

Midterm (ANSWER KEY)

ECNS 432

Fall 2020

Due to me via email ([Dwight.anderson@montana.edu](mailto:Dwight.anderson@montana.edu)) by 10am on Friday, October 9<sup>th</sup>

\_\_\_\_\_ Name

1.) Consider a section of freeway that is uncongested during off-peak hours, but congested during rush hour. Suppose the trip to and from work takes 40 min. when the freeway is uncongested. Also, supposed that taking the side streets to and from work **always** takes 60 min.

On the freeway, assume congestion effects occur only after the 3<sup>rd</sup> car. After the 3<sup>rd</sup> car, each additional car that enters the freeway adds 5 minutes of travel time to all freeway commuters.

Lastly, assume that all commuters value their time at \$12/hour (or, equivalently \$.20/min).

a.) (7 points) Given the open access to the freeway, how many cars will travel on the freeway?

Cars	ave. time	total time	marginal time
1	40	40	40
2	40	80	40
3	40	120	40
4	45	180	60
5	50	250	70
6	55	330	80
7	60	420	90
8	65	520	100
9	70	630	110
10	75	750	120

Cars will enter to the point that average time on the freeway is equal to the trip time on the side streets. As a result, 7 cars will enter when there is open access to the freeway.

b.) (7 points) Suppose the freeway is now privately owned. What toll would be charged by the owner and how many cars would now travel on the freeway?

The owner would charge a toll such that cars would enter the freeway to the point where marginal time is equal to the trip time on the side streets. As a result, 4 cars will travel on the freeway when it is privately owned. And, the owner will charge a toll of \$3.

c.) (6 points) Which situation is efficient (i.e. open access freeway vs. privately owned freeway)? WHY?

The open access freeway is inefficient because cars 5, 6, and 7 could be allocated to different routes (i.e. the side streets) to decrease total commute time of all commuters. The privately owned freeway is efficient because cars 1 through 4 could not be reallocated in any other manner to decrease the total trip time of all commuters.

2.) Suppose we have an efficiently operating market for good X. Also, suppose the government adds a sufficiently large quantity of good X to the market such that the price of good X decreases (as shown in the graph below).

Use the graph below to answer the following:

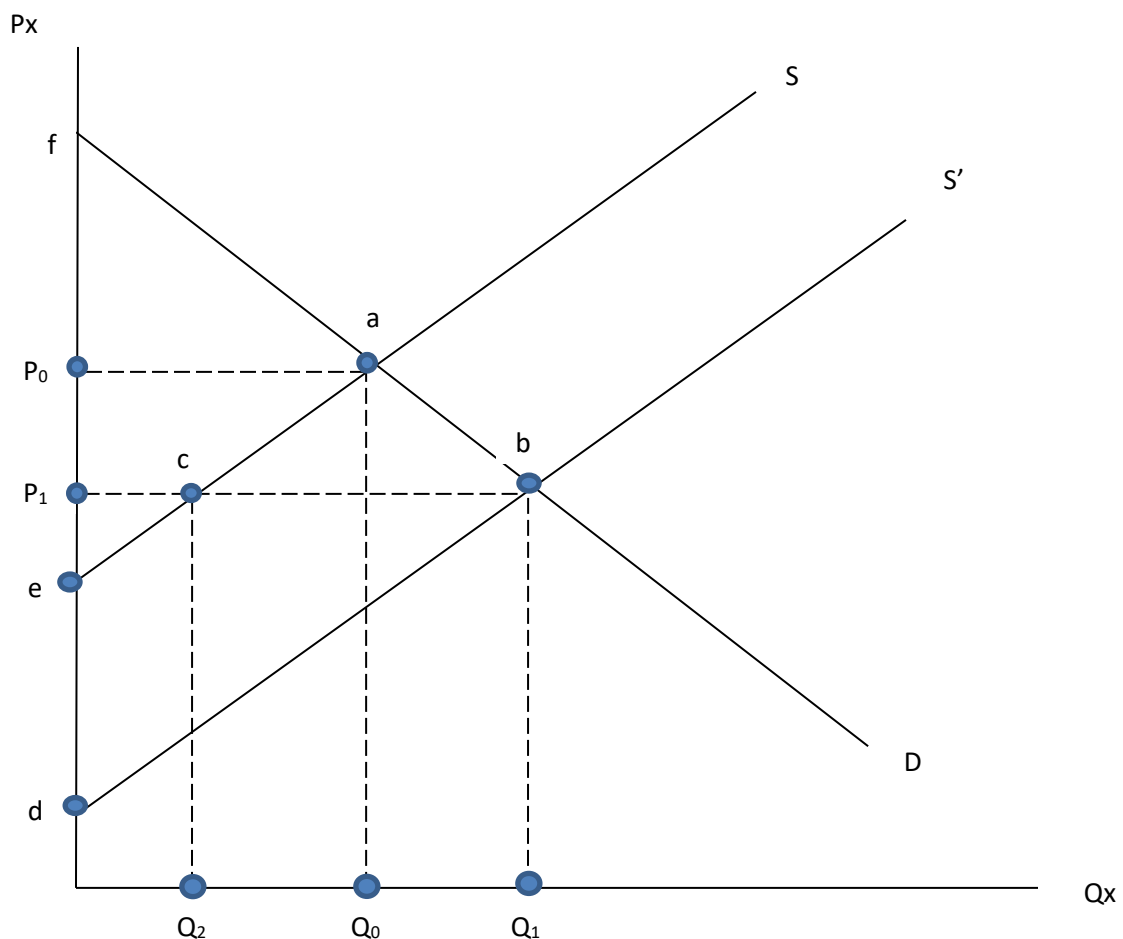
a.) (2 points) The gain in consumer surplus is given by what area on the graph?  $P_0abP_1$

