

**Case, Fair, and Oster
Macroeconomics
Supply and Demand Questions.**

Points to remember:

1. Always begin from and end with an equilibrium position.
2. Shift a curve or curves when you have specific reasons for doing so – and remember that a shift in one curve will NOT cause a shift in another.
3. Remember that an increase in supply shifts the supply curve to the right (increases the quantity offered at any given price) or down (decreases the cost of production).
4. Compare the beginning and ending equilibrium:
 - If only one curve has shifted, the result will be unambiguous: price has risen or fallen, and the equilibrium quantity has increased or decreased.
 - If two curves have shifted, either price or quantity will be uncertain unless you are given more specific information.

Problem 1. Draw supply and demand curves illustrating each of the following situations:

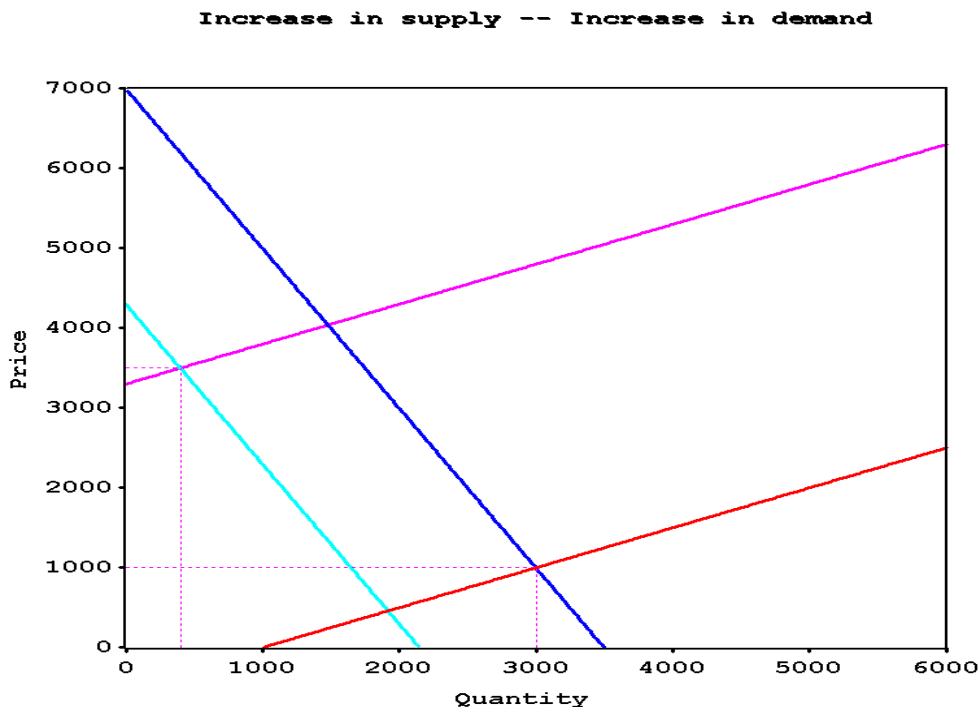
a. Laptops. Quality improvements in laptops have led to an increase in demand. But we know the price of laptops has fallen over time.

Data from oldcomputers.net: Macintosh Power Book, 1990: \$ 2300 (\$ 3500 in 2010 dollars), 2 MB RAM, 10 MB hard drive, 25 MHz processor, monochrome 640 x 400 9-inch LCD. (MB = Megabyte). Sales in 1992 = 400,000.

Current MacBook 2010 (entry level): \$ 1000, 2 GB RAM, 250 GB hard drive, 2.26 GHz processor, color 1280 x 800 13.3 inch LCD. (GB = Gigabyte, 1000 times more than a megabyte). Sales in 2010: about 3 million.

What happened ?

Answer: an increase in demand would drive the equilibrium price of laptops up, so it must have been offset by an even greater increase in supply (= lower cost of production and hence price). The supply and demand diagram would be the following (1990 curves in light blue and magenta, 2010 curves in blue and red):



Problem 1b. Cranberry harvest in Massachusetts.

