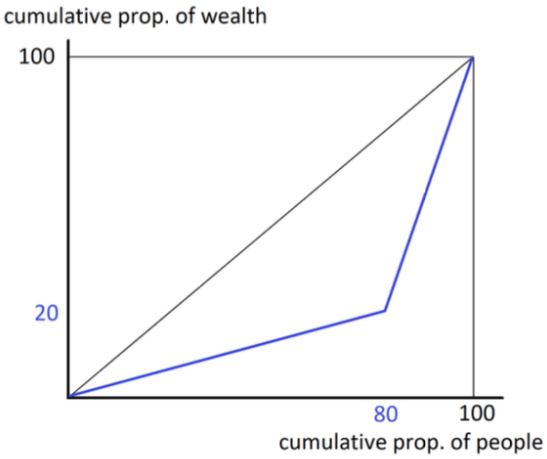
Section Exercise 1 Solutions

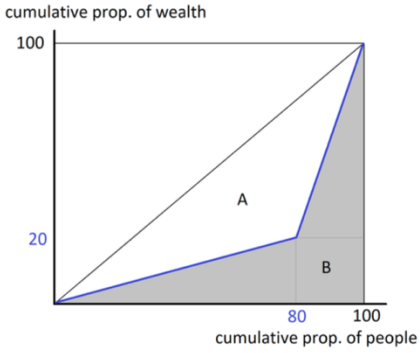
1) Say that a society of 200 people has the following hypothetical Lorenz curve:



a) In words, give an example of a wealth distribution that would be consistent with this Lorenz curve—who has what amount of wealth?

An example would be if 160 people each had \$2,000 in wealth and 40 people each had \$32,000 in wealth. This would mean that the bottom 80% of the society had a total of \$320,000 in wealth, while the top 20% would have a total of \$1,280,000 in wealth, and within each of those two segments the wealth is equally split. Since \$320,000 is 20% of the total \$1,600,000 in wealth, we get exactly the Lorenz curve we see in the diagram.

b) Using the area method, calculate the Gini coefficient for wealth in this society. How does this compare to the 'typical' Gini coefficients for income we see around the world (e.g. in slide 42 of the topic 1 notes)? What's the difference between income and wealth?



To answer this, we can first notice that the whole right triangle underneath the 45 degree line has an area $\frac{1}{2} * 100 * 100 = 5,000$. Next we can split the (shaded) area B into one square and two identical triangles. The total area B is therefore $(20 * 20) + 2(\frac{1}{2} * 80 * 20) = 2000$. The Gini coefficient is given by $\frac{A}{A+B} = \frac{3000}{5000} = 0.6$.

Looking at Ginis for income around the world, we see a slightly higher Gini coefficient in this simple numerical example than we do in the real income Gini data from the slides. In the pre-tax and transfer Gini coefficients, Ireland is the closest to the level of our hypothetical data, with a Gini between 0.55 and 0.6. However, after taxes and transfers, no country in the Our World in Data chart is particularly close to 0.6—Mexico comes closest at just above 0.45.

However, we have to keep in mind that our example focused on *wealth* while those data from the slides are about *income*. In the real world, *wealth* inequality is typically higher than it is in our fake example. In the U.S., estimates put the Gini coefficient on net worth (one measure of wealth) at 0.869 in 2019! Income is about flows of money (what you earn in a month, say) while wealth is about the stock of money you have—or, more accurately, the value of your assets minus your liabilities.

2) In class we will discuss the idea of counterfactuals and the distinction between correlation and causation. A foundational question in the field of labor economics is: does having more years of education lead a person to earn a higher wage/salary? Understanding the answer to this question could be useful to, for example, a policymaker who is considering whether to expand the number of years of public education in their community.

   a) Say that we found that people with more education had higher earnings. Suggest a possible causal explanation for that finding, and then a different possible explanation that be only a correlation and not causal.

Causal: going to college makes you better at thinking about and doing stuff, so you're more productive, so employers want to pay you more money. Not causal: people with high perseverance, wealthy families, or high natural ability both are more likely to go to college and also more likely to get high-paying jobs.

   b) Carefully explain a counterfactual thought experiment that would help you to understand if the causal explanation was correct. What makes your thought experiment difficult to actually conduct in reality?

