1. Equating the right sides of the supply and demand functions and using algebra, we find:

$$0.75 \ln(p) = 2.4 + 0.15 \ln(110)$$
$$\ln(p) = 3.2 + 0.2 \ln(p_t).$$

We then set $p_t = 110$, solve for $\ln(p)$

$$\ln(p) = 3.2 + 0.2(4.7),$$

and exponentiate $\ln(p)$ to obtain the equilibrium price:

$$p \approx \$62.80\text{/ton.}$$

Substituting p into the supply curve and exponentiating, we determine the equilibrium quantity:

$$Q \approx 11.91 \text{ million short tons/year.}$$

2. The supply for processed tomatoes is:

$$\ln(Q) = 0.2 + 0.55 \ln(p) \quad \text{or} \quad Q^S = 1.22 P^{0.55}.$$

The demand for processed tomatoes is:

$$\ln(Q) = 2.6 - 0.2 \ln(p) + 0.15 \ln(p_t) \quad \text{or} \quad Q^D = 13.46 P^{-0.2} P_t^{0.15}.$$

Given our equilibrium condition, $Q^S = Q^D$ and solving for P:

$$1.22 P^{0.55} = 13.46 P^{-0.2} P_t^{0.15}$$
$$P^{0.75} = 11.033 P_t^{0.15}$$
$$P^* = 24.56 P_t^{0.2}$$

and

$$Q^* = 7.095 P_t^{0.11}.$$

If the price of tomato paste falls by 10%, the new price will be $P_t = 99$. Therefore:

$$P^* = 24.56(99)^{0.2} \quad \text{and} \quad Q^* = 7.095(99)^{0.11}$$

or

$$P^* = 61.59 \quad \text{and} \quad Q^* = 11.76.$$

3. At \$65 per ton, supply is given by $\ln(Q) = 0.2 + (0.55)\ln(65) = 2.5$, so

$$Q = 12.18 \text{ million tons.}$$

Firms demand is given by $\ln(Q) = 2.6 + (0.2)\ln(65) + (0.15)\ln(110) = 2.47$.   Therefore, firms' demand is:

$$\exp(2.47) = 11.82 \text{ million tons.}$$

Therefore, the government buys $12.18 - 11.82 = 0.36$ million tons at a cost of \$23.4M.

4. The quota on foreign-trained physicians would alter the supply curve. In Figure 2.7 below, the unregulated supply curve, S, becomes more inelastic once the quota on foreign doctors is reached. The new supply curve, S^1, results in higher prices for medical services due to higher salaries for physicians. American physicians are better off with the quota because of the increase in wages. Consumers are harmed because of the increase in price and decrease in quantity.
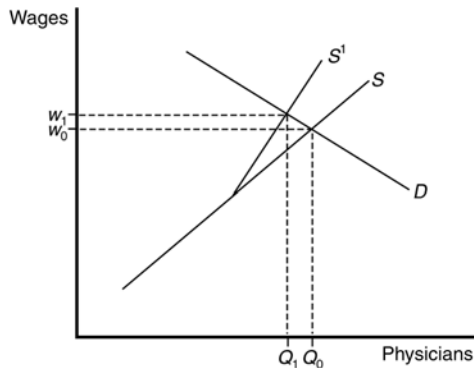

Figure 2.7

5. The law would create a price ceiling (at 110% of the pre-emergency price). Because the supply curve shifts substantially to the left during the emergency, the price control will create a shortage: At the ceiling price, the quantity supplied will be less than the quantity demanded.