**Econ 131**
**Spring 2021**
**Emmanuel Saez**

**Problem Set 1**

**DUE DATE: 11:59pm, Wednesday, February 24 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. Essay**

Take a look at the new dashboard on measuring poverty at the monthly level in almost real time during the COVID crisis. Using the most recent current report on the dashboard, write a short essay [*the essay has to fit in the page below*] explaining what is driving the poverty rate during the COVID crisis and which government policies have had the most impact.

Link to the dashboard `http://povertymeasurement.org/covid-19-poverty-dashboard/`

**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 extreme poverty is falling quickly around the world. This implies that the topic of poverty will become obsolete in economics.

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 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.

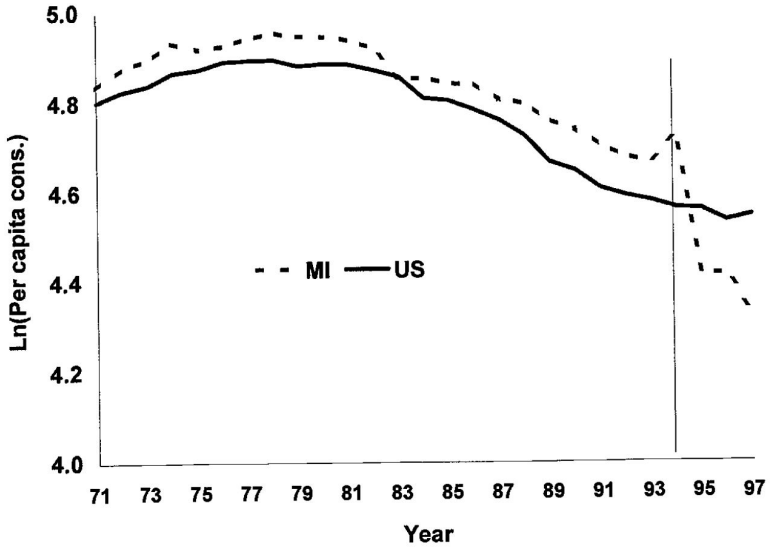
FALSE: Two thirds of US debt is borrowed domestically which implies that 2/3 of US debt is owed to Americans. Therefore, for this part of the debt, it will be a repayment to Americans and hence not a net burden to future Americans. 1/3 of US debt is owed abroad. The repayment of this debt will be a transfer 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) Pre-tax income inequality has increased in the United States since 1980 but government taxes and transfers have offset this increase.

FALSE: The charts we saw in class from Piketty-Saez-Zucman (2018) show a large increase in both pre-tax and post-tax inequality. Although it is true that post-tax inequality has increased by less than pre-tax inequality.

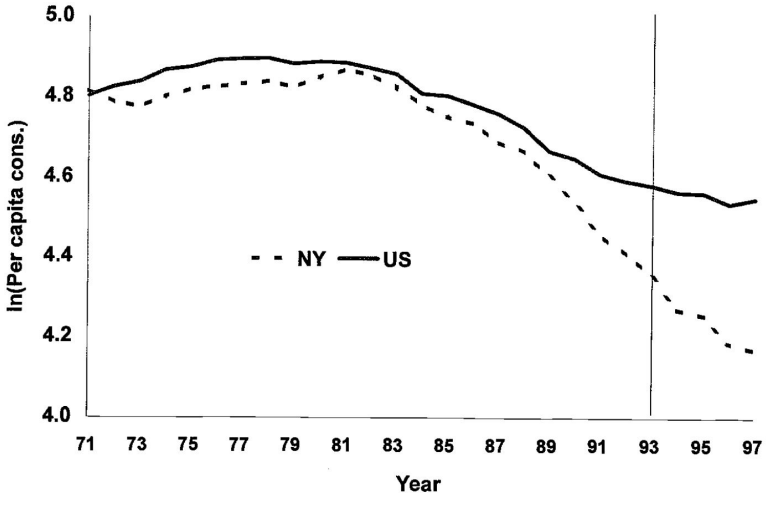
(e) In 1994, Michigan raised taxes on cigarettes sold in Michigan. The graph below shows the evolution of log per capita consumption in Michigan (dashed line) and in the US overall

(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.

(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*)



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)**

Fatima is taking a new job, and must decide how many hours she would like to work. Assume that Fatima gets enjoyment from two things: consumption goods $c$ and hours of leisure $\ell$. Her utility is given by

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

.

The price of consumption goods is given by $p_c = 1$. Fatima's wage in the new job is 20 per hour worked. Assume that Fatima has only 80 available hours each week that she can either spend working or on leisure.

