

Econ 131
Spring 2023
Emmanuel Saez

Problem Set 1 SOLUTION

DUE DATE: 11:59pm, Wednesday, March 1 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 (13 pts)

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

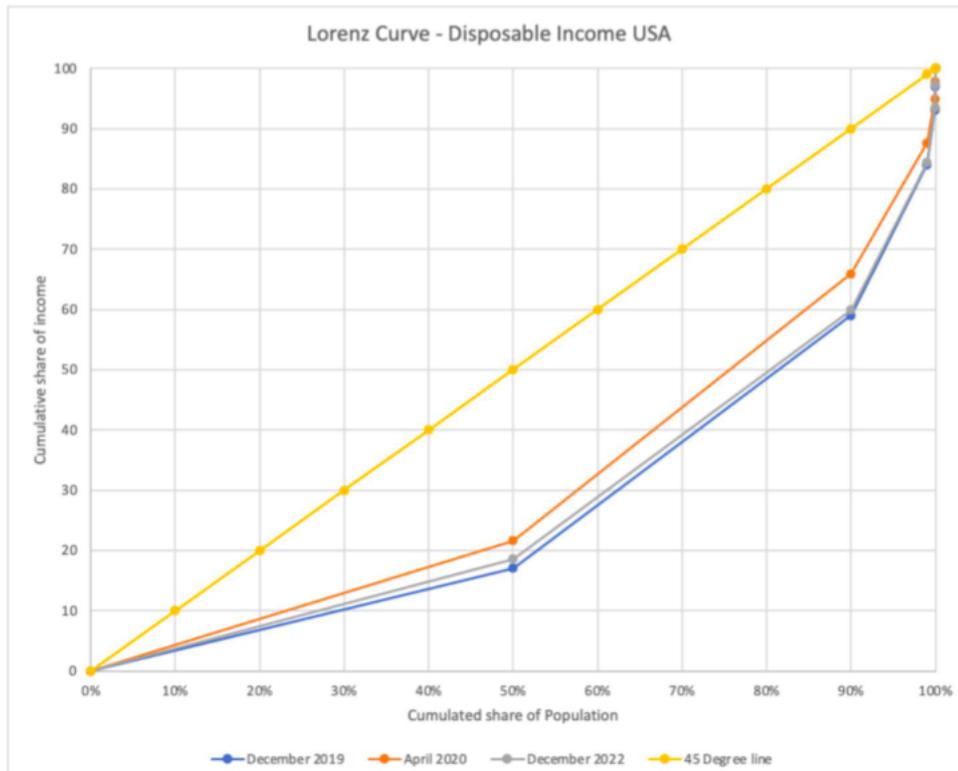
a) Using the income inequality graph section, compute the share of disposable income going to the bottom 50%, bottom 90%, bottom 99%, bottom 99.9%, and bottom 99.99% in December 2019 (pre-covid), April 2020 (during covid), and December 2022 (most recent month). Use individual adult units in population and make sure you use the disposable income concept in income type (not the default “factor income”).

December 2019: bottom 50%=17.1%, bottom 90% share=59%, bottom 99%=84%, bottom 99.9%=93.1%, bottom 99.99%=97%

April 2020: bottom 50%=21.6%, bottom 90% share=65.9%, bottom 99%=87.6%, bottom 99.9%=94.9%, bottom 99.99%=97.8%

December 2021: bottom 50%=18.6%, bottom 90% share=59.9%, bottom 99%=84.4%, bottom 99.9%=93.5%, bottom 99.99%=97.2%

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 using this Lorenz curve.