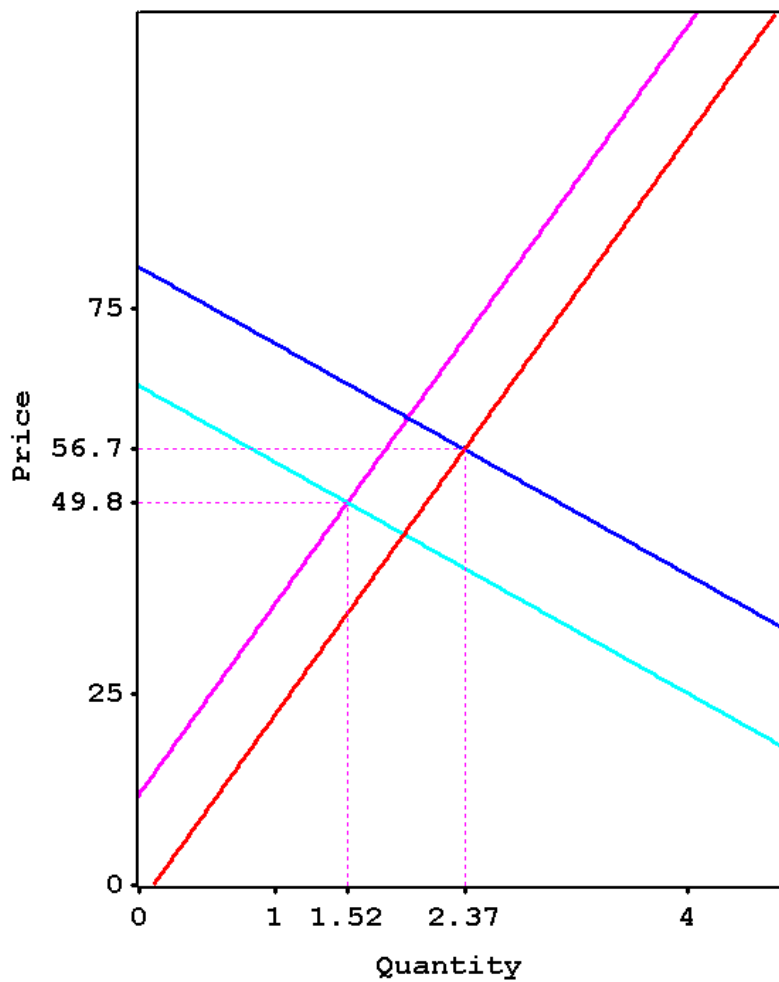
Data from www.nass.usda.gov/Statistics_by_State/New_England_includes/Publications/cran0808.pdf,

“Cranberry Forecast”, Aug. 18, 2009. Harvest is given in millions of barrels.

As in the text problem, the quantity supplied of cranberries increased and the price rose, so the increase in demand had to be greater than the increase in supply.

	Mass. Harvest	Price per Barrel
2007	1.522	\$ 49.80
2008	2.374	\$ 56.70

Increase in supply -- Increase in demand



The 2007 curves are in light blue and magenta, the 2008 curves in blue and red.

Note: In both problem 1 and problem 2 we had an increase in both supply and demand. In problem 1, price went down, and in problem 2, price went up.

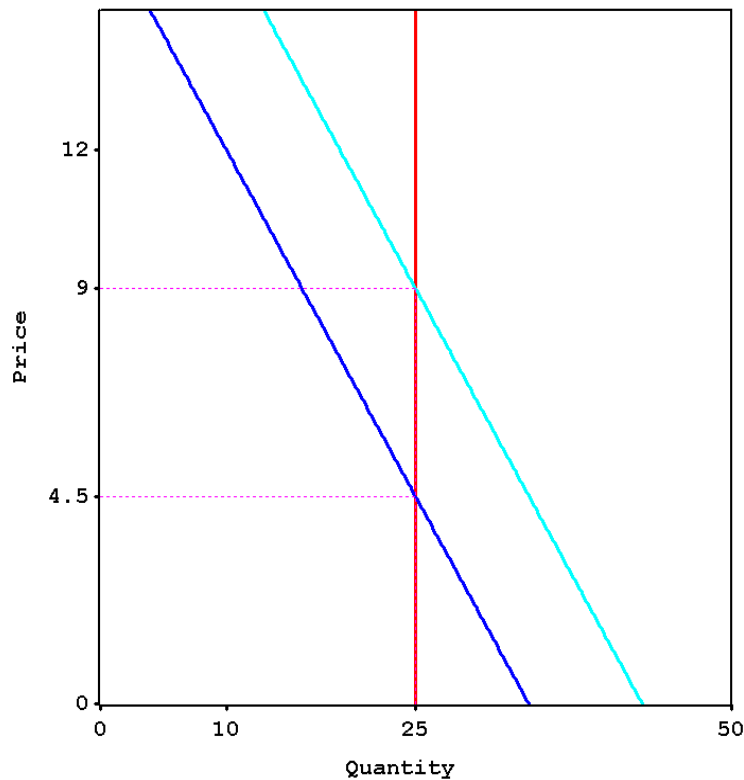
Problem 1.c. San Francisco office space.

