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Location Based Assignment

Spring 2019

SS 154

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Date: March 03, 2019

Memorandum to: Government of India
Ministry of Finance

From: Minerva Economic
Advisors

Subject: An evaluation of public opinion on the effects of demonetization in India.

Summary & Background:

In November 2016, India enacted an unorthodox monetary policy: all 500 and 1,000 rupee notes were taken out of circulation with little notice, causing 86% of the value of India's currency invalid in a cash-based economy (Chakravorti, 2018).

Demonetisation was rooted largely in the fight against corruption, "black money" and counterfeit currency (Chakravorti, 2016). The short-term effects were haphazard: Unprepared banks, empty ATMs, frustrated queues and confusing and constantly changing withdrawal policies posed challenges to citizens (especially in rural areas). Retail and wholesale markets stalled, food prices crashed, and the Rupee was threatened by further devaluation (Chakravorti, 2016).

Some proponents argued that the demonetization force India's largely informal economy away from a cash-reliant system. Debate continues on the impact of demonetization: the authors of the memorandum used survey data from the Reserve Bank of India (RBI) to investigate public opinion on the economic impact of demonetization.

Data: Panel data from the Indian Consumer Confidence Survey (CSS) contains information from households on 42 variables such as demographic information and about views on various aspects of past and future economic development.

Survey data is collected in seven non-consecutive months every year by the RBI. The survey methodology employs two-stage random sampling within the 13 cities. The first stage selects a polling booth area and the second stage selects 15 respondents within the polling booth area (RBI, 2019). For this study, the data from the months before and after the demonization of November 2016 were used - September 2016 and December 2016 with 4,977 and 4,572 observations, respectively.

Samples contain demographic variables (age, sex, and education) along with perception and outlook variables, in which respondents were asked of their opinion of current economic indicators such as price levels and inflation compared to one year ago and their expectations of these indicators one year later.

The authors pre-processed the data by converting the categorical string values into categorical numeric values (Appx 1). The treatment variable TREAT was defined as 0 for observations from the pre-demonisation dataset (September 2016) and 1 for observations from the post-demonetization dataset (December 2016). The dependent variable of PERC was defined as 1 for respondents who thought that the general economy was doing worse one year ago and defined as 0 for respondents who thought that the general economy doing the same or better one year ago (Appendix 1).

```
. tab perc if treat == 0
```

perc	Freq.	Percent	Cum.
0	3,720	74.74	74.74
1	1,257	25.26	100.00
Total	4,977	100.00	

```
. tab perc if treat == 1
```

perc	Freq.	Percent	Cum.
0	3,314	69.74	69.74
1	1,438	30.26	100.00
Total	4,752	100.00	

Fig 1. Tabulation of the frequency of PERC respondents in the treatment group versus the control group.

Fig 1. shows the frequency of PERC respondents in the treatment group versus the control group. Descriptive statistics such as standard deviation cannot be used since both dependent and explanatory variables are both binary. 25.26% of September respondents, versus 30.26% of December respondents thought that the economy was better one year ago. Thus, one can preemptively identify a 5% effect

decrease on public opinion on general economic performance attributed to the impact of demonetization, only if the assumption laid out later are valid.