b.) (2 points) Which supply curve do private sector suppliers operate on, S or S'? S

c.) (2 points) The loss in producer surplus is given by what area on the graph?  $P_0acP_1$

d.) (2 points) Government surplus is given by what area on the graph?  $Q_2cbQ_1$

e.) (2 points) The overall gain in social surplus is given by what area on the graph?  $Q_2cabQ_1$



**3.)** Suppose we have an efficiently operating market for cigarettes (our primary market good). Also, consider the secondary markets for chewing tobacco and whiskey. Cigarettes and chewing tobacco are substitutes, while cigarettes and whiskey are complements.

Now assume the government imposes a tax of  $t_x$  per unit (e.g., a pack) on sellers in the cigarette market.

**a.) (5 points)** Suppose the supply schedule in the market for whiskey is perfectly elastic and this market operates efficiently. Do we count changes in surplus that occur in the market for whiskey (due to the tax in the primary market) in our welfare analysis of the primary market? Why or why not? Keep your answer to a sentence or two.

No, all changes are accounted for already in the primary market. We do not want to double count the increase in consumer surplus.

**b.) (10 points)** Suppose the supply schedule in the market for chewing tobacco is upward sloping. Furthermore, suppose there exists a government-maintained price support (aka price floor) in this market. **Illustrate graphically** what happens in this market when the tax in the primary market is imposed (assume the demand for chewing tobacco shifts such that the price floor is still binding). Do we count any changes in this secondary market in our welfare analysis of the primary market?

-We do not count changes in consumer surplus (already accounted for)...because the price floor is still binding after the demand shift, price has not changed for the consumer.