Since no new office space was built during the 2001-2005 period, we have a **vertical supply curve** – the quantity supplied is fixed, whatever the price. Only the demand curve can shift, driving the rental of a square foot of space up or down.

Data from <http://Rofo.com/CA/San-Francisco> (as of 12 March 2010):

Total of 25,000,000 square feet of office space in the North Financial District; asking rate for Class A office space is \$ 4.50 a month per square foot. According to the Federal Reserve Bank of San Francisco, average office rents were down by about one-half from 2007, so the graph will illustrate the impact of a fall in demand that took office rents from \$ 9.00 per square foot per month to \$ 4.50 a month.

Increase in Demand



Problem 1.d. Price ceilings

Data from David Tarr, "The Welfare Cost of Price Controls on Cars and Color Televisions in Poland", *World Bank Economic Review*, 8:3 (1994), based on his working paper of Aug. 1991 (WPS 741). Data was from Poland under Communism in 1988. The controlled price of color TVs was 394 thousand zlotys (\$ 136); Poles were willing to pay up to twice as much (788 thousand zlotys) for black market sets (they were actually advertised in newspapers – the Communist regime was already shaky and didn't want to crack down on the black market too harshly). See also Fiona Scott Morton, "The Problems of Price Controls", *Regulation*, 24:1 (Spr. 2001)

There were 294 thousand color TVs were sold in Poland in 1988. Tarr estimated the equilibrium price at approximately 698 thousand zlotys and the equilibrium quantity at 368 thousand TV sets.

I have changed his numbers slightly (his equilibrium estimates were $P = 694$ and $Q = 364$) to yield simpler equations for those who want to find the supply and demand equations for themselves. Note that I will NOT expect you to do find the equations yourself on an exam.

These numbers imply the following linear equations (all values will be in thousands of zlotys or thousands of TVs):

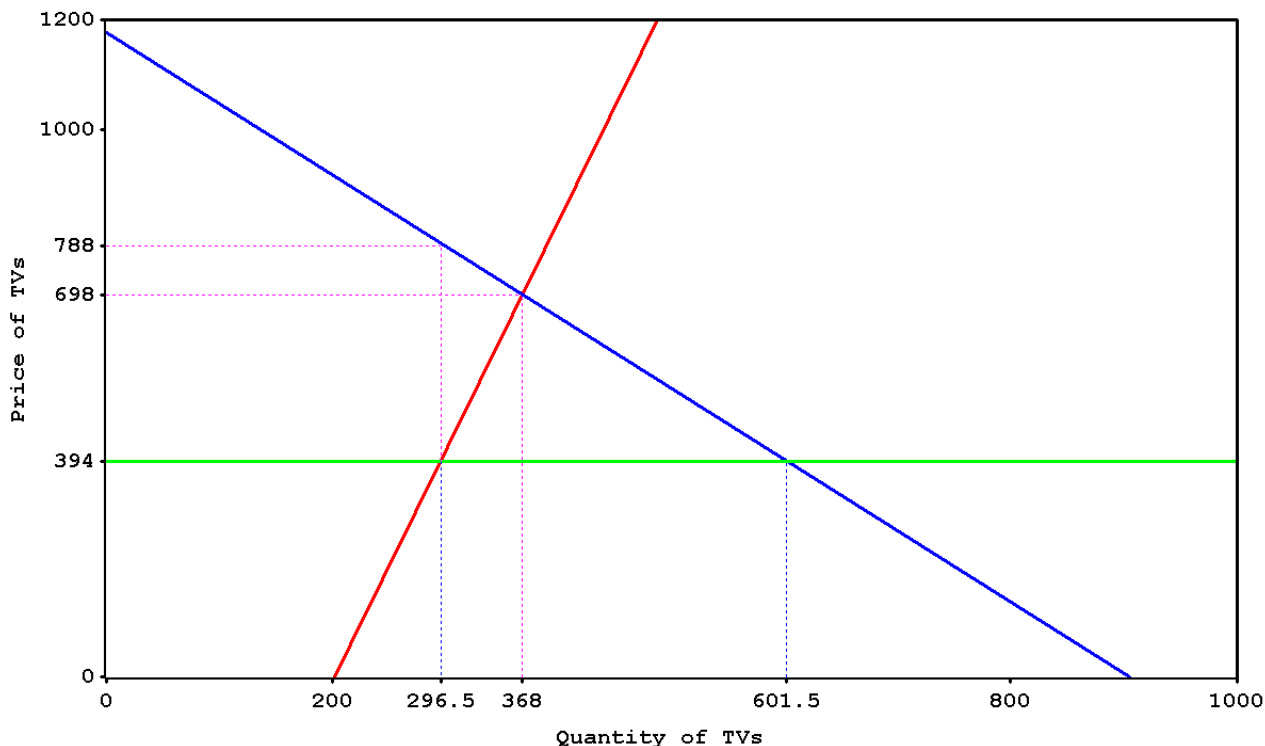
$$\text{SUPPLY: } P_s = -848 + 4.2 Q_s \text{ or } Q_s = 202 + 0.24 P_s$$
$$\text{DEMAND: } P_d = 1177 - 1.3 Q_d \text{ or } Q_d = 905 - 0.77 P_d$$

