Econ 131  
Spring 2022  
Emmanuel Saez  

Problem Set 1  

DUE DATE: 11:59pm, Wednesday, March 2 on Gradescope  

Student Name:  
Student ID:  

• Write or type your answers clearly and in dark ink (physical or electronic ink) so that your responses are legible  

• Tag each of your answers on Gradescope so that it is clear what responses are to which questions  

• 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. Inequality

Take a look at the new dashboard on measuring inequality in real time at
http://realtimeinequality.org

a) Using the most recent data posted (December 2021 for income and 4th quarter of 2021
for wealth), figure out the shares of total income (or wealth) going to the bottom 50%, bottom
90%, bottom 99%, bottom 99.9%, and bottom 99.99% for 3 concepts: (1) factor income, (2)
disposable income, (3) wealth (use individual adult units and make sure you look at the most
recent data point in the series).

<table>
<thead>
<tr>
<th>Dec 2021 or Q4 2021</th>
<th>1) factor income</th>
<th>2) disposable income</th>
<th>3) Wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>bottom 50%</td>
<td>11.4%</td>
<td>18.8%</td>
<td>0.8%</td>
</tr>
<tr>
<td>bottom 90%</td>
<td>53.4%</td>
<td>59.9%</td>
<td>28.3%</td>
</tr>
<tr>
<td>bottom 99%</td>
<td>80.6%</td>
<td>84.2%</td>
<td>63.6%</td>
</tr>
<tr>
<td>bottom 99.9%</td>
<td>91.2%</td>
<td>93.2%</td>
<td>80.8%</td>
</tr>
<tr>
<td>bottom 99.99%</td>
<td>96%</td>
<td>97.1%</td>
<td>89.7%</td>
</tr>
</tbody>
</table>

b) Using these numbers, draw the corresponding three Lorenz curves on the same chart
(assume the Lorenz curve is linear in between each point you can draw). Compute the Gini
coefficients for each of the 3 concepts.
\[ Gini_{\text{Wealth}} = 2 \cdot \left[ 0.5 - (0.5 \cdot 0.5 \cdot 0.008) - \left( \frac{0.008 + 0.283}{2} \cdot 0.4 \right) - \left( \frac{0.283 + 0.636}{2} \cdot 0.09 \right) - \left( \frac{0.636 + 0.897}{2} \cdot 0.009 \right) \right] \]

\approx 0.78

\[ Gini_{\text{Factor Income}} = 2 \cdot \left[ 0.5 - (0.5 \cdot 0.5 \cdot 0.114) - \left( \frac{0.114 + 0.534}{2} \cdot 0.4 \right) - \left( \frac{0.534 + 0.812}{2} \cdot 0.009 \right) \right] \]

\approx 0.56

\[ Gini_{\text{Disposable Income}} = 2 \cdot \left[ 0.5 - (0.5 \cdot 0.5 \cdot 0.188) - \left( \frac{0.188 + 0.844}{2} \cdot 0.21 \right) - \left( \frac{0.844 + 0.982}{2} \cdot 0.009 \right) \right. \]

\left. - \left( \frac{0.982 + 0.971}{2} \cdot 0.0009 \right) \right] \]

\approx 0.44
c) Discuss how inequality ranks for the three concepts. Can we conclude that taxes and cash transfers combined reduce US income inequality? Should we be worried about the level of US wealth inequality?

Since $Gini_{DI} < Gini_{FI} < Gini_W$, inequality is higher in wealth than in two measures of income. It’s true, however, that taxes and transfers reduce income inequality because inequality in disposable income (which is factor income + taxes and transfers) is lower than in factor income. The charts we saw in class from Piketty-Saez-Zucman (2018) show a large increase in both pre-tax and post-tax inequality, though it is true that post-tax inequality has increased by less than pre-tax inequality. Wealth inequality also remains on the rise globally, though there is diversity of national trajectories. Wealth inequality in the US is a source of concern because it inhibits economic mobility, restricts equality of opportunity, and creates political risks.

