

**Economics 607  
PROBLEM SET 3**

**Due at 8pm Friday, November 12 (via email)**

In this problem set, you will analyze the effect of very low birth weight classification (i.e., having a recorded birth weight strictly less than 1500 grams) using a regression discontinuity design. This assignment is in large part a replication of Almond, Doyle, Kowalski, and Williams (2010) with important extensions, some of which are explored in Barreca, Guldi, Lindo, and Waddell (2010). The original study was motivated by the argument that low birth weight classification triggers additional treatment that might promote infant health.

**Further instructions:**

- A. Title your do file PS3\_F10\_<yourlastname>
- B. Your program should input the data using the command:  
**use \$GradLaborPS3/runandjump\_sample1500g, clear**  
\$GradLaborPS3 is a macro that will tell Stata where the data set is. This will be different on everyone's computers so DO NOT turn in a do file that has a command **global GradLaborPS3 'yourdirectoryjunk'** in to me as it will not run. I will have GradLaborPS3 defined based on my own file directory structure via a profile.do file (google it if you're interested in doing the same).
- C. Near the beginning, your program should have a command **capture mkdir Output\_<yourlastname>**  
ALL logs, figures, tables, etc. should be written to this folder.
- D. Produce a write-up with tables, figures and responses.

Please send me a zip file that, when uncompressed, contains a folder titled PS3\_F10\_<lastname>. Within this folder I expect to find your do file, your writeup, and the folder titled Output\_<lastname> which contains the raw output from your program. If your program doesn't run on my computer, I will deduct half of a point and send it back to you to fix.

**Data notes:**

- The data file, runandjump\_sample1500g.dta, is based on Vital Statistics Linked Birth and Infant Death Data. Each observation corresponds to a birth. Because the births have been matched to death data, we can see whether a given child does or does not survive one hour, 24-hours, etc. This data is available for 1983-1992 and 1994-2002.
- The data has already been "cleaned." See ADKW for more information.
- Data has been limited to children with birth weights between 1350 grams and 1650 grams. N=376,408.
- Running variable: birth weight in grams (bweight).
- Potential outcome variables: one-hour mortality, 24-hour mortality, one-week mortality, 28-day mortality, and one-year mortality. These correspond to agedth1-agedth5, respectively.

Before doing any analysis, you will want to create a normalized birth weight (bwtnorm) variable for which 1500g corresponds to zero. This makes interpretation easier.

### 1. Testing the validity of the RD design

- a. Show the distribution of birth weights around the 1500-gram cutoff in three ways. Plot the frequencies using 1-gram bins, 10-gram bins, and 25-gram bins with bins radiating out from the 1500-gram cutoff. [Be careful not pool together observations across the threshold.]

*Details: You're going to want to create variables that tell you what "bin" an observation is in. For the one-gram bins, use the following command: `bin01=bwtnorm+0.5`*

*This will make it so that the x-variable (bin01) is centered on the middle of the bin. It is trickier to do the 10-gram and 25-gram bins. For those, you will need to use the round command but note that it is not 100% straightforward so do check that observations are not pooled across the threshold into the same bins. To get the frequencies, I'd recommend you preserve the data, then do a collapse command, and then scatterplot the data before restoring.*

Is the distribution of birth weights smooth?

- b. Non-random sorting across the treatment-threshold is always a concern in RD designs, especially when the threshold is known (since agents could engage in strategic behavior to gain access to favorable treatment). McCrary (2008) proposes that we test for this by considering whether the distribution is discontinuous at the treatment threshold. Using the bins and associated frequencies from part 1a as your observations, estimate whether the distribution is discontinuous at the 1500-gram threshold. Estimate the discontinuity using a regression that is linear in birth weights, allowing the slope to be different on each side of the cutoff, using bandwidths of 150 grams, 100-grams, and 50 grams. Use robust standard errors. [Hint: In addition to the constant, your regression model should have three additional parameters it is estimating.]

*Details: For each bin size, you will want to preserve the data, collapse the data as above, create variables needed to get RD estimate, conduct the analysis, and then restore the data. Make your sample restrictions (relating to bandwidth) after the data has been collapsed.*

Based on these nine estimates, do we conclude that the running variable is smooth across the threshold?

- c. Another way of testing for non-random sorting is to compare the underlying (or pre-existing) characteristics of those on each side of the cutoff. We usually expect these characteristics to be smooth through the treatment threshold because they cannot be affected by treatment. If they are not, it is usually taken as evidence that agents are manipulating the running variable. Regardless of *why* characteristics might be discontinuous at the threshold, if they are, it threatens the validity of the research design—the purpose of focusing on observations near the threshold is to balance observable and unobservable characteristics related to outcomes across the treatment groups.

Obtain RD estimates for discontinuities in whether the mother is white and whether she has less than a high school education. In each of the two tables, present estimates based on the following specifications (clustering standard errors on birth weights):

- i. Bandwidth=90, rectangular kernel weights, slope flexible on each side of threshold
- ii. Bandwidth=60, rectangular kernel weights, slope flexible on each side of threshold
- iii. Bandwidth=30, rectangular kernel weights, slope flexible on each side of threshold
- iv-vi. Same as above but using triangular kernel weights.

*Details: A triangular kernel gives the most weight to observations closest to the threshold. In particular, those exactly at*

*the threshold are given a weight of one while those at the boundary of the bandwidth are given a weight of zero. Observations in between are given a weight proportional to their distance from the cutoff.*

Are the results sensitive to the choice of bandwidth or to the choice of weighting strategy? Does the RD design pass the “balanced covariates test?”

- d. Based on what we observed in part 1a, we should be concerned that covariates might be discontinuous where the distribution is discontinuous. That is, where there are large heaps at birth weights at ounce multiples and at the 1500-gram threshold. Use a linear regression (clustering standard errors on grams) to test whether the characteristics considered in part 1c “jump off the trend-line” at the 51, 52, 53, and 54 ounce heaps. Use a 25-gram bandwidth and, where applicable, omit observations at 1500 grams. Then do the same for the 100-gram threshold but omit from the analysis any observations corresponding to ounce multiples. [Hint: Your regressions should be estimating 3 parameters.]

Are the characteristics of children at ounce heaps systematically different from the characteristics of children with similar birth weights whose weights are not recorded at ounce heaps? How about those at the 1500-gram data heap?

## **2. Estimated Effects on Outcomes**

You will now estimate the effect of very low birth weight classification on one-year mortality (agedth5). Report your results from each of the following parts in a separate table (or in four panels of the same table).

- a. Estimate the effect of very low birth weight classification on one-year mortality (agedth5) using the same specifications as those in part 1c but use robust standard errors. Are the estimates sensitive to the bandwidth or weighting scheme?
- b. Repeat 2a but cluster the standard errors on grams. What happens to the standard error estimates? What does this tell us about the error structure?
- c. Repeat 2b after dropping observations that fall exactly at the 1500-gram cutoff. Have the results changed? Should RD estimates ever be sensitive to dropping observations exactly at the cutoff? Explain.
- d. Repeat 2c after also dropping observations with weights recorded exact ounces. How have the results changed?
- e. Now drop those falling exactly at the 1500-gram cutoff and control flexibly for those at ounce heaps by including an indicator variable for being at an ounce heap and an interaction of this indicator with each slope variable. What do these results show?
- f. Which set of estimates are you most inclined to believe? Why? What do you conclude about the effect of very low birth weight classification on infant mortality?