To find the amount supplied at the official price, substitute the price of 394 thousand into the supply equation:

$$Q_s = 202 + 0.24 (394) = 296.5$$
$$Q_d = 905 - 0.77 (394) = 601.5$$

Excess demand will be approximately $601.5 - 296.5 = 305,000$ TV sets.

Market for Polish Color TVs



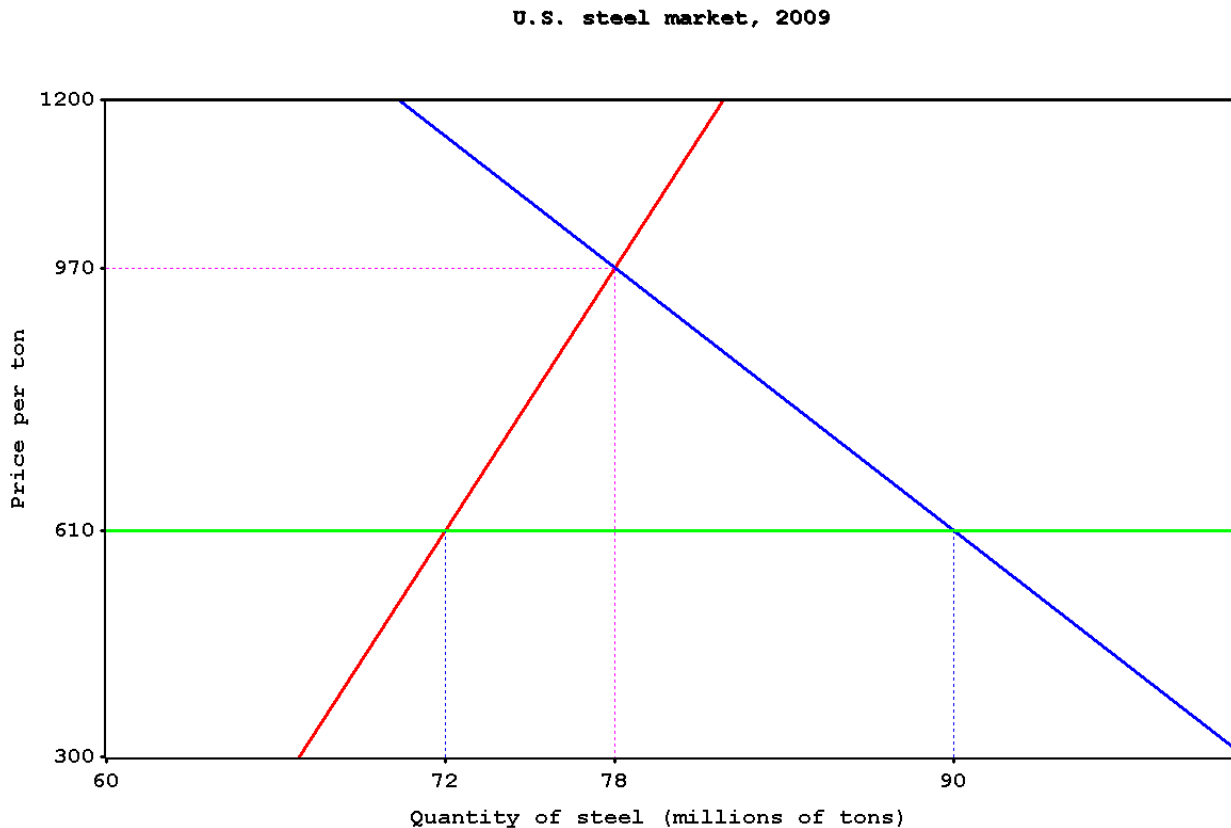
Problem 1. e. Steel Imports

The text values for steel prices (\$ 610 per ton for world prices, \$ 970 per ton for estimate of US price without imports) are used. The American Iron and Steel Institute (www.steel.org) reports that the United States produced about 72 million tons in 2009, and imported about 18 million tons. No estimate is provided for the amount of steel which would be produced in the US without imports, so I assume it would be 78 million tons per year.