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 poverty 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 poverty is still very present in the political debate. Countries typically switch from an absolute measure to poverty to a relative measure of poverty as they grow. With a relative measure, poverty does not vanish even with economic growth.
(b) The United States is a land of opportunity because kids from low income family background can succeed economically.

[FALSE/UNCERTAIN]: 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) During the COVID crisis, income inequality in the United States increased.

UNCERTAIN: Data are posted at [http://realtimeinequality.org](http://realtimeinequality.org). Pre-tax income inequality grew during the covid crisis as bottom 50% income earners were more likely to lose their jobs. However, thanks to government transfers to help with COVID losses (including checks to families, extra unemployment benefits, the Paycheck Protection Program, etc.), disposable income (defined as income after taxes and cash transfers) increased by a sizable amount, especially for the Bottom 50%, so that inequality in post-tax income actually fell.
(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*)

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.
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*)

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 (12 points)

Stanislav is taking on a new job and must decide how many hours he would like to work. Assume that Stanislav gets enjoyment from two things: aggregate consumption of goods, \( c \), and hours of leisure, \( \ell \). His utility (in logs) is given by

\[
U(c, \ell) = \frac{1}{2} \ln(c - 40) + \frac{1}{2} \ln(\ell)
\]

The price of consumption goods is given by \( p_c = 1 \). Stanislav’s wage in the new job is 20 per hour worked. Assume that Stanislav has only 80 available hours each week that he can either spend working or on leisure.

(a) What is Stanislav’s budget constraint? (1 point)

\[
c = 20(80 - \ell)
\]

(b) What is Stanislav’s optimal choice of aggregate consumption, \( c \), and hours of leisure, \( \ell \)? (4 points)

This problem can be solved using substitution, a Lagrangian or the formulaic approach. This is the formulaic approach

\[
MRS = \frac{\partial U}{\partial c} \cdot \frac{\partial U}{\partial \ell} = \frac{\frac{1}{c-40}}{\frac{1}{\ell}} = \frac{\ell}{c-40}
\]

\[
\frac{p_c}{p_\ell} = \frac{1}{20}
\]

At the optimum, the \( MRS = \text{price ratio} \):

\[
\frac{\ell}{c-40} = \frac{1}{20}
\]

\[
c - 40 = 20\ell
\]

\[
c - 40 = 1600 - c \quad \text{from budget constraint}
\]

\[
2c = 1640
\]

\[
c^* = 820
\]

From budget constraint: \( \ell^* = \frac{c}{20} - 2 = 39 \)
(c) Now assume that Stanislav gets a raise so that he is paid 40 an hour. What is his new optimal choice of $c$ and $\ell$? (2 points)

The formulaic approach now gives

$$\frac{\ell}{c - 40} = \frac{1}{40}$$

and the budget constraint is now

$$c = 40(80 - \ell)$$

With some algebra this gives $c^* = 1620, \ell^* = 39.5$

(d) What is the sign (direction) of the substitution effect and the income effect induced by the raise on Stanislav’s choice of $c$ and $\ell$? If the effect is motivating Stanislav to increase $c$ or $\ell$, fill in the cell with the (↑) symbol, if decreasing (↓), if no effect (0) and if the effect is ambiguous (?). (4 points)

I’ve added explanation although it is not required.

<table>
<thead>
<tr>
<th></th>
<th>$c$</th>
<th>$\ell$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substitution</strong></td>
<td>↑ the increase in wage makes $c$ less expensive relative to $\ell$, so you are incentivized to buy more</td>
<td>↓ the raise raises $w$, since $w$ it is the price of $\ell$, so you are incentivized to buy less</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td>↑ the raise increases wealth, and $c$ is a normal good, so you are incentivized to buy more</td>
<td>↑ the raise increases wealth, and $\ell$ is a normal good, so you are incentivized to buy more</td>
</tr>
</tbody>
</table>

(e) Which effect (income or substitution) has a larger impact on Stanislav’s choice of $\ell$, or are they the same size? In one sentence, how can you tell? (1 point)

The income effect, because Fatima’s hours of leisure increase and the income effect is incentivizing leisure while the substitution effect is disincentivizing it.
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 are 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.

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