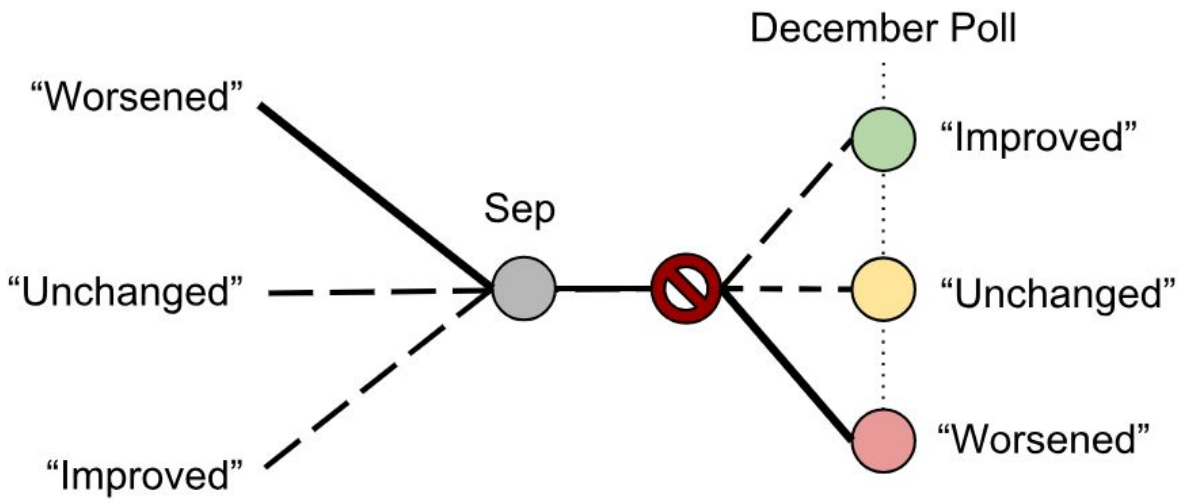

Fig 2. Diagram showing the logic behind the study design. The red stop-sign represents demonetization, circles represent the perception of general economic conditions at the time of the survey, as compared to before. The thick, solid lines represent the viewpoint that the economic condition is worse now, as compared to before. For example, voting "Worsened" in the December poll reflects the viewpoint that the economic conditions have changed for the worse. The variable PERC measures the relative frequency of this viewpoint.

Justification of variables: The values of the variable PREC allows us to infer how the person surveyed views the current economic conditions stand in relation to the economic conditions before. If there is a perceived difference between the two, we can infer that some event(s) must have happened to change general economic conditions within the last year. Since the data collection was randomized, the sample in each month is identical in expectation, and can therefore be directly compared. Thus, if there is a difference in the relative frequency from one survey

month to the next, we can infer that some economic event must have taken in the time between them to induce that change. Then, under the assumption that the demonetization was the only significant economic event that occurred between September 2016 and December 2016, we can attribute any difference between the results of the September and December surveys to demonetization.

Assumptions:

1. To evaluate the randomization procedure employed in the RBI survey the authors chose to perform Exact Matching (EM) on treatment and control group on the demographic variables of the dataset (AGES, INCOME, EDUC, FA_MEMB, EMP_TYPE). If the randomization procedure was truly random, we would expect the balance on the covariates to be perfect, or close thereto. This was indeed the case, performing exact matching on all categorical variables, only 34 out of 9,729 observations were dropped because an exact match was not found. This lends credibility to the assumption that the treatment and the control group are directly comparable.
2. No significant economic event occurred between collection of September and December, thus the difference views between samples can be attributed to demonetization. Whilst not a rigorous proof of the assumption, none of the events – with the exception of demonetization

itself – listed in Business Today's list of the ten most impactful economic events in 2016 occurred between September and December 2016 (Ramesh, 2017).

3. The answers to the survey question on respondents "perception of the general economic condition - compared to one year ago" give a reveal respondents opinions on changes *in the recent past* or *during the last year*. Despite being logically phrased as a comparison between two specific points in time - today and exactly one year ago -, the authors assume that the question was not answered literally by respondents. This assumption is consonant with behavioral economic theory - one would expect the very hard question " (...) compared to one year ago" - which requires exact recollection of a specific, distant moment in time - to be substituted with one that is easier to answer. Questions asking for objective comparisons between some point in the past and the present are commonly substituted for heuristic questions about how respondents feel about change that has taken place in the time between then and now (Kahneman, 2012). Typically, a particular weight is given to recent and widely covered events – this is referred to as availability bias (Kahneman, 2012).

Fig 3. India's Consumer Price Index between Sep 2015 to January 2017. Notice the decline starting July. Notice that the prices are higher in both September and December in 2016 as compared to the year before. However, prices were in decline throughout the latter half of 2016, starting in July.

To evaluate this assumption empirically in this specific context, the authors took advantage of the fact that the CCS asks for respondent's perception on a topic for which an objective answer exists and has been rigorously documented: inflation rate. If no heed was paid to recent trends, but attention was only paid to the current price level as compared to the price level one year prior, we would expect the relative frequency of answers to be the same in both the September and December survey. If instead of considering only the two specific dates, respondent's allowed their answers to be influenced by more recent trends, we would expect to observe an increased frequency of answers not indicating an increase in price. We would expect the the relative frequency of these answers to

be higher in December, as the demonetization that occurred the month before was both highly reported on and resulted in downward pressures on the prices of consumption - food, in particular (Rashad, 2017).

```
. tab perception_price if treat == 0
```

perception_price	Freq.	Percent	Cum.
0	1,084	21.78	21.78
1	3,893	78.22	100.00
Total	4,977	100.00	

```
tab perception_price  if treat == 1
```

perception_price	Freq.	Percent	Cum.
0	1,238	26.05	26.05
1	3,514	73.95	100.00
Total	4,752	100.00	

Fig 4. Tabulation of the fraction of respondents in the CCS who perceived current price levels to be higher now, as compared to last year (represented by 1 in the frequency table). The left table displays the results of the September survey, the right table displays the results of the December survey. The relative frequency of this belief decreased by 4.27% points, from 78.22% to 73.95%, between the two surveys.