December 2019:

$$\begin{aligned} \text{Gini coefficient} &= 2 \left[\frac{1}{2} - \left(\frac{0.171 \cdot 0.5}{2} \right) - \left(\left(\frac{0.171 + 0.59}{2} \right) \cdot 0.4 \right) \right. \\ &\quad \left. - \left(\left(\frac{0.59 + 0.84}{2} \right) \cdot 0.09 \right) - \left(\left(\frac{0.84 + 0.981}{2} \right) \cdot 0.009 \right) - \left(\left(\frac{0.97 + 1}{2} \right) \cdot 0.001 \right) \right] \\ &= 0.46355 \approx \underline{\underline{0.464}} \end{aligned}$$

April 2020:

$$\begin{aligned} \text{Gini coeff} &= 2 \cdot \left[\frac{1}{2} - \left(\frac{0.216 + 0.5}{2} \right) - \left(\left(\frac{0.216 + 0.669}{2} \right) \cdot 0.4 \right) - \left(\left(\frac{0.659 + 0.876}{2} \right) \cdot 0.09 \right) \right. \\ &\quad \left. - \left(\left(\frac{0.876 + 0.949}{2} \right) \cdot 0.009 \right) - \left(\left(\frac{0.949 + 0.998}{2} \right) \cdot 0.0009 \right) - \left(\left(\frac{0.998 + 1}{2} \right) \cdot 0.0001 \right) \right] \\ &= \underline{\underline{0.315}} \end{aligned}$$

December 2022:

$$\begin{aligned} \text{Gini coefficient} &= 2 \left[\frac{1}{2} - \left(\frac{0.186 + 0.5}{2} \right) - \left(\left(\frac{0.186 + 0.599}{2} \right) \cdot 0.4 \right) \right. \\ &\quad \left. - \left(\left(\frac{0.599 + 0.814}{2} \right) \cdot 0.09 \right) - \left(\left(\frac{0.814 + 0.935}{2} \right) \cdot 0.009 \right) \right. \\ &\quad \left. - \left(\left(\frac{0.935 + 0.992}{2} \right) \cdot 0.0009 \right) - \left(\left(\frac{0.992 + 0.1}{2} \right) \cdot 0.00001 \right) \right] \\ &= \underline{\underline{0.445}} \end{aligned}$$

closer to 1 \rightarrow more unequal

c) Discuss how inequality ranks for the three months and why? Without re-doing all the computations but just looking at the figures on the website, would you have obtained the same conclusion if you had used the “factor income” income type (i.e., income before any taxes are paid and before any transfers from the government are received)?

Inequality is much lower in April 2020 because of the massive transfers that the government carried out to fight the covid crisis and benefited the bottom 50% relatively more. This conclusion would be reversed when looking at factor income as the bottom 50% incomes were hit the most during COVID.

2. True/False Statements (12 pts)

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

- (a) If US economic growth continues, the fraction of people living in poverty in the United States (as defined by the official US poverty measure) will eventually fall to zero in coming decades. This implies that the analysis of inequality will become an obsolete topic for economists.

FALSE: The first statement is correct only if economic growth is widely shared so that low income earners see their income increase. This has not been in the case in the US since 1970 so not certain US economic growth will be widely shared in coming decades. 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 and inequality is still very present in the US political debate.

- (b) The government should only intervene in the economy when there are market failures.

FALSE: For economists, there are 2 broad reasons of government interventions. One is market failure, the other is inequality. Only libertarians would view inequality as NOT a good reason for government taxes and transfers. Beyond economists, it is obvious that humans are social and function in groups (families, communities, states, etc.) Indeed, the structure of the economy is organized through laws, regulations, etc. which are part of the government.

- (c) Repaying the large US debt accumulated during the Great recession and the covid crisis will be a heavy burden on future generations of Americans.

FALSE: Two thirds of US debt is borrowed domestically which implies that 2/3 of US debt is owed to Americans. Therefore, for this part of the debt, it will be a repayment to Americans and hence not a net burden to future Americans. 1/3 of US debt is owed abroad. The repayment of this debt will be a transfer from the US to foreigners and hence could be considered a burden on future Americans. Finally, it is possible that the debt will never be repaid and that the interest rate will remain low, in which case, even debt to foreigners will not be a burden to future Americans.

- (d) Suppose two individuals are out of work and receive the same means tested benefit of \$1000/month. One would be able to 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 '16 show that in surveys, people will overwhelmingly find that the person not able to work is more deserving. That's why transfers to groups unable to work (the disabled or the elderly) are in practice much more generous than those deemed able to work.

