|--------------|----------|----------|
| Bio-fuel | increase | decrease |
| Other | increase | decrease |

(c) Wheat is a substitute for corn in consumption. If the demand for corn declines, corn prices will fall and the opportunity costs of using wheat instead of corn would increase. Consumers would likely switch from using wheat to using corn, therefore leading to a decrease in the demand of wheat and, consequently, the price.

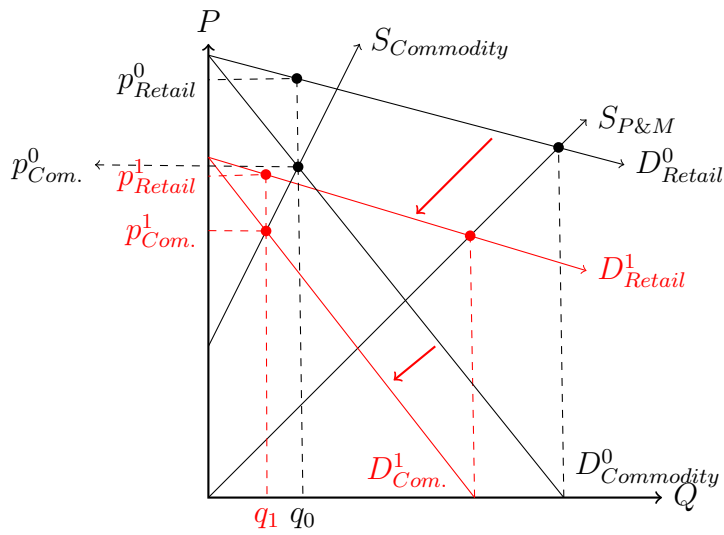
9. Corn supply elasticity

(a) Inelastic supply of corn

Retail-Level Corn Market

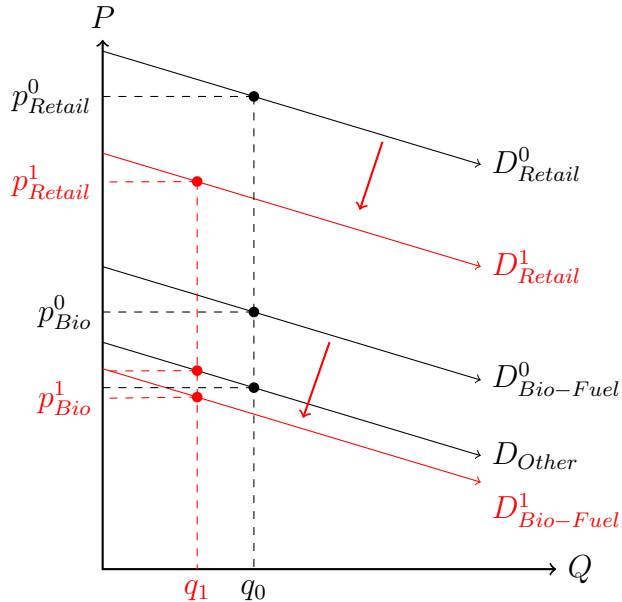


Farm-Level Corn Market

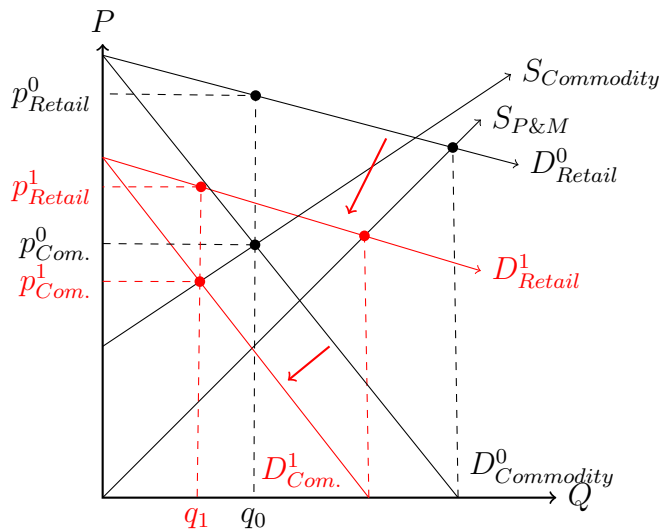


(b) Elastic supply of corn

Retail-Level Corn Market



Farm-Level Corn Market



(c) If corn supply is relatively inelastic, then the price of corn will change much more so than when the supply of corn is relatively elastic. Therefore, when corn supply is inelastic, there is expected to be a greater decrease in the demand for wheat, because corn prices will be much lower than with the RFS program and the opportunity costs of continuing to purchase wheat will be higher.

10. (a) $Q_{corn} = 13.134$ million bushels

$$P_{corn} = \$4.62/\text{bushel}$$

(b) $P_{eth} = \$147/\text{thousand gallons}$