What we'd really love here is to say: if this person had not gone to college, would they have earned a higher or lower income? If this other person *had* gone to college, would they have earned a higher or lower income? Of course, in the real world, we only get one shot at each moment: you can't rewind the tape and see what would have happened if you'd chosen a different path. (Of course, you can choose a different path *later*, but that's not the same thing.) There are a lot of ways that economists try to figure out these types of question! One way is to look to experiments (trying to keep two situations as similar as possible except for the difference you want to see the effect of); in cases like this, you might look for groups of people that are as similar as you can possibly make them except for whether they went to college. Twins are disproportionately studied in medical and social science for this reason!

3) Let's say that we wanted to figure out the answer to the following question: if we changed the top marginal income tax rate, would the amount of hours that people work change?

a) Is this question positive or normative and why? What would be an example of a question on the same topic but of the other type?

This is a positive question: it's about our best guess about what *is*, rather than what should be. A normative question on this topic might be something like: *should* we raise the top marginal income tax rate? This requires taking a stand on what the objective or goal is, which is characteristic of a normative question.

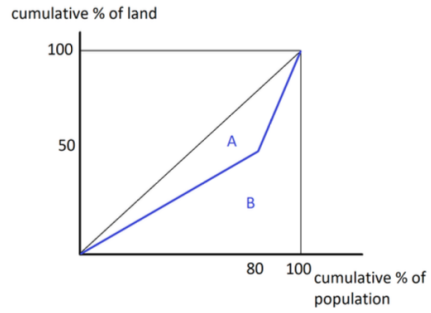
b) Carefully explain what your ideal counterfactual would be to help you answer this question—even if it's totally unrealistic or infeasible!

The totally unrealistic, sci-fi counterfactual might be something like: if we had an exact replica of the U.S. sitting somewhere, identical to our version in every respect, then we could go back in time, change the top rate of income tax in one version but not the other, change absolutely nothing else, and see how working hours compared between the two places. This gets us closer to the 'all else equal' idea we need, albeit with the caveat that if lots of other things are also changing over time then we still might not be able to cleanly identify the effect of the tax rate change.

When we ask even simple sounding questions like this, figuring out if one causes the other is very, very difficult—something that approximates a controlled experiment is really difficult in situations like this, and disentangling causality out of messy real-world data is a hard task for the science of econometrics!

4) Let's think about the distribution of land in two hypothetical societies.

a) First, let's think about society A. It has 100 people, 80 of whom own 0.5 acres of land each, and 20 of whom own 2 acres of land each. The Gini coefficient in society A is 0.3. Sketch the Lorenz curve for land in society A. Explain how the Gini coefficient can be found from your diagram.



(My notes about the diagram: note the proper scale on each axis is cumulative proportion of population and of land, from 0 to 100 percent. 80% of the population here own a combined 50% of the land, with each person in that 80% having a precisely equal share; the remaining 20% own the remaining 50% of the land, again with each person in that 20% having a precisely equal share. The Lorenz curve is therefore piecewise linear through the point $(80, 50)$.

The Gini coefficient can be calculated from the diagram as the area A divided by the area A+B.

b) Society B has 2,000 people, 1,600 of whom own 1 acre of land each, and 400 of whom own 4 acres of land each. Is the Gini coefficient for land in society B higher, lower, or the same as in society A? Explain your answer.

The Gini coefficient is exactly the same in society B as it is in society A. Just as in society A, we have precisely 50% of the land held by 80% of the population, with each having an equal share, and precisely 50% of the land held by 20% of the population, with each having an equal share. The Lorenz curve in society B is therefore completely identical to the Lorenz curve in society A, and so the Gini coefficient will also be the same. This is an example of the fact that the size of the population and the total amount of the resource are immaterial to the Lorenz curve and Gini coefficient; rather it is the *proportions* of population and resource that matter.

Discussion prompts

5) Can you ever observe a truly useful counterfactual in economics?

6) Is the level of inequality we live with today something that was inevitable? Does it matter to your answer if we're talking about wealth or income inequality?