Solution to Problem Set 3

ENVIRON 805K

November 6, 2017

1. (20')

(a)

John's marginal utility for market good is $\text{MU}_1 = \frac{\partial u(x_1,x_2)}{\partial x_1} = \frac{0.4}{x_1}$ while his marginal utility for environment is $\text{MU}_2 = \frac{\partial u(x_1,x_2)}{\partial x_2} = \frac{0.6}{x_2}$.

(b)

John's budget line is $x_1 + 2x_2 = 25$.

(c)

The optimal choice $E(x_1^*, x_2^*)$ should satisfy two conditions: E is a point on the budget line; the budget line is tangent to the indifference curve at E. Therefore, we can derive the following equations

$$\begin{cases} x_1^* + 2x_2^* = 25 \\ \frac{\text{MU}_1}{\text{MU}_2} = \frac{0.4x_2^*}{0.6x_1^*} = \frac{1}{2} \end{cases}$$

Solving the equations, we have

$$\begin{cases} x_1^* = 10 \\ x_2^* = 7.5 \end{cases}$$

Therefore, the optimal choice for John is $(x_1^*, x_2^*) = (10, 7.5)$.

2. (20')

See Figure 1.

(a)

Dan's initial consumption is $(6, 3)$. Suppose Dan is willing to give up Δx to change the environment quality from 3 to 4. Then, Δx should satisfy

$$u(6 - \Delta x, 4) = u(6, 3)$$

Solving this equation, we have WTP $= \Delta x = 1.5$.

(b)

Dan's initial consumption is $(6, 4)$. Suppose Dan is willing to be compensated with Δx to let the environment deteriorate from 4 to 3. Then, Δx should satisfy

$$u(6 + \Delta x, 3) = u(6, 4)$$

Solving this equation, we have WTA $= \Delta x = 2$.

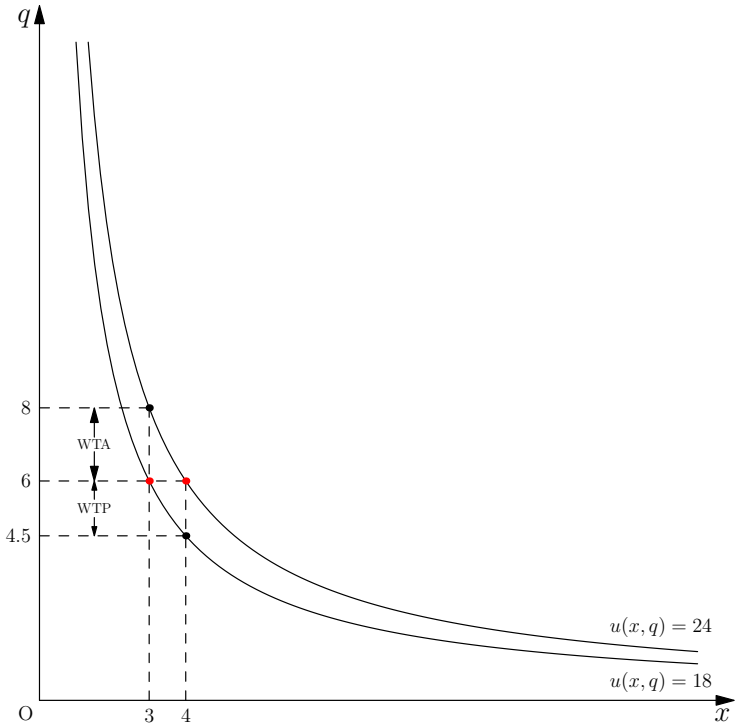

Figure 1: WTP and WTA

3. (20′)

(a)

According to Table 1, the marginal cost of air pollution measured by one unit of AQI is 100 RMB. (I forgot to tell you that the unit in the dataset is 10 thousand Yuan.)

(b)

This hedonic price model cannot reveal the causal relationship between air pollution and housing price. First, this model omits some important variables. In addition to the independent variables given in this model, there are still many other variables that may affect housing price and are relevant to the pollution exposure, such as the floor level. Second, the sample used in this estimation is not representative. It may has the selection problem.

(*See housing_aqi.do for corresponding stata code.*)

4. (10′)

$$\text{VSL} = \frac{\$1.5}{8 \times 10^{-7} - 6 \times 10^{-7}} = \$7.5 \times 10^{6}$$

5. (20′)

When $q = 5$, the demand function is $v = 35 - 2p_v$. When $q = 4$, the demand function is $v = 32 - 2p_v$.

According to Figure 2, the welfare loss is $S_{ABCD} = 41.25$.

6. (10′)

People think that the existence of such place is valuable. They may go to Coastal Alaska and the Amazon basin for a visit in the future. In this case, these places contain tourism

value. Besides, in terms of biodiversity preservation, maintaining a healthy environment in the Coastal Alaska is important for the ecosystem there.

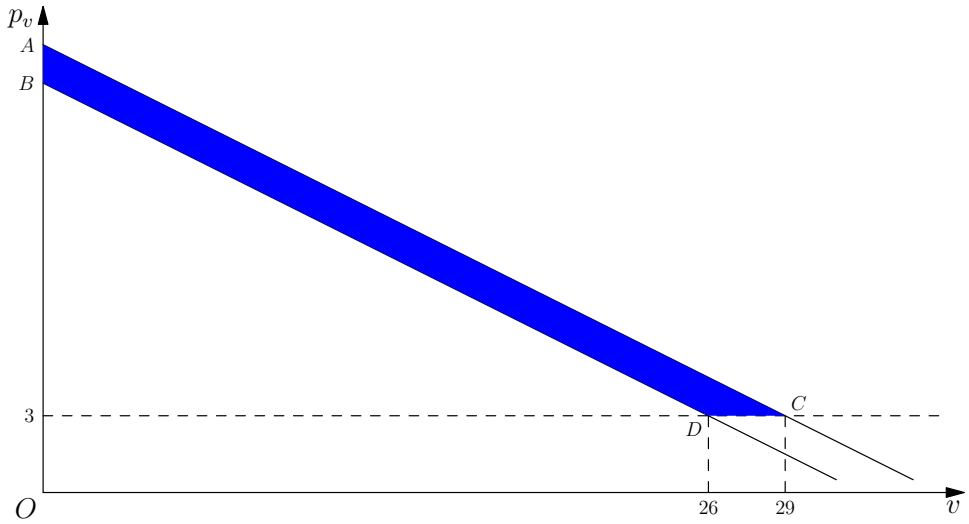

Figure 2: Welfare Loss from a Change in Quality

Table 1: Housing Price and AQI

VARIABLES	price
area	1.200***
	(3.15×10^{-8})
bedroom	4.63×10^{-7}
	(7.95×10^{-7})
bathroom	0.0300***
	(8.96×10^{-7})
AQI	-0.0100***
	(3.64×10^{-8})
Constant	2.28×10^{-6}
	(3.13×10^{-6})
Observations	100
R-squared	1.000