The assumptions would lead to the demand and supply equations:

$$\text{SUPPLY : } P_s = -3710 + 60 Q_s \text{ or } Q_s = 61.83 + 1/60 P_s$$

$$\text{DEMAND: } P_d = 3310 - 30 Q_d \text{ or } Q_d = 110.33 - 1/30 P_s$$



You can substitute the price of imports into the supply curve to find that $Q_s = 61.83 + 610 / 60 = 72$, which will be US production of steel.

Substitute the price of imports into the demand curve for steel to find that $Q_d = 110.33 - 610/30 = 90$; the excess demand for steel of $90 - 72 = 18$ million is the quantity of steel imported.

One surprising fact reported by the AISI is that more than 10 percent of US steel production is exported – steel is not a homogenous product, and the US has a comparative advantage in many specialty steels.

In the microeconomics class, we will look at this graph again in discussing the welfare impact of international trade in terms of consumer and producer surplus.

Problem 2. Tigers and Yankees, Indians and Devil Rays.

The graph for the supply of stadium seating is simple: a vertical line at the capacity of the stadium.

If prices were not set at the beginning of the season, without regard to demand, the intersection of supply and demand would determine the price. But with fixed prices, excess supply (= empty seats) or excess demand (or disappointed consumers and an opportunity for ticket scalpers) are possible.

A graph of Yankee Stadium follows; we assume tickets are priced at \$ 40 and would rise to \$ 200 for end-of-season games were prices not fixed.

The assumed demand curves are:

Normal demand: $Q_d = 65,478 - 200 P_d$ for a game where all seats are sold at a price of \$ 40.

The normal demand curve is in light blue on the graph.

Playoff demand : $Q_d = 73,478 - 200 P_d$

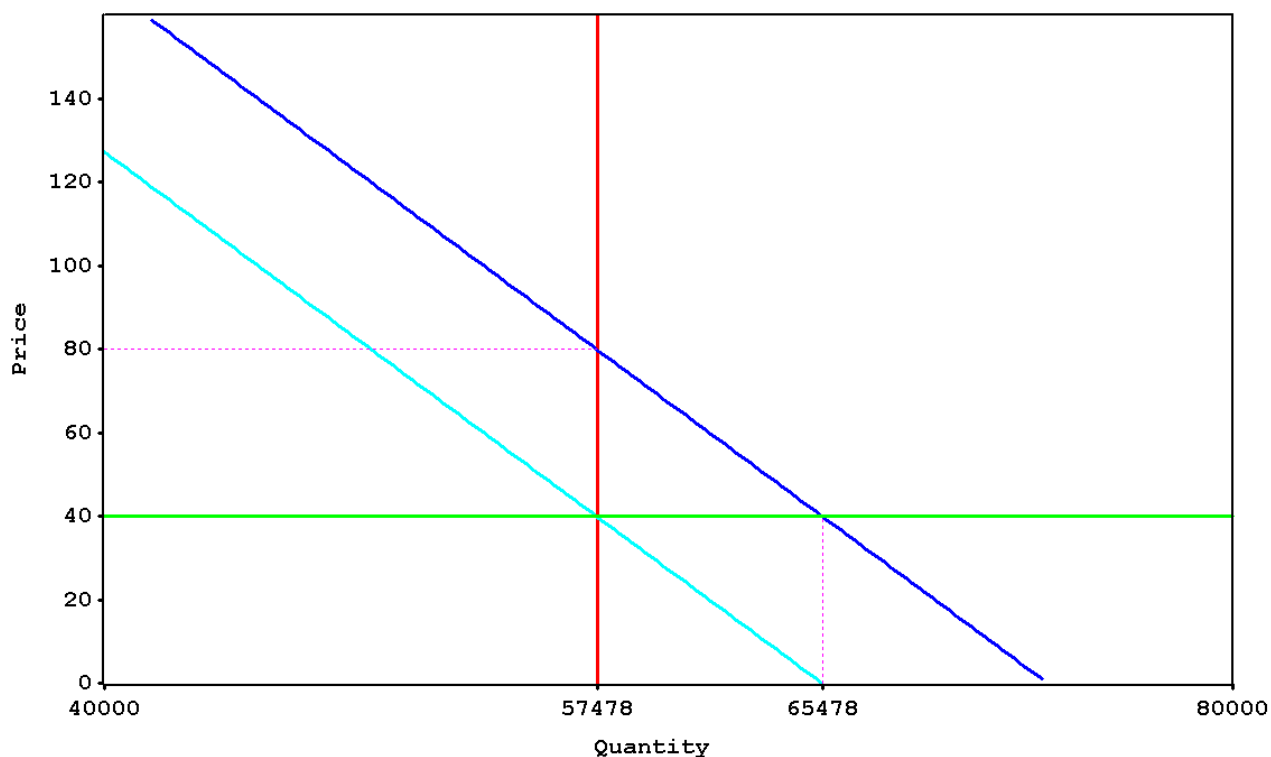
The playoff demand curve is in dark blue on the graph.