(a) What is Fatima's budget constraint? (*1 point*)

$$c = 20(80 - \ell)$$

(b) What is Fatima's optimal choice of consumption goods $c$ 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

$$MRS = \frac{\frac{\partial U}{\partial c}}{\frac{\partial U}{\partial \ell}} = \frac{\frac{1}{2(c-40)}}{\frac{1}{2\ell}} = \frac{\ell}{c - 40}$$

$$\frac{p_c}{p_\ell} = \frac{1}{20}$$

At the optimum, the MRS = price ratio:

$$\begin{aligned} \frac{\ell}{c-40} &= \tfrac{1}{20} \\ c - 40 &= 20\ell \\ c - 40 &= 1600 - c \quad \text{from budget constraint} \\ 2c &= 1640 \\ c^* &= 820 \end{aligned}$$

From budget constraint: $\ell^* = \frac{c}{20} - 2 = 39$

(c) Now assume that Fatima receives a raise so that she is paid 40 an hour. What is her 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, caused by the raise she received, on Fatima's choice of $c$ and $\ell$? If the effect is motivating Fatima to increase $c$ or $\ell$, fill in the cell with the ($\uparrow$) symbol, if decreasing ($\downarrow$), if no effect (0) and if the effect is ambiguous (?). (*4 points*)

I've added explanation although it is not required.

| | $c$ | $\ell$ |
|---|---|---|
| Substitution Effect | $\uparrow$ the increase in wage makes $c$ less expensive relative to $\ell$, so you are incentivized to buy more | $\downarrow$ the raise raises $w$, since $w$ it is the price of $\ell$, so you are incentivized to buy less |
| Income Effect | $\uparrow$ the raise increases wealth, and $c$ is a normal good, so you are incentivized to buy more | $\uparrow$ the raise increases wealth, and $\ell$ is a normal good, so you are incentivized to buy more |

(e) Which effect (income or substitution) has a larger impact on Fatima'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 (13 points)**

Let's consider the market for toilet paper. Suppose that, on March 19, 2020, aggregate demand for toilet paper in Berkeley is given by $Q^D = 120 - 30P$, where $P$ represents the price of toilet paper roll and $Q$ represents the quantity of rolls in a given day. Suppose aggregate supply is given by $Q^S = 10P$.

(a) What are the equilibrium price and quantity in the Berkeley toilet paper market? (*1 point*)

$$\begin{aligned} 120 - 30P &= 10P \\ 120 &= 40P \\ P &= 3 \\ Q &= 30 \end{aligned}$$

(b) Calculate the price elasticity of supply and the price elasticity of demand at the equilibrium. Compare the values and explain which side you would expect to face a higher incidence if a tax is levied on toilet paper? (*4 points*)

$$\varepsilon_S = \frac{p}{S}\frac{dS}{dp} \equiv \frac{P}{Q}\frac{dQ}{dP} = \frac{3}{30} \times 10 = 1$$

$$\varepsilon_D = \frac{p}{D}\frac{dD}{dp} \equiv \frac{P}{Q}\frac{dQ}{dP} = \frac{3}{30} \times -30 = -3$$

(c) Now suppose a tax of $t = \$0.40$ is imposed on toilet paper sales. More specifically, at the time of any transaction, for each roll purchased, the consumer is taxed \$0.40 above the sticker price. Who bears the statutory incidence of the tax? (*1 point*)

The statutory incidence is on consumers

(d) Compute the new equilibrium with the tax. What are the new equilibrium price and quantity? How many fewer rolls of toilet paper are sold as a result of the tax? (*2 points*)

$$\begin{aligned} 120 - 30(P + 0.4) &= 10P \\ 120 - 30P - 12 &= 10P \\ 108 &= 40P \\ P &= 2.7 \\ Q &= 27 \end{aligned}$$

Three fewer rolls of toilet paper were sold.

(e) How is the incidence of the \$0.40 tax split between producers and consumers? (*2 points*)

We can calculate this two different ways. Consumers benefit from lower prices, but are forced to pay the tax, so their burden is 2.7 - 3 + 0.4 = 0.1.

Alternatively, we can use the formula

$$CI = \frac{\varepsilon_S}{\varepsilon_S - \varepsilon_D} = \frac{1}{1 - -3} = \frac{1}{4}$$

And one-fourth of the tax is 0.1.

We can therefore infer that the producer incidence is $\frac{3}{4}$ or 0.3.

(f) How much revenue does Berkeley collect from this tax? (*2 points*)

Berkeley collects 0.40 on each roll sold, and $Q^* = 27$ thus the revenue is $27 \times 0.4 = 10.80$

(g) Suppose that on March 20, 2020, all of California (including Berkeley) went under lockdown. Because of uncertainty, the demand for toilet paper shoots up to become $Q_D = 1200 - 30P$. Under this new demand function, would the tax incidence of consumers increase, decrease or stay the same? Explain briefly. (*1 point*)

The incidence remains the same, since the *relative* elasticity does not change