Technical Appendix

Econ HW 2

Maddie Berger & Sara Orofino

5/1/2019

1. Aggregate Demand, Supply, and Surplus

High income demand curve:
$Price = 23.3914418 - (1.2966378 \times 10^{-4})Q$

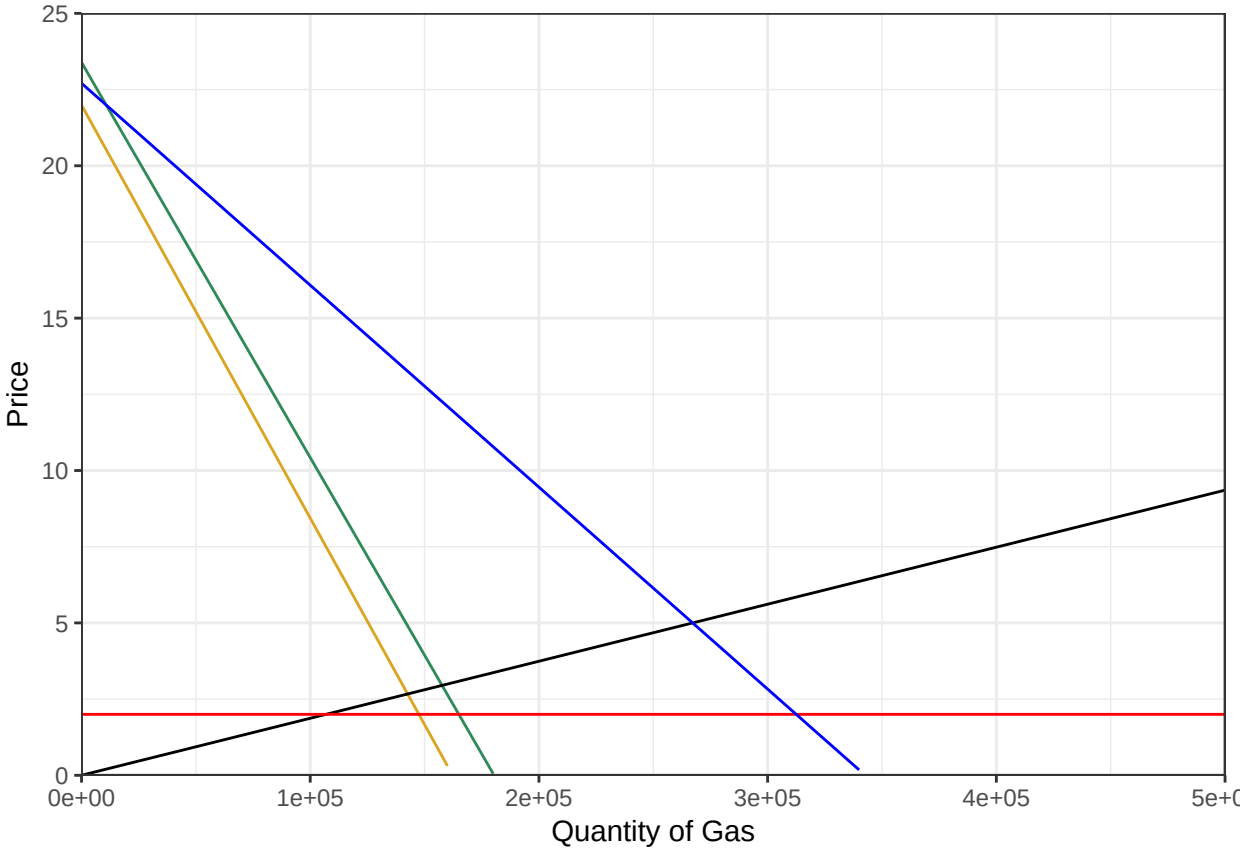
Low income demand curve:
$Price = 21.9908534 - (1.3551741 \times 10^{-4})Q$

