Econ 131
Spring 2020
Emmanuel Saez

Problem Set 1

DUE DATE: 11:59pm, Wednesday, February 27 on Gradescope

Student Name:

Student ID:

• You must submit your solutions using this template.

• Although you may work in groups, each student must submit individual sets of solutions. You must note the names other students that you worked with. Write their names here:
1. Essay

Read the following recent New York Times article about taxing the rich. Write a short essay [the essay has to fit in the page below] explaining whether the Times article accurately reported on changes in tax progressivity over recent decades (the grade is not based on whether you agree or not with the article but how well you can put the arguments in perspective based on what you learned in class).

NY Times link:

2. True/False Statements

Determine whether each statement is true, false, or uncertain and explain why. Answers with no explanation will receive no points.

(a) The number of people in poverty is falling quickly around the world. This implies that the analysis of inequality will become an obsolete topic for economists.

FALSE: The first statement is correct (see World Bank stats discussed in classnotes). However, this does not mean that inequality does not remain an issue. For example, the US does not have poor people according to the World Bank definition (living on less than $2/day) and yet the issue of inequality is still very present in the political debate.

(b) The United States is a land of opportunity because kids from low income family background can succeed economically.

[FALSE]: See Chetty-Hendren-Kline-Saez QJE 2014 paper discussed in class. Kids from low income family can sometimes succeed. However: a) Intergenerational mobility is less in the US than in other rich countries such as Denmark. b) Intergenerational mobility varies a lot across US places with some places having high mobility and others quite low mobility.

(c) Suppose two individuals are unemployed and receive the same unemployment benefits of $800/month. One is looking for work while the other is not. Are they both equally deserving of support?

UNCERTAIN. It depends on the social justice criterion used. Under a utilitarian social welfare criterion, they are both equally deserving because they have the same income and hence same marginal utility. However, most people social justice principles do not follow utilitarianism. Saez and Stantcheva AER’16 show that in surveys, people will overwhelmingly find that the person looking for work is more deserving. That’s why actual unemployment insurance systems typically require that people be looking for work.

(d) The fundamental reason why governments in modern economies are so large is because human are social beings.

PROBABLY TRUE: Governments are large because of large welfare states that fund education for the young, health for the sick, retirement benefits for the elderly, and income support for the poor. These functions are present in any human society because humans do depend on others when young, sick, or old. These functions were often done informally through family or small communities. They have been formalized through government only in the 20th century (for the most advanced economies).
(e) In 1994, Michigan raised taxes on cigarettes sold in Michigan. The graph below shows the evolution of log per capita consumption in Michigan (dashed line) and in the US overall (solid line). Based on what you know about the difference-in-difference methodology learned in class, do you find that this graph provides compelling evidence of an effect of cigarette taxation on consumption? (graph from Evans, Ringel, Stech “Tobacco Taxes and Public Policy to Discourage Smoking” Tax Policy and the Economy, volume 13)

![Graph showing log per capita consumption in Michigan and the US over time.](image)

TRUE: The graph shows a sharp drop in cigarette consumption right after the reform and the trends were parallel before. Hence, we can be quite confident that the DD estimate does pick up the effect of the tax increase.

(f) In 1993, New York substantially raised taxes on cigarettes sold to consumers in New York. The graph below shows the evolution of log per capita consumption in New York (dashed line) and in the US overall (solid line). Based on what you know about the difference-in-difference methodology learned in class, do you find that this graph provides compelling evidence of an effect of cigarette taxation on consumption? (graph from Evans, Ringel, Stech “Tobacco Taxes and Public Policy to Discourage Smoking” Tax Policy and the Economy, volume 13)

![Graph showing log per capita consumption in New York and the US over time.](image)
FALSE: The graph shows a faster drop in cigarette consumption in NY relative to the US but this widening gap starts 3-5 years BEFORE the cigarette tax increase in NY. This shows that the parallel trend assumption fails. Hence, we cannot be confident that the DD estimate that would deliver an effect is the causal consequence of the tax increase.
3. Optimization

Azim is taking a new job, and must decide how many hours he’d like to work. Assume that Azim gets enjoyment from two things: consumption goods \( c \) and hours of leisure \( \ell \). His utility is given by \( U(c,\ell) = c^{2/3} \ell^{1/3} \). The price of consumption goods is given by \( p_c = 1 \). Azim’s wage in the new job is 30 per hour worked. Assume that Azim has only 90 available hours each week that he can either spend working or on leisure.