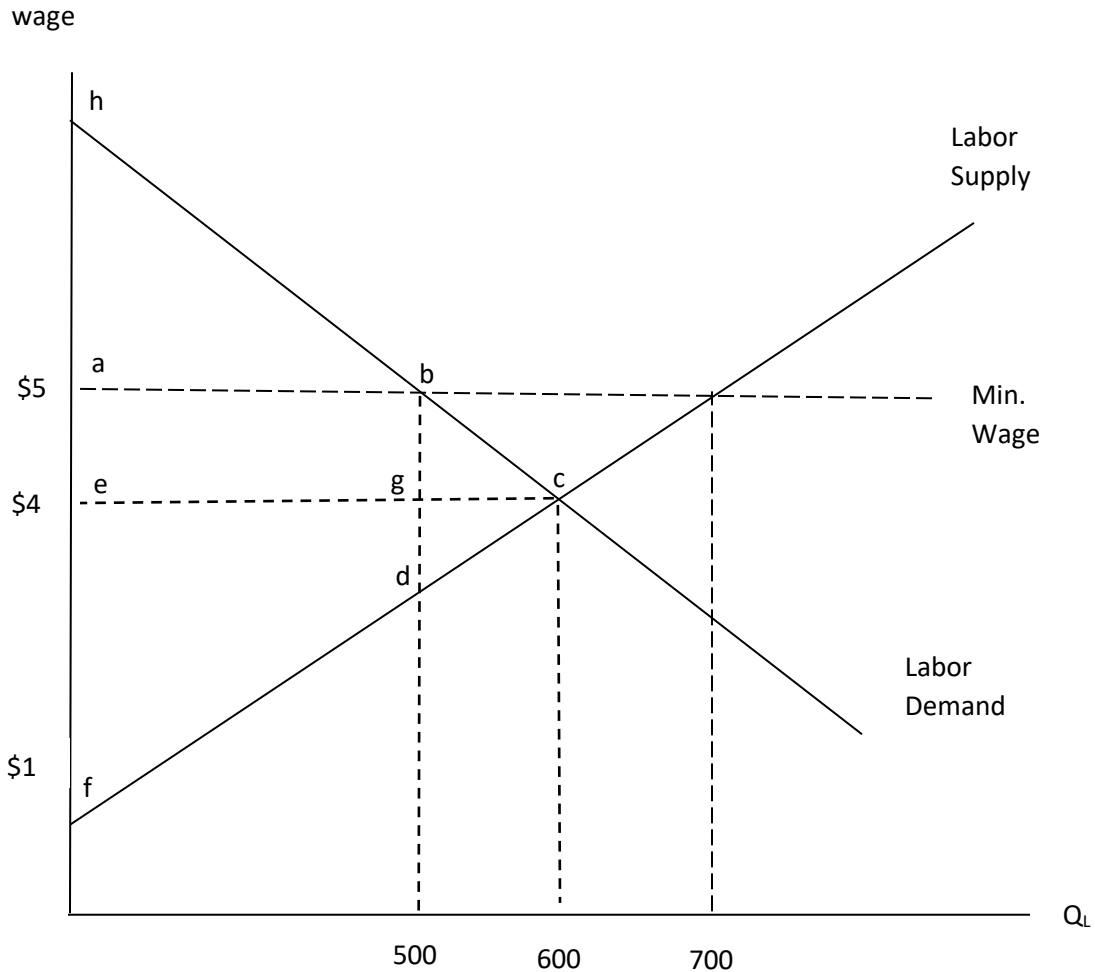
-Producer surplus in the secondary market does not change given that the government buys up the surplus and the price floor remains binding after the demand shift.

-BUT, the DWL gets smaller...and this is a change that we would want to count!

**4.) (10 points)** To finance a policy, the government will impose a per unit tax on either cigarettes or apples. The government wishes to minimize leakage when imposing the tax. Given this, which good do you think the government should tax? Make sure to briefly explain your answer. No explanation, no points.

Imposing the tax on an item with a relatively inelastic demand will likely yield a much smaller DWL to society. Cigarettes likely have few substitutes relative to apples. So, on these grounds, tax cigarettes.

**5.) (15 points total)** Consider a low-wage labor market. Workers in this market are not presently covered by the minimum wage, but the government is considering implementing such legislation. If implemented, this law would require employers to pay workers a \$5 hourly wage. Suppose all workers in the market are equally productive, the current market-clearing wage is \$4 per hour, and that at this market-clearing wage there are 600 employed workers. Further suppose that under the minimum wage legislation, only 500 workers would be employed and 200 workers would be unemployed. Finally, assume that the market demand and supply curves are linear and that the market reservation wage, the lowest wage at which any worker in the market would be willing to work, is \$1 per hour. The graph below depicts this situation.



