ESM 204 HW 3 Appendix

Jennifer Truong, Haley Grant, and Qusai B.

5/8/2020

Question 1

'Low' income demand curve: y = 11.6854836 - $-6.6114372 \times 10^{-5}$x

'High' income demand curve: y = 15.803428 - $-6.6114372 \times 10^{-5}$x

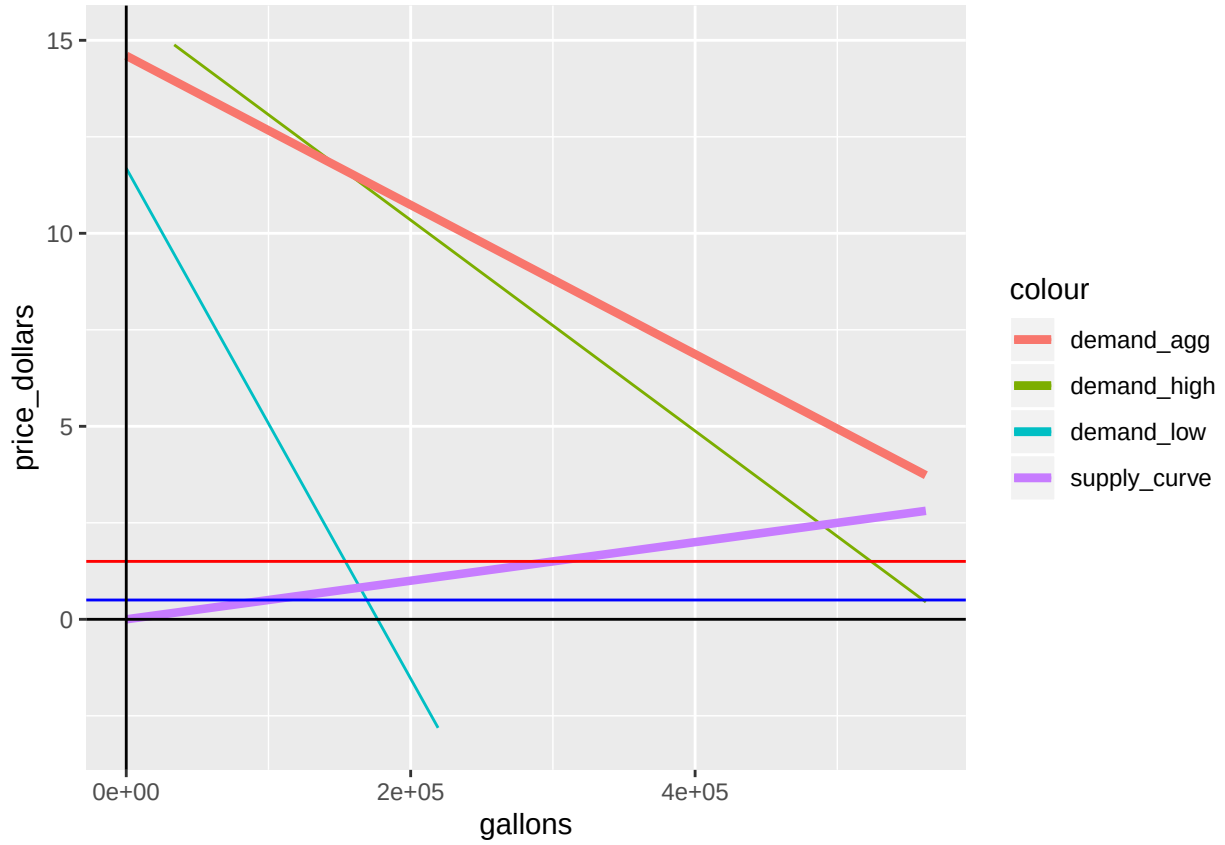
$y_{low} = 11.68548 - 6.611437e-05x_{low}$ $x_{low} = (11.68548/6.611437e-05) + (1/-6.611437e-05)y_{low}$ $x_{low} = 176746.4 - 15125.3y_{low}$

$y_{high} = 15.80343 - 2.730926e-05x_{high}$ $x_{high} = (15.80343/2.730926e-05) + (1/-2.730926e-05)y_{high}$ $x_{high} = 578683.9 - 36617.62y_{high}$

$x_{agg} = (176746.4 + 578683.9) + ((1/-6.611437e-05) + (1/-2.730926e-05))$ $x_{agg} = 755430.3 - 51742.92y$

Aggregate demand curve: y_{agg} = 14.5996844 - $-1.9326316 \times 10^{-5}x_{agg}$

Supply curve: $y = (1/200,067)x$



Consumer Benefit

The benefit to consumers under the status quo is the consumer surplus (the area under the demand curve, which we integrate when the price is $3).

