Economics 172: Problem Set #1

Due on September 29, 2025 at 11:00pm

Zachary Brandt
zbrandt@berkeley.edu

Problem 1: Short questions

1. What is the poverty gap? What is the drawback of poverty head count ratio? What is the advantage of poverty gap over the headcount ratio?

2. Consider a country in which 20 percent of the population live on 20 cents per day, 15 percent live on 30 cents per day, 15 percent live on 50 cents per day, 10 percent live on 70 cents per day, 20 percent live on 90 cents per day, and 20 percent live on 1.50 dollars per day. If the poverty line is set at one dollar per day, what is the poverty headcount ratio? What is the poverty gap? What is the poverty severity?

3. Show an example that P_1 (poverty gap) and P2 (poverty severity) can change while P_0 (headcount ratio) is fixed. (You may not need to calculate each value)

4. How P_0 (headcount ratio), P_1 (poverty gap), P_2 (poverty severity) change in graph (a), (b), (c) between situation 1 (black line) and situation 2 (blue line)? '

Solution

1. The poverty gap measures the intensity of poverty by calculating the mean shortfall of the total population from the poverty line, expressed as a ratio with the poverty line. The drawback of the headcount ratio, the percentage of the population living below the poverty line, is that it does not account for the intensity of poverty among those who are below the poverty line, only the incidence of it. The advantage of the poverty gap over the headcount ratio is that it provides a more comprehensive measure of poverty by considering both the incidence and intensity of poverty.

2. The poverty headcount ratio is 80%. The poverty gap is

$$\begin{aligned} P_1 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right) &= \frac{1}{100}\left(20\times\frac{1.00-0.20}{1.00}+15\times\frac{1.00-0.30}{1.00}\right. \\ &\left.+15\times\frac{1.00-0.50}{1.00}+10\times\frac{1.00-0.70}{1.00}+20\times\frac{1.00-0.90}{1.00}\right) \\ &= 0.195. \end{aligned}$$

   The poverty severity is

$$\begin{aligned} P_2 = \frac{1}{N}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^2 &= \frac{1}{100}\left(20\times\left(\frac{1.00-0.20}{1.00}\right)^2+15\times\left(\frac{1.00-0.30}{1.00}\right)^2\right. \\ &\left.+15\times\left(\frac{1.00-0.50}{1.00}\right)^2+10\times\left(\frac{1.00-0.70}{1.00}\right)^2+20\times\left(\frac{1.00-0.90}{1.00}\right)^2\right) \\ &= 0.0595. \end{aligned}$$

3. Consider a country with 100 people and a poverty line of \$1.00. Situation 1: 20 people live on \$0.50, 10 people live on \$0.75, and 70 people live on \$1.50. Situation 2: 20 people live on \$0.25, 10 people live on \$0.75, and 70 people live on \$1.50. In both situations, the headcount ratio (P_0) is 30% (30 people are below the poverty line). However, the poverty gap (P_1) and poverty severity (P_2) change due to the different income levels of the poor.

4. In graph (a), the blue line lies above the black line at all fractions of households and rises above the poverty line earlier as well. This indicates that the headcount ratio (P_0) has decreased, as fewer households are below the poverty line. The poverty gap (P_1) has also decreased, as the area between

the blue line and the poverty line is smaller than that between the black line and the poverty line. The poverty severity (P_2) has decreased as well, as the blue line is closer to the poverty line than the black line, indicating that the poorest households are less poor in situation 2 compared to situation 1.

In graph (b), the blue line intersects the poverty line at the same point as the black line, but is higher than the black line at all fractions of households before this point. Thereafter, it follows the same path as the black line. This indicates that the headcount ratio (P_0) remains unchanged, as the same number of households are below the poverty line. However, the poverty gap (P_1) has decreased, as the area between the blue line and the poverty line is smaller than that between the black line and the poverty line. The poverty severity (P_2) has also decreased, as the blue line is closer to the poverty line than the black line, indicating that the poorest households are less poor in situation 2 compared to situation 1.

In graph (c), the areas of A and B are equal, and the poverty gap and headcount ration remain unchanged. However, the blue line bumps up earlier than the black line so the the poverty severity is lower.

Problem 2: Regression

A group of researchers wishes to test whether cash transfers to low-income households have any spillovers on local small business owners. Their sample consists of 160 villages across 20 districts in India. The researchers randomly assign 80 villages to control and 80 villages to treatment, stratifying by district. In control villages, no households receive cash transfers. In treatment villages, approximately one fourth of households receive a cash transfer.