Fixed price of \$ 40 is shown by the green horizontal line.

Note that if you substitute the price of \$ 40 into normal demand, you get the stadium capacity of 57,478, and if you substitute \$ 40 into $Q_d = 73,478 - 200 * 40 = 73,478 - 8000 =$ a quantity demanded of 65,478.

There is an excess demand of 8000 customers who would like to have a ticket, but cannot buy one.

Excess Demand in Yankee Stadium



Note that it is accidental that the light blue demand curve ends at 65,478 – the point that counts is the intersection of the green line and the dark blue demand curve, which determines the total demand of 65,478 during the playoff race at a price of \$ 40.

The Tampa-Cleveland graph is left as an exercise.

Problem 3. Orlando Housing Market

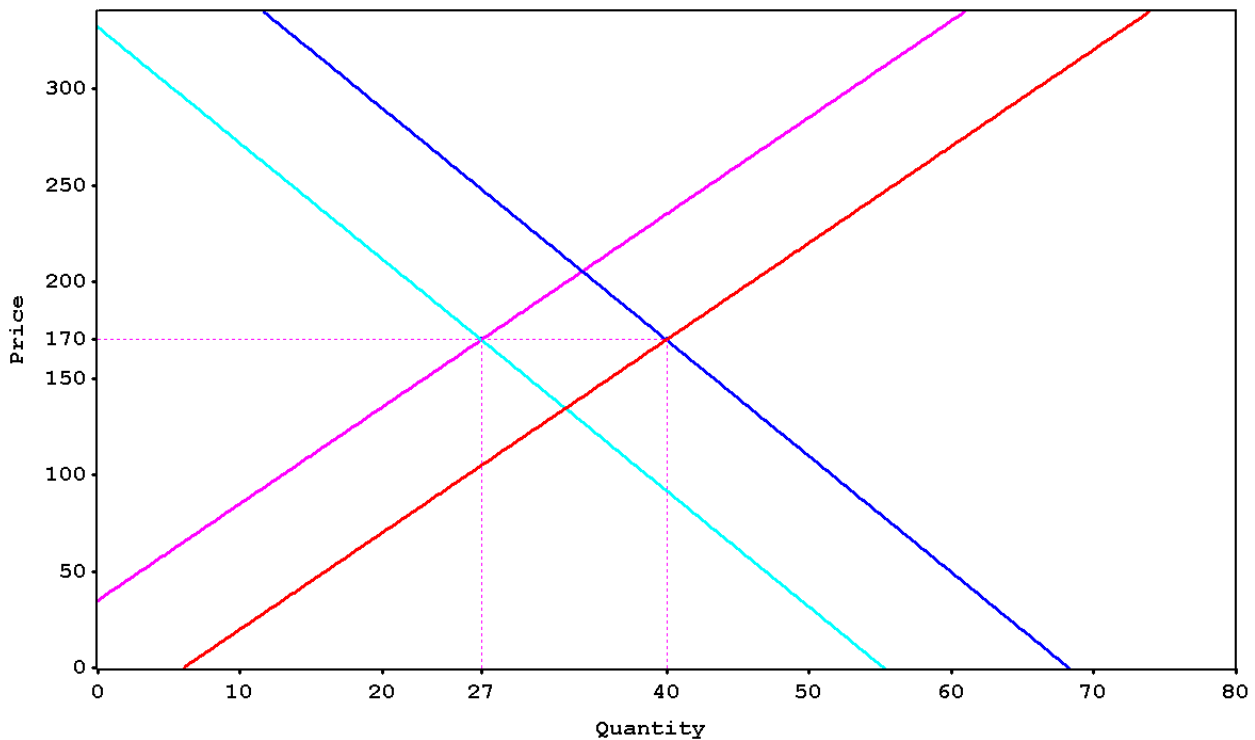
Despite an expansion in population and the demand for houses, the price of houses in Orlando remained unchanged. The only possible explanation is that the increase in the demand for houses was matched by an increase in supply.

Data from Orlando Regional Realtor Association, Feb. 19, 2010:

The median house price for normal sales in Orlando in Jan. 2010 was \$ 170,000; we will assume it was the same in 2005. (This is a big counter-factual: the Orlando housing market was hit very hard by the recession and foreclosures; non-normal sales due to bank foreclosure had a median price of \$ 70,000, and lowered average price for all sales to \$ 103,000) .