(a) What is Azim’s budget constraint?

\[
2700 = 30\ell + c \\
\left( \text{or } 90 = \ell + \frac{c}{30} \right)
\]

because: \((\text{hours possible}) \cdot (\text{wage}) = 90 \cdot 30 = 2700\)

(b) What is Azim’s optimal choice of consumption goods \( c \) and hours of leisure \( \ell \)?

\[
\max_{c,\ell} U = c^{2/3} \ell^{1/3} \quad \text{s.t.} \quad 2700 = 30\ell + c
\]

We can use a log transform \( u = \log U \), which simplifies the math, so that:

\[
u = \frac{2}{3} \log c + \frac{1}{3} \log \ell
\]

And thus:

\[
\frac{\partial u}{\partial c} = \frac{2}{3c} \quad \text{and} \quad \frac{\partial u}{\partial \ell} = \frac{1}{3\ell}
\]

And using the equimarginal principle:

\[
\frac{\partial u}{\partial c} = \frac{\partial u}{\partial \ell} \quad \frac{p_c}{p_\ell}
\]

\[
\frac{2/3c}{1/3\ell} = \frac{p_c}{p_\ell}
\]

\[
c = 60\ell
\]

Plugging into the budget:

\[
2700 = 30\ell + (60\ell)
\]

\[
\ell = 30
\]

\[
c = 1800
\]
(c) Now assume that the government imposes a 30% tax on wages. What is Azim’s new budget constraint?

Now we must only consider after-tax wages, so:

\[(1 - t)30 \cdot 90 = (1 - .3)30 \cdot 90 = 21 \cdot 90 = 1890\]

And thus:

\[1890 = 21\ell + c\]

(d) What is Azim’s new optimal choice of consumption goods \(c\) and hours of leisure \(\ell\)?

\[
\max_{c,\ell} U = c^{2/3}\ell^{1/3} \quad \text{s.t.} \quad 1890 = 21\ell + c
\]

Recognizing this is a Cobb-Douglas utility, we can use the trick from section:

\[
c = \frac{\alpha \cdot w}{p_c} = \frac{2/3(1890)}{1} = 1260
\]

\[
\ell = \frac{(1 - \alpha) \cdot w}{p_\ell} = \frac{1/3(1890)}{21} = 30
\]

(e) What is the sign (direction) of the substitution effect and the income effect, caused by the introduction of the tax, on Azim’s choice of \(c\) and \(\ell\)?

<table>
<thead>
<tr>
<th>Substitution Effect</th>
<th>Consumption (c)</th>
<th>Hours of Leisure (\ell)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income Effect</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For \(c\): SE: ↓, IE: ↓
For \(\ell\): SE: ↑, IE: ↓

(f) Which effect (income or substitution) has a larger impact on Azim’s choice of \(\ell\), or are they the same size? How can you tell?

Since \(\ell\) did not change after the tax, we know that the substitution and income effects are the same size, and cancel out.
4. Tax Incidence

Let’s consider the market for cups of coffee purchased at coffee shops in Berkeley. Suppose that aggregate demand for coffee is given by \( Q^D = 20000 - 2500P \), where \( P \) represents the price of a cup of coffee and \( Q \) represents the quantity of cups in a given day. Suppose aggregate supply is given by \( Q^S = -10000 + 5000P \).

(a) What are the equilibrium price and quantity in the Berkeley coffee market?

Set \( Q^D = Q^S \):

\[
20000 - 2500P = -10000 + 5000P
\]

\[
P = 4
\]

\[
Q = 10000
\]

(b) Calculate the elasticity of demand \( \varepsilon^D \) and the elasticity of supply \( \varepsilon^S \) at the market equilibrium price and quantity. If a tax is imposed on soda purchases, do you expect consumers or producers would bear more of the tax?

\[
\varepsilon^D = \frac{p}{Q^D} \frac{dQ^D}{dp} = \frac{4}{10000} \times (-2500) = -1
\]

\[
\varepsilon^S = \frac{p}{Q^S} \frac{dQ^S}{dp} = \frac{4}{10000} \times (5000) = 2
\]

Since in equilibrium consumers are more inelastic than producers, we would expect them to bear a higher share of the tax burden.

(c) Now suppose a tax of \( t = $0.30 \) is imposed on coffee sales. More specifically, at the time of any transaction, for each cup purchased, the consumer is taxed $0.30 above the sticker price. Who bears the statutory incidence of the tax?

Consumers bear the statutory incidence, as the tax is levied on them.

(d) Compute the new coffee equilibrium with the tax. What are the new equilibrium price and quantity? How many fewer cups of coffee are sold as a result of the tax?

Now the consumer must pay \( P + t \) or \( P + $0.30 \):

\[
20000 - 2500(P + .3) = -10000 + 5000P
\]

\[
20000 - 750 + 30000 = 7500P
\]

\[
Q^* = 9500
\]

\[
P^S = 3.90
\]

\[
P^D = 3.90 + 0.30 = 4.20
\]

The equilibrium quantity dropped by 500 cups per day, the price producers face is now $3.90 and the after-tax price consumers face is now $4.20.
(e) How much revenue does the government collect per day?

\[ t \cdot Q^* = 0.30 \cdot 9500 = 2850 \]

(f) How is the incidence of the $0.30 tax borne between producers and consumers?

Consumers bear $4.00 − $3.90 + $0.30 = $0.20.
Producers bear $4.00 − $3.90 + $0.00 = $0.10.

(g) Compute and graphically depict deadweight loss due to the tax (The graph doesn’t have to be in scale, just make sure you write down the important information)

Deadweight loss is represented by a triangle. Its height is the tax of $0.30 and its length is the distortion in the quantity exchanged: 500 units.

\[ DWL = (500 \cdot 0.30)/2 = 75 \]