The researchers conduct surveys with a sample of 10–15 small business owners in each village 3 months after the cash transfers are disbursed. Note that none of the small business owners are also cash transfer recipients. In these surveys, the researchers collect information such as the nature of the business as well as monthly revenues, labor costs, input costs, and profits. The researchers run the following regression:

$$Y_{ivd} = \alpha_0 + \alpha_1 \text{Treatment}_v + \varepsilon_{ivd},$$

where Y_{ivd} represents outcomes of interest (revenues, profits) for business owner i in village v in district d, and Treatment_v denotes treatment status at the village level.

Here is the regression table and results (standard errors in parentheses). The "Village wealth index" (VWI) combines several indicators of village wealth, constructed so the index has mean zero and standard deviation one. Positive values indicate a wealthier village, and the index is measured in standard deviation units. "Above median business assets" is a dummy variable equal to 1 if the business has above median assets and 0 otherwise.

(a) Write out the regression equation for results presented in column (3). What's the variable of interest and coefficient?

(b) Columns (1) and (2) above show the results of this analysis. Interpret these results, commenting on the magnitude and significance of the parameters of interest.

(c) What is the 95% confidence interval around the estimated treatment effect in column (1) and (2)? What does this confidence interval tell you?

(d) In columns (3) and (4), the researchers test whether the cash transfers had differential impacts on business revenues based on individual business owner's characteristics and village characteristics. Write down the regressions depicted in columns (3) and (4). Interpret each of the parameters in detail.

(e) How would you summarize these results?

Solution

(a) The regression equation for column (3) is:

$$Y_{ivd} = \alpha_0 + \alpha_1 \text{Treatment}_v + \alpha_2 \text{Village wealth index}_{iv} + \alpha_3 \left(\text{Treatment}_v \times \text{VWI}_{iv}\right) + \varepsilon_{ivd}$$

The variable of interest is Treatment_v, and the coefficient is $\alpha_1 = 280.1$.

(b) Column (1) shows that the treatment effect on monthly revenues is significant at the 1% level, with a coefficient of 180.3. This indicates that, on average, business owners in treatment villages have monthly revenues that are \$180.3 higher than those in control villages. Column (2) shows that the treatment effect on monthly profits is only significant at the 10% level, with a coefficient of 22.5. This suggests that business owners in treatment villages have monthly profits that are \$22.5 higher than those in control villages, but the effect is less robust than for revenues.

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(c) The 95% confidence interval for the treatment effect in column (1) is approximately (65.4, 295.2), calculated as $180.3 \pm 1.96 \times 58.6$. The 95% confidence interval for the treatment effect in column (2) is approximately (–1.8, 46.8), calculated as $22.5 \pm 1.96 \times 12.4$. For the second confidence interval, since it includes zero, we cannot be confident that the treatment effect is different from zero at the 95% level.

(d) The regression equation for column (3) is:

$$Y_{ivd} = \alpha_0 + \alpha_1 \text{Treatment}_v + \alpha_2 \text{Village wealth index}_{iv} + \alpha_3 \left(\text{Treatment}_v \times \text{VWI}_{iv}\right) + \varepsilon_{ivd}.$$

$\alpha_1 = 280.1$ represents the treatment effect on monthly revenues for business owners in villages with an average wealth index (VWI = 0). $\alpha_2 = 130.8$ indicates that for each one standard deviation increase in the village wealth index, monthly revenues increase by \$130.8 on average, holding treatment status constant. $\alpha_3 = -105.3$ suggests that the treatment effect decreases by \$105.3 for each one standard deviation increase in the village wealth index. This implies that the treatment effect is larger in poorer villages (lower VWI) and smaller in wealthier villages (higher VWI).

The regression equation for column (4) is:

$$Y_{ivd} = \alpha_0 + \alpha_1 \text{Treatment}_v + \alpha_2 \text{Above median business assets}_{iv} + \alpha_3 \left(\text{Treatment}_v \times \text{Above-median}_{iv}\right) + \varepsilon_{ivd}.$$

$\alpha_1 = 240.4$ represents the treatment effect on monthly revenues for business owners in villages with above-median business assets. $\alpha_2 = 110.5$ indicates that for each one standard deviation increase in the above-median business assets, monthly revenues increase by \$130.8 on average, holding treatment status constant. $\alpha_3 = -68.3$ suggests that the treatment effect decreases by \$68.3 for each one standard deviation increase in the above-median business assets. This implies that the treatment effect is larger in villages with lower above-median business assets and smaller in villages with higher above-median business assets.