**a.) (3 points)** Which area in the graph represents the change in employer surplus due to the minimum wage? Calculate this change in employer surplus (making sure to indicate whether it is positive or negative). *abce is a loss in employer surplus. This amount is equal to  $-[(\$5-\$4)*500 + (1/2)*100*(\$5-\$4)] = -\$550$*

**b.) (3 points)** Which area represents the new employee surplus? (i.e., employee surplus after the minimum wage has been implemented) Is the change in employee surplus positive or negative? **abdf is the new employee surface. The gain in employee surplus of abge clearly outweighs the loss in employee surplus of gcd.**

**c.) (3 points)** Which area represents a transfer from employers to employees? **abge is a transfer from employers to employees**

**d.) (3 points)** Which area represents the total impact of the minimum wage on employers and employees as a whole? Is this amount positive or negative? **The DWL is bcd and this is clearly negative.**

**e.) (3 points)** Finally, 100 workers are induced by the higher wage to enter the market. Do these workers experience a change in surplus that should be counted in a welfare analysis? Why or why not? **Because these individuals neither had a job before or after the min. wage policy, they see no change in surplus.**

6.) Suppose that the current market equilibrium for a good is such at  $p^* = \$50$  and  $q^* = 10$ . Also suppose that the elasticity of supply is 2.5 and the supply curve is linear.

a.) (10 points) Use the price elasticity of supply and market equilibrium to solve for the supply curve.

·In general, a linear supply curve can be represented by

$$q = a + (\Delta q / \Delta p)p \quad (1)$$

·Using the formula for the elasticity of supply, we can solve for the slope of the supply curve

$$\epsilon_s = (\Delta q / \Delta p)(p/q)$$

$$\Rightarrow 2.5 = (\Delta q / \Delta p)(50/10)$$

$$\Rightarrow \Delta q / \Delta p = 2.5/5 = 1/2$$

·Plugging the slope and market equilibrium points into (1), we can solve for the intercept:

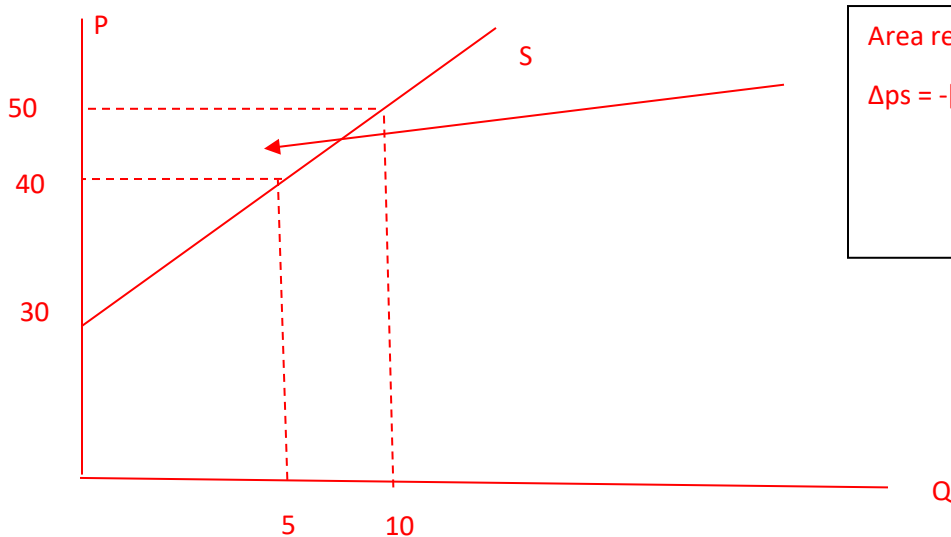
$$10 = a + (1/2)(50)$$

$$\Rightarrow a = -15$$

·Finally, we can write the supply curve as

$$q = -15 + (1/2)p$$

b.) (5 points) Suppose a policy is enacted such that the price falls from \$50 to \$40. By how much does producer surplus fall? Show this graphically and calculate the actual  $\Delta ps$ .



Area represents loss in PS due to price fall.

$$\Delta ps = -[(1/2)(5)(10) + (5)(10)] = -\$75$$

7.) Suppose we have a three-person neighborhood consisting of a gardener named Arnold and his neighbors Sylvester and Jean Claude. Arnold plants flowers in his garden every year because he gets benefits from being able to enjoy a nice-looking yard. In addition, Sylvester also gets benefits from being able to enjoy the flowers that Arnold plants. However, Jean Claude has bad allergies and the pollen from the flowers make his allergies worse. Assume that Arnold gets \$100 of benefits from each batch of flowers that he plants. Also, assume that Sylvester gets \$50 in benefits from each batch of flowers that Arnold plants. Lastly, assume that Jean Claude's allergy medication costs increase \$20 for each batch of flowers that are planted. In addition, suppose that Arnold faces the following marginal cost schedule for planting flowers:

<u>Q(# of batches of flowers)</u>	<u>Arnold's MC</u>
1	25
2	40
3	65
4	80
5	100
6	125
7	150
8	180

**a.) (4 points)** Due to Arnold's extremely thick accent he cannot communicate with his neighbors (i.e. transaction costs to communication and negotiation are prohibitively high). How many batches of flowers will Arnold plant? Is this outcome socially efficient? Why or why not?