About 3500 houses a month, or 40,000 a year are sold. This is an increase of about 50 percent from January, 2009, so we will presume that 27,000 houses were sold in 2009. The graph of the situation should remind you of Problem 1, parts a and b.

Increase in supply -- Increase in demand



Note: The original (2009) equilibrium is indicated by a light blue demand curve and a magenta supply curve; the 2010 equilibrium is indicated by a dark blue demand curve and a red supply curve. How does this graph differ from the Problem 1, parts a and b graphs? What happens to price when both supply and demand increase?

Problem 4. True or false.

- a. If the price of good X rises and the demand for good Y falls, the two must be complements.
Example: price of bacon rises, and the demand for eggs falls.
- b. An increase in supply will result in a fall in price in the new equilibrium, as claimed.
- c. Income increases will increase the demand (and hence the price) of normal goods, but the demand for inferior goods (and hence their price) will fall.
- d. Both passenger sedans and SUVs are normal goods, but they are substitutes.
- e. If demand and supply increase at the same time, price is uncertain. Compare Prob. 1, a and b, and problem 3.
- f. What happens when the price of bacon falls?

Problem 5. Price supports for tobacco and anti-smoking advertisements.

Are the policies opposed? The answer is NO if the objective is to decrease the quantity of cigarettes consumed. The anti-smoking ads are intended to decrease the demand for cigarettes, and the acreage restriction will operate to decrease the supply of tobacco, and thereby increase the cost of production of cigarettes.

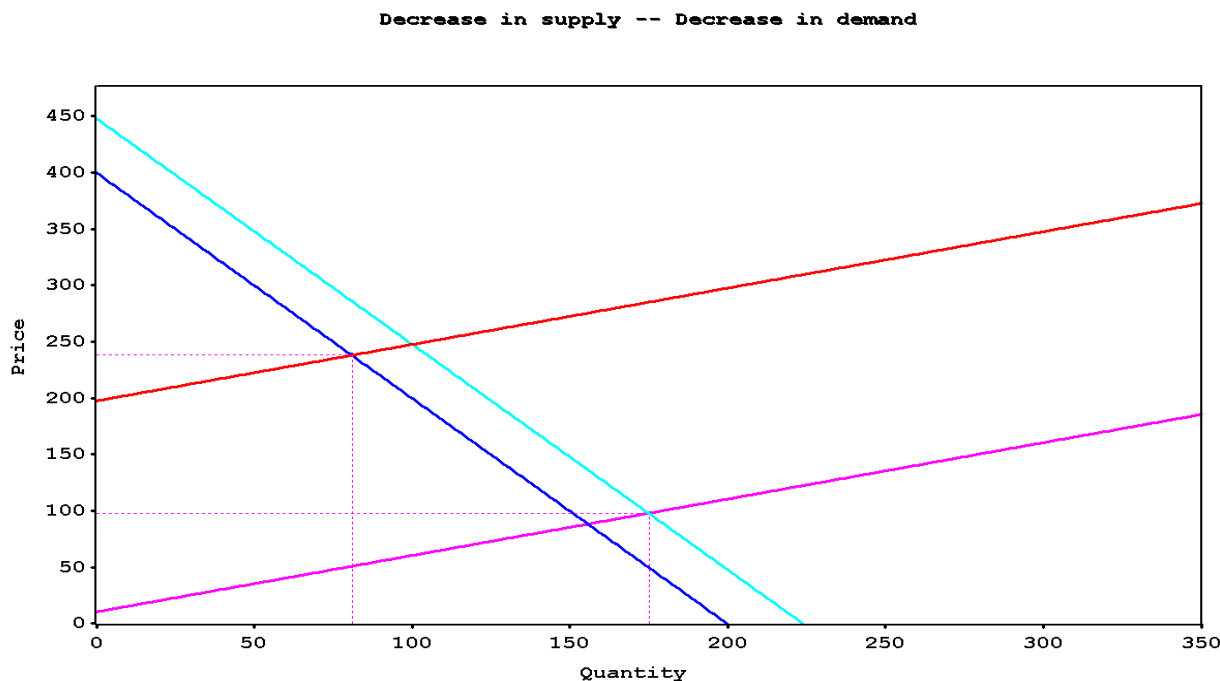
In the cigarette market, both the supply and demand fall, and although the change in the price of cigarettes is uncertain, the quantity sold will certainly decrease.

In 1970, the nominal price of cigarettes was 38 cents a pack, and the CPI (1982-4 base) was 38.90, so the real price of cigarettes was 98 cents a pack.