$3 = 14.5996844 - $-1.9326316 \times 10^{-5}$x

x = 6.0020154×10^5 gallons

1.8006046×10^6 = 3*6.0020154×10^5

5,284,660 - 1.8006046×10^6 = 3,484,057

The consumer benefit is $____.

Producer Benefit

The benefit to producers under the status quo is the producer surplus (the area under the demand curve, which we integrate when the price is $3).

The producer benefit is $____.

Environmental Cost

Local

The local environmental cost is 9.0030231×10^5. It is the area under the curve from 0 to 600201, so we integrate $y = 1.50$ from 0 to 600201

Rest of the world

The rest of the world environmental cost is 3.0010077×10^5. It is the area under the curve from 0 to 600201, so we integrate $y = 0.50$ from 0 to 600201

Question 2 - Individual Consumer Benefit

Low Income

x_{low} = (3 - 11.6854836)/$-6.6114372 \times 10^{-5}$

The quantity for the low income demand curve where the price is $3 is 1.3137058×10^5. The consumer surplus is the area of a triangle.

5.7050852×10^5 = 0.5 * (11.6854836 - 3) *1.3137058×10^5

The consumer benefit for low income consumers is 5.7050852×10^5.

High Income

x_{high} = (3 - 15.803428)/$-2.7309265 \times 10^{-5}$

The quantity for the high income demand curve where the price is $3 is 4.6883093×10^5.

5.7050852×10^5 = 0.5 * (15.803428 - 3) *4.6883093×10^5

The consumer benefit for high income consumers is 3.0013216×10^6.

The aggregate benefit is 3.5718301×10^6.

Question 3 - Effects from Gas Tax

a) The amount of gasoline produced and consumed.

$1 will be subtracted from every gallon purchased.

The new supply curve is $y - 1 = (1/200,067)x$. Less gas would be produced and consumed. Setting this new supply curve equal to the aggregate demand curve, the new equilibrium quantity is 5.5909096×10^5 gallons.

b) Gas price

The new gas price is 3.79/gallon at 5.5909096×10^5 gallons.

c) Welfare of 'high' income consumers

$4.5820286 \times 10^5 = (1 - 15.803428)/(-2.7309265 \times 10^{-5} - 4.9983211 \times 10^{-6})$

The quantity where P = 3.79 is 4.5820286×10^5

$2.7512589 \times 10^6 = 0.5 * (15.803428 - 3.7945161) * 4.5820286 \times 10^5$

The welfare of high income customers after the tax is 2.7512589×10^6.

d) Welfare of 'low' income consumers

$1.5026127 \times 10^5 = (1 - 11.6854836)/(-6.6114372 \times 10^{-5} - 4.9983211 \times 10^{-6})$

The quantity where P = 3.79 is 1.5026127×10^5

$5.928534 \times 10^5 = 0.5 * (11.6854836 - 3.7945161) * 1.5026127 \times 10^5$

The welfare of low income customers after the tax is 5.928534×10^5.

e) Welfare of gas producers

The welfare of gas consumers is $ _____.

f) Local environmental damage

A tax of $1.00 doesn't cover all of local environmental damage, but it covers more than half of it, raising the tax to $2.00.

g) Rest of world environmental damage

A tax of $1.00 covers all of the world environmental damage and more. A socially optimum equilibirum is met at least with this externality. The MPC has captured the MEC value of this externality. The new supply curve with the tax is the MSC.

h) Total revenue generated by the tax

The total revenue generated by the tax is 1.5623887×10^6.

Question 4

a) overall welfare of 'High' income consumers

b) overall welfare of 'Low' income consumers

The low income customers have to pay a higher tax because they have greater MECs. We assume that they will cover both the local externality and the ROW externality.

Global externality = $\$1.50(local) + \$0.50(ROW) = \$2.00$

They will need to pay a $2 tax.

Maybe the ideal tax is $1.25 because $2 + .50 = 2.50$ which split between two groups is 1.25.

c) gas producers

Question 5 - EV Technology

Note: For the following calculations, we divided the y-intercept of each demand curve by half.

a) gas consumption by 'High' income consumers

The new consumption by high income consumers is 2.4457767×10^5 gallons. Consumption decreases about 52.2%

b) gas consumption by 'Low' income consumers

The new consumption by high income consumers is 8.2161728×10^4 gallons. Consumption decreases about 62.5%

c) gas price

The new gas price is $1.5.

d) local environmental damage from gasoline

$.5 * 1.50 * 300,101 = 225,075.75$

e) rest of world environmental damage from gasoline

$.5 * .50 * 300,101 = 75,025.25$

Question 6

$\tau = 7.3$

New supply curve with optimal tax: $y = 4.9983211 \times 10^{-6}x + 7.3$

A tax of $7.3 makes the local environmental quality equal between the gas tax situation and the electric car situation.