3. Optimization (12 points)

Paula is a Uber driver and must decide how many hours she would like to work in a week in which she is available 90 hours at most. She makes 30 USD per hour worked. Paula enjoys two things: aggregate consumption of goods, c , and hours of leisure, ℓ . Her utility is given by

$$U(c, \ell) = (c - 60)^{\frac{1}{2}} \ell^{\frac{1}{2}}$$

The price of consumption goods is normalized to $p_c = 1$.

- (a) What is Paula's budget constraint? (1 point)

$$c = 30(90 - \ell)$$

- (b) What is Paula's optimal choice of aggregate consumption, c , and hours of leisure, ℓ ? (4 points)

The optimization problem is $U(c, \ell) = (c - 60)^{\frac{1}{2}} \ell^{\frac{1}{2}}$ s.t. $2700 = 30\ell + c$

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

$$u = \frac{1}{2} \log(c - 60) + \frac{1}{2} \log \ell$$

This problem can be solved using substitution, a Lagrangian or the equimarginal principle. Using the equimarginal principle:

$$MRS = \frac{\frac{\partial U}{\partial c}}{\frac{\partial U}{\partial \ell}} = \frac{\frac{1}{2(c-60)}}{\frac{1}{2\ell}} = \frac{\ell}{c - 60}$$

$$\frac{p_c}{p_\ell} = \frac{1}{30}$$

At the optimum, the MRS = price ratio:

$$\begin{aligned} \frac{\ell}{c - 60} &= \frac{1}{30} \\ c - 60 &= 30\ell \end{aligned}$$

$$c - 60 = 2700 - c \quad \text{from budget constraint}$$

$$2c = 2760$$

$$c^* = 1380$$

From budget constraint: $\ell^* = \frac{c}{30} - 2 = 44$

- (c) In the summer, demand for Uber rides decreases. Paula has a harder time finding clients, and her wage decreases to 20 USD an hour. How does Paula re-optimize her consumption of c and ℓ ? (2 points)

The equimarginal principle now gives

$$\frac{\ell}{c - 60} = \frac{1}{20}$$

and the budget constraint is now

$$c = 20(90 - \ell)$$

$$c - 60 = 20\ell$$

$$c - 60 = 1800 - c \quad \text{from budget constraint}$$

$$2c = 1860$$

$$c^* = 930$$

From budget constraint: $\ell^* = \frac{c}{20} - 3 = 43.5$

- (d) Are c and ℓ normal or inferior goods? Explain why in a sentence. (2 points)

They are both normal goods, because demand decreases as income decreases.

- (e) What is the sign (direction) of the substitution effect and the income effect induced by the income cut on Paula's choice of c and ℓ ? If the effect is motivating Paula to increase c or ℓ , fill in the cell with the (\uparrow) symbol, if decreasing (\downarrow), if no effect (0) and if the effect is ambiguous (?). (2 points)

I've added explanation although it is not required.

	c	ℓ
Substitution Effect	\downarrow the decrease in wage makes c more expensive relative to ℓ , so you are incentivized to buy less	\uparrow the opportunity cost or price of leisure is the wage an individual can earn. If, as in our example, this price goes down, Paula is going to consume more of it.
Income Effect	\downarrow the income cut decreases wealth, and c is a normal good, so you are incentivized to buy less	\downarrow the income cut decreases wealth, and ℓ is a normal good, so you are incentivized to buy less

- (f) Which effect (income or substitution) has a larger impact on Paula's choice of ℓ , or are they the same size? In one sentence, how can you tell? (*1 point*)

The income effect, because Paula's hours of leisure decreases. The income effect is indeed disincentivizing leisure while the substitution effect is incentivizing it.

4. Tax Incidence

Consider the following model for the surfboard market in Berkeley. Suppose the aggregate demand for surfboards in Berkeley is given by $Q^D = 600 - P/3$ where P denotes the price and Q denotes the quantity of surfboards in terms of thousands of surfboards demanded. The aggregate supply for surfboards in Berkeley is given by $Q^S = P/6$.