In 2006, the nominal price of cigarettes was \$ 4.80 a pack, and the CPI was 201.9, so the real price of cigarettes was \$ 2.38 a pack.

Total sales: 24 billion cigarettes for an over-16 population of 137 million, or 175 cigarettes per capita in 1970.
18.5 billion cigarettes for an over-16 population of 229 million or 81 cigarettes per cap in 2006.

The data is summarized in the following graph:



Problem 6. Construction industry.

In the 2000s, the story told in the problem repeated itself (see the Orlando problem above):

a. As the economy recovered from the recession of 2001, and as the Federal Reserve kept interest rates low, housing demand increased. (Note that lower interest rates will shift a demand curve drawn with the price of a house on the vertical axis). By 2003, price increased, and as a result, the quantity supplied increased (a movement along the supply curve, as existing contractors worked harder).

b. By 2005, the construction industry was booming – and the entry of new contractors, and perhaps some improvements in technology, increased the supply of houses. The shift in the supply curve meant lower prices, and that induced a movement along the demand curve.

c. In 2008, the financial crisis centered in the housing sector, and stricter standards for lending meant that demand for housing fell (note that demand in economics does not mean simply the wish to buy a house, but being willing and able to put up the money to do so).

You should draw a graph similar to the Orlando housing market graph, and label the original equilibrium point 2001, the topmost intersection 2003, the rightmost intersection 2005, and the bottom intersection 2008. Note that although we can look at a supply-demand graph all at once, telling a story about it may require us to add a time dimension to our explanation.

Problem 7. Common fallacies.

a. "Demand increases, so prices rise. But higher prices reduce demand, so we will wind up back where we started, with prices unchanged." Higher prices do not reduce demand, but the quantity demanded.

b. "The supply of meat increases, so prices fall and households spend more on meat." Prices will fall due to an increase in supply, but whether people will spend more is uncertain. The law of demand says only that people will buy more, not that they will spend more. For example, if the price of beef falls from \$ 5 a pound to \$2 a pound, you could increase your consumption of beef from 10 pounds a month to 12 pounds a month. Your spending will have decreased from $\$ 5 * 10 = \$ 50$ to $\$ 2 * 12 = \$ 24$, despite the increase in beef consumption.

Problem 8. Market for eggs. Treat each of the following events separately; draw a graph with the initial equilibrium at a price of \$ 2 a dozen and a quantity of 50 dozen eggs a year, and (using a separate graph for each problem), sketch the impact of:

a. The recent revelation that the cholesterol in eggs is the "good" cholesterol, and that past warnings overstated the danger.

b. An increase in the price of bacon.

c. Increase in the price of chicken feed.

d. Robots used for chicken herding reduce chicken mortality.

Problem 8. Supply and demand.

Text problem would have solution $P = \$ 1.50$, $Q = 70$. I modify the equations to:

$$\text{DEMAND: } Q_d = 200 - 20 P \text{ or } P_d = 10 - 0.05 Q_d$$

$$\text{SUPPLY : } Q_s = -160 + 40 P \text{ or } P_s = 4 + 0.025 Q_s$$

Note that the supply equation was slightly changed to incorporate the more realistic situation in which it takes a positive price of \$ 4 for anyone to think about supplying eggs. Note also that rearranging the demand and supply equations so that price rather than quantity is on the left helps in graphing the equations.

For example, we know that the maximum quantity demanded will be 200 (substitute 0 for P in the original demand equation) and the maximum price anyone would pay is \$ 10 (substitute 0 for Q_d in the second demand equation). Likewise we know that the supply equation indicates that if the price were zero, -40 would be supplied (suppliers would turn into demanders!), and that if the quantity supplied is zero, $P_s = \$ 4$

To solve the equations, the form with quantity on the left is more convenient:

Equilibrium by definition implies that $Q_d = Q_s$.

$$\text{Substitute the right hand of equations: } 200 - 20 P = -160 + 40 P$$

$$\text{Add 120 to each side of this equation: } 360 = 60 P$$

$$\text{Divide both sides by 60: } P^* = 6 \text{ [I usually star equilibrium price and quantity]}$$

Substitute the equilibrium price into either the supply or demand equation to find equilibrium quantity.

$$Q^* = 200 - 20 P^* = 200 - 20 (6) = 200 - 120 = 80 \text{ from the demand equation.}$$

$$Q^* = -160 + 40 P^* = -160 + 40 (6) = -160 + 240 = 80 \text{ from the supply equation.}$$

Equilibrium will be at $P^* = \$ 6$ and $Q = 80$.

Supply and Demand, Problem 3.9