Arnold will plant to the point where his pvt. MC = pvt. MB. He plants 5 batches of flowers.

This is not socially efficient b/c this is not taking into consideration benefits/costs to the other guys.

**b.) (6 points)** Now assume Sylvester and Jean Claude each have an interpreter so they can understand Arnold. Assume the interpreters are free of charge so communicating with each other is now costless (i.e. transaction costs are zero). How many batches of flowers will Arnold plant? Is this outcome efficient?

Now, Arnold will plant to the point where soc.MC = soc.MB. Thus, he plants 6 batches. This is efficient because all mutually beneficial gains from trade have been exhausted.

**8.) (5 points)** Consider the abstract to the following paper: “Can Mobile Phones Improve Learning? Evidence from a Field Experiment in Niger”, Jenny Aker, Christopher Ksoll, and Travis Lybbert, *American Economic Journal: Applied Economics*, October 2012: 4(4).

The returns to educational investments hinge on whether such investments can improve the quality and persistence of educational gains. This has been a challenge in adult education programs, which are typically characterized by rapid skills depreciation. We report the results from a randomized evaluation of an adult education program (Project ABC) in Niger, in which adult students learned how to use simple mobile phones as part of a literacy and numeracy class. Overall, students demonstrated substantial improvements in writing and math skills. Students in ABC villages achieved additional literacy and numeracy gains, with test scores that were .19-.25 standard deviations higher than those in non-ABC villages. There are persistent impacts of the program: seven months after the end of classes, average math test scores are still higher in ABC villages. These effects are driven by the effectiveness of mobile phones as a motivational tool, primarily through their ability to increase the value of skills learned in class. These results suggest that simple and cheap information technology can be harnessed to improve educational outcomes among rural populations.

Thinking about the randomized field experiment in Niger, what type of omitted variable bias would you be most concerned with? Be concise and to the point in your answer.

As long as the program was truly randomized, omitted variable bias should not be a concern.



**9.) (10 points)** Suppose MSU is trying to decide how to use a piece of land. One option is to put up an outdoor rock-climbing wall with an expected life of 3 years. Another is to install an outdoor swimming pool with an expected life of 6 years. The climbing wall would cost \$120,000 to construct and would yield net benefits of \$46,000 at the end of each of the 3 years. The swimming pool would cost \$500,000 and would yield net benefits of \$100,000 at the end of each of the 6 years. Each project is assumed to have zero salvage value at the end of its life. Using a real discount rate of 5 percent, which project offers larger net benefits? (HINT: Notice that the proposed project lengths are not the same.)

As only one of these projects can be built on the site, they are mutually exclusive. The comparison is complicated because the swimming pool has an expected life two times longer than the rock-climbing wall.

Consider first the NPV of each project separately:

NPV(one climbing wall project)

$$= -\$120,000 + \sum_{i=1}^3 \frac{46,000}{(1+0.05)^i} = \$5,269$$

NPV(one swimming pool project)

$$= -\$500,000 + \sum_{i=1}^6 \frac{100,000}{(1+0.05)^i} = \$7,569$$

If we choose on the basis of this comparison, then the swimming pool has a larger present value of net benefits. However, this is not appropriate as the projects are of different lengths. One possible correct approach is the following:

One could choose between one swimming pool and two successive climbing wall projects so that the site is used in each case for the same length of time.

NPV(two successive climbing wall projects)

$$= \$5,269 + \$5,269/(1+.05)^3$$

$$= \$9,821$$

Thus, two successive climbing wall projects offer a higher present value of net benefits than the swimming pool project. One should build the climbing wall.

**Extra Credit (worth up to 5 points).** Evaluate the following statement:

“If a job is worth doing, it is worth doing well.”

Keep your answer to short (two sentences or less).

A job is worth doing up to the point where  $MB = MC$ .