As shown in the tabulations in ***Fig 4.*** the data support the latter interpretation. Thus, both theory and case-specific data support this assumption.[1]

Model Selection & Specification: Since the explanatory variables TREAT is binary, logit and probit models that rely on the normal distribution data were impossible. Thus, the authors decided to use a linear-linear regression model to test

[1] #Biasidentification. Examining the data set, we realized that one of the survey questions may be posed in such a way as to have systematically biased answers, based on behavioral economics (explained in essay). This identification of bias is what allowed us to use the data set to answer our research question. Furthermore, we use the data set to evaluate the plausibility of this assumption in this specific context.

the veracity of the 5% point effect decrease of public opinion on general economic performance attributed to the impact of demonetization identified earlier.

Although the RBI's survey methodology is randomized, the authors chose to perform Coarsened Exact Matching on the demographic variables of the dataset (AGES, INCOME, EDUC, FA_MEMB, EMP_TYPE) to further decrease sampling variance and improve the comparability of the treatment and control groups (Appx1).

Model Results:

```
Linear regression                               Number of obs     =      9,696
                                                F(1, 9694)        =      22.84
                                                Prob > F          =     0.0000
                                                R-squared         =     0.0025
                                                Root MSE          =     .44819
------------------------------------------------------------------------------
                                   |               Robust
        perc |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       treat |   .0450044   .0094168     4.78   0.000     .0265455    .0634634
       _cons |   .2574243   .0066417    38.76   0.000     .2444051    .2704435
```

A pre-EM robust linear-linear regression of PERC against TREAT reveals a 4.5% point effect decrease of public opinion on general economic performance attributed to the impact of demonetization.

A drawback of the model is that since both explanatory and dependent variables are binary, hypothesis testing statistics of standard error, t-statistic and p-values are not interpretable. R-squared value of 0.0025 reveals a badly fitted model, which accurately reflects how there are only four possible points on a scatter-plot of the linear model (***Fig. 3***)

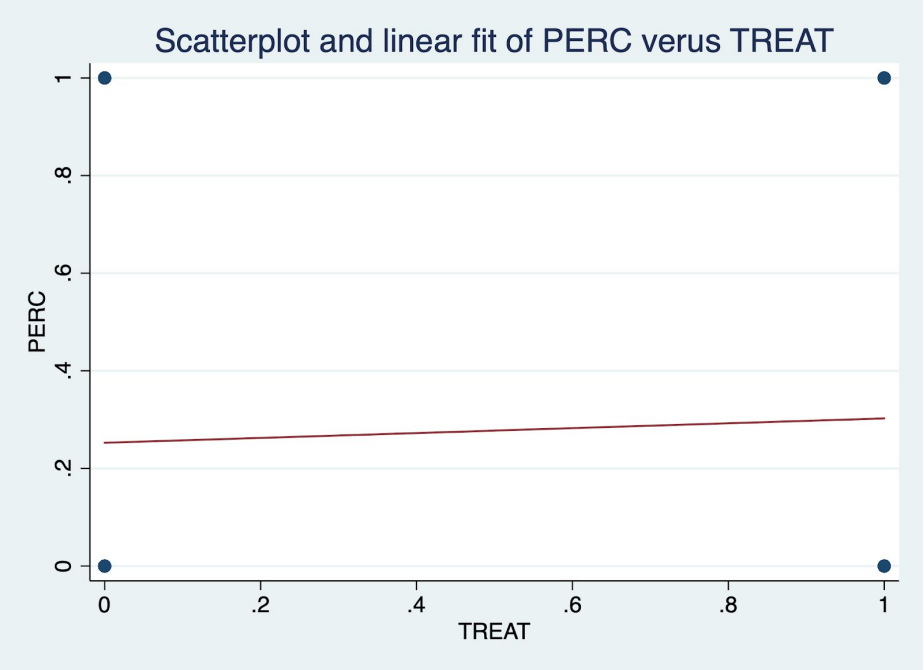

Fig 3. A scatterplot of and linear fit of PERC versus TREAT. Note the positive gradient of the regression, which indicates a 4.5% point effect change.