- (a) Compute the surfboard market equilibrium. What are the equilibrium price and quantity?

Equating Supply and Demand:

$$\begin{aligned}P/6 &= 600 - P/3 \\P^* &= 1200, Q^* = 200\end{aligned}$$

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

$$\begin{aligned}\varepsilon_D &= \frac{P}{Q^D} \frac{dQ^D}{dP} = \frac{1200}{200} \times \left(-\frac{1}{3}\right) = -2 \\ \varepsilon_S &= \frac{P}{Q^S} \frac{dQ^S}{dP} = \frac{1200}{200} \times \frac{1}{6} = 1\end{aligned}$$

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

- (c) Now suppose a tax of $t = \$60$ is imposed on each surfboard that is purchased. Compute the surfboard market equilibrium with the tax. What are the equilibrium prices and quantity? How much revenue does the government collect?

Remember that it does not matter who bears the statutory incidence of the tax. We add the tax on the demand side and therefore find the before tax price (faced by the supplier).

$$P_D = P_S + t \tag{1}$$

$$P_S/6 = 600 - (P_S + 60)/3 \tag{2}$$

$$3P_S = 3480 \tag{3}$$

$$P^S = 1160, Q^* = 193.33 \tag{4}$$

$$P^D = 1160 + 60 = 1220 \tag{5}$$

The government raises:

$$G = Q^* \times t = 193.33 \times \$60 \approx \$11.600$$

- (d) Compute and graphically depict deadweight loss due to the tax. The deadweight loss is represented by a triangle. Its height is the tax of \$60 and its base is the distortion in the quantity exchanged: $200 - 193.33 = 6.67$ units. (See Section 4 notes for the graph).

$$DL = (6.67 \times 60)/2 = \$200$$

- (e) What is the economic incidence of the tax (calculate who bears the burden)? Very briefly explain the intuition for the key factors that determine the incidence.

We can use our formulas from Section 4:

$$\frac{dP_S}{dt} = \frac{\varepsilon_D}{\varepsilon_S - \varepsilon_D} = \frac{-2}{1 - (-2)} = \frac{-2}{3}$$

$$\frac{dP_D}{dt} = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D} = \frac{1}{1 - (-2)} = \frac{1}{3}$$

Out of the \$1 tax, \$0.33 is borne by consumers and \$0.67 by producers, therefore $\frac{1}{3}$ is on the demand and $\frac{2}{3}$ on the supply. As predicted, most of the incidence of the tax is on the more inelastic side of the market (demand) because that side of the market is less responsive to price changes. (Note that you will get full marks if you have said something similar even if you have made the calculation of the burden differently).

Now suppose that consumers are inattentive to the tax and demand is given by

$$Q^D = 600 - (P + \theta t)/3$$

where $\theta = 1/2$. Again, suppose that a tax of $t = \$60$ is imposed on each surfboard that is purchased.

- (f) What are the new equilibrium prices and quantity? Compute and graphically depict deadweight loss arising due to the tax. How does your answer compare to your answer from part (c)? Explain.

θ represents the share of inattentive of consumers, or the degree of inattentiveness of all consumers. As the Chetty et al. paper shows consumers don't fully internalize sales tax. the 1/2 coefficient implies that 1/2 of consumers are inattentive to the sales tax (or that all consumers only internalize 1/2 of the tax).

$$P_S/6 = 600 - [P_S + \frac{60}{2}]/3$$

$$3P_S = 1180$$

$$P^D = 1180 + 60 = 1240, Q^* = 196.667$$

We can use the same equation as before to compute the DWL. Note that now the height of the triangle is only θt since the demand curve is only shifted by that amount due to inattention.

$$DL = (3.33 \times \frac{60}{2}) / 2 = 50$$

See the graph below for more detail.

The distortion is now smaller because the consumers' inattention reduces their response.

