**Quiz #4 - EconS 330, Friday October 11th**

**Question #1 (100 Points)**
Assume that the U.S. oil demand is represented by the following demand function:

\[ P_d = 40 - 0.15q_d \]

and the Supply curve (which represents the domestic oil producers) is:

\[ P_s = 5 + 0.10q_s \]

where \( P_d \) and \( q_d \) are the price and quantity demanded, respectively. In addition, \( P_s \) is the price charged by domestic suppliers and \( q_s \) is the quantity supplied.

a) Find the optimal quantity and price in the oil market. (10 Points)

b) Assume that the oil world price is $12. Find the quantity produced by U.S. firms and quantity demanded by U.S. consumers. (15 Points)

c) How many units U.S. will import? (15 Points)

d) Assume that the vulnerability premium is equal to $5. Find the new quantity produced by U.S. firms, new quantity demanded by U.S. consumers and the quantity imported. (15 Points)

e) Draw a graph that represents your results in part (a), (b), (c) and (d). (15 points)

f) Calculate the price elasticity of demand when the new price is $17. Is the demand elastic or inelastic? (10 points)

g) Assume that the domestic firm internalizes a fix cost of climate damage which is equal to $5. Identify the new quantity produced by U.S. firms and the quantity imported when the price is $17. Discuss why imports are different than in part (d). (20 Points)

**Solution**

a. In order to find the optimal quantity we need to equalize demand and supply:

\[ 40 - 0.15q_d = 5 + 0.10q_s \]

\[ 35 = 0.25q \]

\[ q = 140 \text{ and } p = 40 - 0.15 	imes 190 = 19 \]

b. Assume that the world price is $12. The quantity produced by U.S. firms is obtained from the supply curve: \( P_s = 5 + 0.10q_s \). Hence, we have to analyze what is the quantity that U.S. firms are willing to produce when the price is $15. Therefore:

\[ 12 = 5 + 0.10q_s \]

\[ 7 = 0.10q_s \text{ Solving by } q_s \text{ we have that: } q_s=70 \]

The quantity demanded by U.S. consumers is obtained from the demand function: \( P_d = 40 - 0.15q_d \), we have to analyze what is the quantity that U.S. consumers are willing to consume when the price is $15. Therefore:

\[ 12 = 40 - 0.15q_d \]

\[ -28 = -0.15q_d \text{ Solving by } q_d \text{ we have that: } q_d=186.67 \]
c. U.S. will import: \( q_d - q_s = 186.67 - 70 = 116.67 \) barrels of oil

d. Vulnerability premium is equal to $5. Therefore, the new price will be:

\[
P(\text{new}) = \text{World price} + \text{Vulnerability premium} = 12 + 5 = 17
\]

Hence, the new quantity produced by domestic firms when the price is $17 is:

\[
17 = 5 + .10q_s \\
12 = .10q_s \\
q_s = 120
\]

and the quantity demanded by domestic consumers is:

\[
17 = 40 - .15q_d \\
-23 = -.15q_d \\
q_d = 153.33
\]

Finally, the new quantity imported is: 153.33-120= 33.33

e.

f. The formula of the price elasticity of demand is:

\[
E_{pd} = \frac{\text{Change in quantity}}{\text{Change in price}}
\]

\[
\text{Change in quantity} = \frac{Q_{\text{new}} - Q_{\text{original}}}{Q_{\text{original}}} \times 100 = \frac{153.33 - 140}{140} \times 100 = 9.52\%
\]

\[
\text{Change in price} = \frac{P_{\text{new}} - P_{\text{original}}}{P_{\text{original}}} \times 100 = \frac{17 - 19}{19} \times 100 = -10.53\%
\]
\[ E_{pd} = \frac{9.52\%}{-10.53\%} = -0.90, \text{ therefore the demand is relatively inelastic.} \]

g. Given the cost of the climate damage, the new supply function is: \( P_S = 10 + 0.10q_s \). Hence, the quantity imported is \( 17 = 10 + 0.10q_s \), and solving for \( q_s \) we obtain \( q_s = 70 \). The quantity imported increases and it is equal to: \( 153.33 - 70 = 83.33 \). Note that only domestic firms internalize the costs of climate damage making the production of oil more expensive. Hence, given the new supply function, the amount of oil that they can produce at a price \$17 is lower. However, the domestic demand has not changed; as a consequence, foreign firms will cover a higher proportion of the domestic demand (since foreign firms do not internalize the costs of climate change).