Additional quantitative evaluation data on the economic performance from a year ago from respondents would have improved the model by allowing access to hypothesis testing statistics, and the ability to use logit and probit models to predict unit level approval level of demonetisation. [2]

[2] The authors attempted a predictive logit model. A composite quantitative 'general perception' variable was created from the qualitative responses on the perception of household income and spending, employment scenario from a year ago. This variable was the explanatory variable was plotted against TREAT in a logit model, which predicted the probability of a respondent to be in

Since our model only has one explanatory variable, the model assumes that the change in economic performance perception was solely attributed to the demonetization. The authors believe that it is reasonable to infer causation of the effect to demonitisation because of the randomized controlled samples and the additional exact matching procedure employed.

Survey Results: A survey was conducted in Hyderabad to explore the public opinion on demonetization, it contains 17 respondents with different traits and backgrounds. Keeping in mind convenient sampling and selection bias, we found that:

Over 75% think that the policy had a negative impact (Appx 4). In addition, the interviewees were asked about their confidence in policymakers after adopting this policy, 40% of the people considered the decision to shake their confidence in policymakers and their interventions in the market. The rest are somewhat unsure whether the long term results of this policy would trump the short term disruption that it had on their economy. An online survey conducted by *The Economic Times* showed opposition to the controversial move of the government with almost 60% of people saying that it had collateral damage despite the intention to make the economy more transparent (*The Economic Times*, 2017).

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of demonetization. The results from this model was highly insignificant and thought to be too model dependent by the authors to be included.

Conclusion & Recommendation:

The authors of this memorandum determine conclusively that the policy of demonetization enacted in November 2016 had an negative effect of (4.5 to 5)% points on the perception of India's economic performance. This finding was supported by the survey results, which shows that the majority of survey respondents thought that they were negatively affected by the demonetization and that their confidence in policymakers was negatively affected is memorandum recommends that the Indian Ministry of Finance should improve the implementation of future currency related policies such as demonetization, or avoid the implementation of demonetization in the manner it was enacted in 2016 given how the Indian public has been surveyed to be negatively affected by the demonetisation, and casually inferred to be think on the policy of demonetisation poorly across demographic groups.

Appendix:

1. The Stata code file:

https://drive.google.com/open?id=1BIfgXU44ddDAbgBBezda9VfP35dcVtRc

2. The survey template[3]:

https://drive.google.com/file/d/1b6DXSMxfGpiQRDzXfWuztphjq5tI6oPY/view?usp=sharing

3. The survey results (CSV delimited)

https://drive.google.com/file/d/1csyCYWvB1H7epEYYmAA6elqS2xZ0bK-t/view?usp=sharing

4. Summaries of the survey:

```
. tabulate affectedbydemonitization
affected by    |
demonetization |      Freq.     Percent        Cum.
---------------+-----------------------------------
 Negatively    |         13       76.47       76.47
 Positively    |          2       11.76       88.24
     Unsure    |          2       11.76      100.00
---------------+-----------------------------------
      Total    |         17      100.00
```

Table 1. Public opinion on the effect of demonetization.

[3] #interview_survey: sample of the survey used to examine Hyderabadi's opinion on demonetarization. The questionnaire was written in both English and Telegu to reduce convenient sampling based on English speakers and nonspeakers. Most questions are categorical as people might find it hard to estimate an exact effect of the policy on their daily life.

```
. tabulate affectedbydemonitization effectonconfidednceinpolicymaker
  affected by  |     effect on confidence in Policymakers
demonetization | Extremely      Quite   Somewhat |     Total
---------------+---------------------------------+------
Negatively     |         4          3          6 |        13
Positively     |         0          1          1 |         2
    Unsure     |         0          0          2 |         2
---------------+---------------------------------+------
     Total     |         4          4          9 |        17
```

Table 2. Public opinion on the effect of demonetization and their confidence in current policymakers.

References:

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Kahneman, D. (2012). *Thinking, fast and slow.* Pt. II, Chapter 12. The Science of Availability. Farrar, Straus, and Giroux.

Ramesh, D. (2016). "From demonetization to GST: 10 major events in the Indian economy in 2016". *Business Today.* Retrieved from: https://www.businesstoday.in/topics/year-round-up-2016/demonetisation-to-gst-major-events-indian-economy-raghuram-rajan/story/243264.html

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