Tutorial 6 [NOT GRADED]
Regression Discontinuity Design - Due on 13.07.2020 24:00

Empirical Banking and Finance
Konrad Adler

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This exercise is based on [Chava and Roberts, 2008] who study how covenant breaches affect a firm's investment. The data come from Compustat and DealScan. If you want to use this data outside of the university you would need to get permission first, because these datasets are not publicly available. Only firms with a loan contract including a net worth covenant are in the sample. The dataset contains the following variables:

- *firmid* A firm identifier
- *quarter* Time variable
- *networth* A firm's net worth defined as total assets - total debt
- *diff_networth* Difference net worth - covenant threshold
- *inv* Capital expenditures scaled by net property, plant and equipment (physical capital)
- *macroq* Market to book value used in the paper
- *cashflow* A firm's earnings scaled by net property, plant and equipment
- *covenantbreach* Indicator when the *diff_networth* is negative
- *firstcovenantbreach8* Indicator when *covenantbreach*=1 for the first time after being 0 during the previous 8 quarters
- *relativecovenantbreach8* A timing variable counting from -8 to +8 around *firstcovenantbreach8*, with time 0 being the quarter of the covenant breach.

1. Data & Descriptives

   a) Have a look at the dataset and provide some descriptive statistics. For the next steps replace the largest and smallest 5% of the continuous variables in the dataset by missing values.

   b) How many firm-quarter observations are firms breaching a covenant?

   c) Compare the characteristics of firm-quarters breaching a covenant against the others. This is similar to Table IV in [Chava and Roberts, 2008].

2. Regression Discontinuity Design:
   a) We want to study the causal impact of a covenant breach on a firm's investment. Why is it not enough to just compare investment between the two groups of firms? Refer to what you have found in Question 1)c).
   b) How does RDD allow us to find the causal effect of a covenant breach on investment?
   c) Is this a sharp or a fuzzy design?
3. RDD Assumptions
   a) Using only 8 quarters before and 4 quarters after *firstcovenantbreach8* create a graph of average *inv*, *macroq* and *cashflow*.
   b) Assumption 1: For RDD to work, how should the control variables *macroq* and *cashflow* evolve around the time of the covenant breach? Do you think the assumption about the other control variables is satisfied when you look at the graph?
   c) Assumption 2: Create a histogram of *diff_networth* excluding *diff_networth* > 200. Describe what you observe and how this is a threat to RDD.
4. Regression 1
   a) Run the following three regressions with *inv* as LHS variable and *covenantbreach* as the RHS variable of interest including year and firm FE. Cluster standard errors at the firm level.
      i) $inv = covenantbreach + networth$
      ii) $inv = covenantbreach + \sum_i^4 networth^i$
      iii) $inv = covenantbreach \times \sum_i^4 \text{diff\_networth}^i$[1]
   b) Briefly discuss the assumptions of models i) to iii) concerning the relationship between *inv* and *networth* and how the model below is relaxing the assumption.
   c) Compare the size and significance of the coefficient of interest across the three models.
   d) How different are the coefficients to the *Bind* coefficients from Table V of [Chava and Roberts, 2008]?
5. Regression 2
   a) Compute the absolute distance in % of *networth* to the covenant threshold
   b) Re-run regressions i) and ii) of the previous question restricting the sample to only firm-quarters where the absolute distance is less than 15% of *networth*
   c) What is the motivation for restricting the sample in this particular way?
   d) Compare the coefficients obtained using the restricted sample to the ones above and provide a short comment.

References

[Chava and Roberts, 2008] Chava, S. and Roberts, M. R. (2008). How does financing impact investment? the role of debt covenants. *The journal of finance*, 63(5):2085–2121.

[1] This is an interaction term