a. Find aggregate demand

Aggregate demand curve:
$Price = 22.7066059 - (6.6262994 \times 10^{-5})Q$

b. Find the supply curve

Supply curve:
$Price = (1.8711376 \times 10^{-5}) * Q$



c. Surplus under the status quo

Consumers:
$CS = 2.3694528\ Million\ USD$

Producers:
$PS = 0.6680428\ Million\ USD$

d. Environmental Cost under the Status Quo

$Environmental\ Cost = 0.5344342\ Million\ USD$

2. Division of Consumer Benefit

Consumer Surplus for High Income:
$CS_{High} = 1.3043162\ Million\ USD$

Consumer Surplus for Low Income:
$CS_{Low} = 1.0651366\ Million\ USD$

3. Implement a Gas Tax of $0.50/gallon

a. New quantity of gasoline

$Q_{Tax} = 2.6133299 \times 10^5$

b. New price of gasoline

$P_{Tax} = 5.3898999$

c. Surplus to high income consumers

$CS_{High} = 1.2495992\ Million\ USD$

d. Surplus to low income consumers

$CS_{Low} = 1.0168127\ Million\ USD$

e. Producer surplus

$PS_{Tax} = 0.6389461\ Million\ USD$

f. Environmental damage

$TEC_{Tax} = 0.522666\ Million\ USD$

g. Tax revenue

$Tax\ Revenue = 0.1306665\ Million\ USD$

4. Tax Revenues for Infrastructure Repairs

a. Surplus to high income consumers

Table 1: High Income Consumer Welfare at Variable Gas Tax Amounts

Tax Amount	High Income Consumer Welfare (Million USD)
0.25	1.3119
0.50	1.3190
0.75	1.3257
1.00	1.3319
1.25	1.3376
1.50	1.3429
1.75	1.3477
2.00	1.3521
2.25	1.3560
2.50	1.3595
2.75	1.3625
3.00	1.3650
3.25	1.3671
3.50	1.3687
3.75	1.3698
4.00	1.3705
4.25	1.3708
4.50	1.3706
4.75	1.3699
5.00	1.3688

b. Surplus to low income consumers

Table 2: Low Income Consumer Welfare at Variable Gas Tax Amounts

Tax Amount	Low Income Consumer Welfare (Million USD)
0.25	0.5433
0.50	0.5554
0.75	0.5671
1.00	0.5783
1.25	0.5891
1.50	0.5995
1.75	0.6095
2.00	0.6189
2.25	0.6280
2.50	0.6366
2.75	0.6448
3.00	0.6525
3.25	0.6598
3.50	0.6667
3.75	0.6731
4.00	0.6791
4.25	0.6847
4.50	0.6898
4.75	0.6944
5.00	0.6987

c. Surplus to producers

Table 3: Producer Welfare at Variable Gas Tax Amounts

Tax Amount	Producer Welfare (Million USD)
0.25	0.6534
0.50	0.6389
0.75	0.6246
1.00	0.6105
1.25	0.5965
1.50	0.5827
1.75	0.5690
2.00	0.5555
2.25	0.5422
2.50	0.5290
2.75	0.5160
3.00	0.5032
3.25	0.4905
3.50	0.4780
3.75	0.4656
4.00	0.4534
4.25	0.4414
4.50	0.4295
4.75	0.4178
5.00	0.4062

Possible Revenues and Welfare Changes from Gas Tax:

Assumptions
- Benefits from infrastructure repairs are proportional to amount driven
- Low income consumers pay the entire environmental cost

Table 4: Comparison of Revenue and Welfare Potential with Variable Gas Tax Amounts

Tax Amount (USD)	Tax Revenue (Million USD)	Welfare Change Low Income (%)	Welfare Change High Income (%)	Welfare Change Producers (%)
0.25	0.0661	-48.9954	0.5811	-2.1899
0.50	0.1307	-47.8567	1.1270	-4.3555
0.75	0.1938	-46.7593	1.6377	-6.4969
1.00	0.2554	-45.7031	2.1133	-8.6141
1.25	0.3156	-44.6881	2.5537	-10.7070
1.50	0.3743	-43.7142	2.9589	-12.7756
1.75	0.4316	-42.7816	3.3290	-14.8200
2.00	0.4874	-41.8902	3.6640	-16.8402
2.25	0.5417	-41.0399	3.9637	-18.8361
2.50	0.5945	-40.2309	4.2283	-20.8078
2.75	0.6458	-39.4631	4.4577	-22.7553
3.00	0.6957	-38.7365	4.6520	-24.6785
3.25	0.7442	-38.0510	4.8111	-26.5774
3.50	0.7911	-37.4068	4.9351	-28.4521
3.75	0.8366	-36.8038	5.0238	-30.3026
4.00	0.8806	-36.2419	5.0774	-32.1288
4.25	0.9231	-35.7213	5.0959	-33.9308
4.50	0.9642	-35.2419	5.0792	-35.7085
4.75	1.0038	-34.8036	5.0273	-37.4620
5.00	1.0419	-34.4066	4.9403	-39.1912

5. Electric cars lower demand for each group by one half (vertically)

a. & b. Gas consumption by High/Low income Consumers

Low Income Consumption:
$Q_{Low} = 7.129296 \times 10^4$

High Income Consumption:
$Q_{High} = 7.8825332 \times 10^4$

Aggregate Consumption:
$Q_{Aggregate} = 1.5765066 \times 10^5$

c. New price of gasoline with higher EV use and lower gas demand

$Price = 0.906898$

d. Environmental Cost

$Environmental\ Cost = 0.3153013\ Million\ USD$

6. Compare a 2.00 per gal tax to the influence of EV

Table 5: Environmental Cost Comparison

	Environmental Cost (USD)	Reduction (%)
Baseline	0.5344	0.0000
$2.00 Gas Tax	0.4874	8.8080
High EV Demand	0.3153	41.0028