Econometrics Project

An analysis of infant deaths due to Low Birth Weight (LBW) (to total reported infant deaths)

Group-14

Group Members-

1. Utkarsh Arora (2020143)
2. Keshav Rajput (2020308)
3. Krishnasai Addala (2020442)
4. Samarth Raina (2020465)
5. Sejal Kardam (2020467)

Model Description

k/r denotes that the variable is different for rabi and kharif

$$V42 = Intercept + v12_{kr} + v15_{kr} + v16_{kr} + v25_{kr} + v28_{kr} + female\_pct_{kr} + log(beds_{kr}) + log(tap_{kr}) + log(gdp_{kr}) + cash\_index_{kr} + cereal\_index_{kr} + child\_marriage_{kr} + nitrate_{kr} + error$$

Where ->

- v42: Percentage of infant deaths due to Low Birth Weight(LBW)(to total reported infant deaths)
- v12: Percentage of women discharged in less than 48 hours of delivery(to total reported deliveries in public institutions)
- v15:Percentage of institutional deliveries(to total reported deliveries)
- v16: Percentage of safe deliveries(to total reported deliveries)
- v25: Percentage of reported live births(to reported births)
- v28: Percentage of newborns having weight less than 2.5 kg (to newborns weighed at birth)
- female_pct: Percentage of female births to total births
- $\log_{10}$(gdp): Log of gdp of states
- $\log_{10}$(beds): Log of number of hospital beds by states
- $\log_{10}$(taps): Log of number of taps with water access district wise
- cash_index: Yield Index of the cash crops grown at a particular district at a particular time.
- cereal_index: Yield Index of the cereal crops grown in a particular district at a particular time.
- child_marriage: Number of child marriage cases reported state-wise at a particular time.
- nitrate: Measure of quality of water, indicates the presence of nitrate in water supply in standard units.

Data Description

Data for the project was provided during assignment-1. We added a few more variable namely **‘nitrate’** and **‘child marriage’** which indicates the **presence of nitrate in water supply** and **number of child marriage cases reported in a particular district at a particular time** respectively. Null values were removed and we also took care of duplicates and outliers for the dependent variable.

The outlier criteria was Mean **± 3*Standard deviations**.

Choice of Variables

The variables we chose in our model were due to intuition and empirical data we found on the internet. For example, we chose *child marriage* as that increases the risk of **premature birth which in turn is the single biggest cause of low birth weight.** Similarly, we chose nitrate to consider **environmental factors** that could possibly **affect the mother's health**. The variables v12,v15,v16,v25, and v28 were chosen purely on the basis of intuitive reasoning. We chose cereal index as it can affect the nutrition of the mother, which is likely to affect the health of the child.

The function of the variables

Most of the variables are linear, but we chose to take $\log_{10}$ for GDP,taps and beds as those values are very large, and also log(x) is a monotonic function so it will not affect our overall ‘trend’ i.e slope sign. We took $\log_{10}$ of beds for the same reason as those values were quite high and were skewing the regression so to speak. The same argument can be made for taps value. These 3 values have higher magnitudes of values within our sample so taking a function that will reduce them down to comparable values made much more sense.

Regression Results

Kharif Crops

Name of the Independent Variables	Values intercepts/slopes of the Independent Variables	P-values
Intercept	-4.613096	0.89657
V12_Kharif	-0.006821	0.41328
V15_Kharif	0.085319	0.08371
V16_Kharif	-0.088949	0.11546
V25_Kharif	-0.946380	0.00372**
V28_Kharif	0.056808	0.02583*

Female_Pct_Kharif	0.266830	0.26838
log(GDP_Kharif)	8.476883	<2e-16***
log(Beds_Kharif)	-3.853067	8.42e-09***
log(Taps_Kharif)	0.084959	0.58439
Cash_Index_Kharif	-0.200288	<2e-16***
Cereal_Index_Kharif	-0.960962	1.34e-05***
Child_Marriage_Kharif	-0.079927	1.77e-05***
Nitrate_Kharif	0.083899	0.14199

N = 2354

R^2 (adjusted) = 0.2135

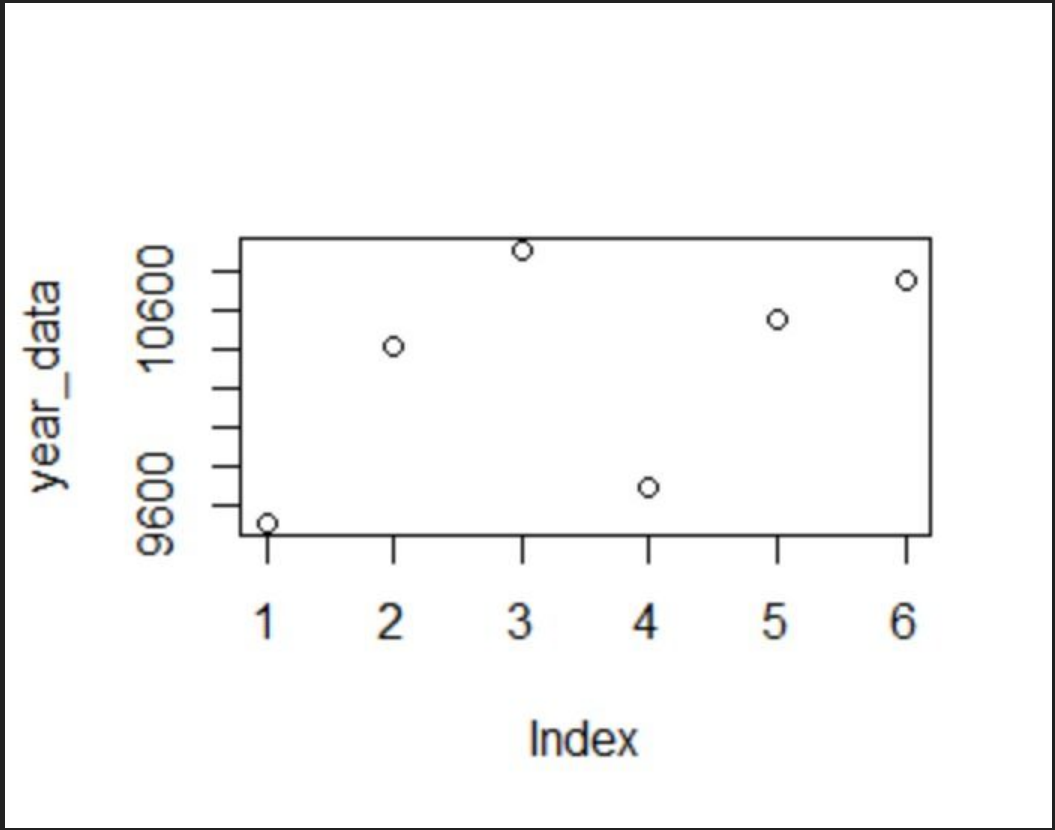
Rabi Crops

Name of the Independent Variables	Values intercepts/slopes of the Independent Variables	P-values
Intercept	26.982771	0.449815
V12_Rabi	-0.020824	0.01396*
V15_Rabi	0.158064	0.001338**
V16_Rabi	-0.146382	0.009558**
V25_Rabi	-1.201496	0.000254***
V28_Rabi	0.084825	0.001031**
Female_Pct_Rabi	0.270657	0.269665
log(GDP_Rabi)	8.545709	<2e-16***
log(Beds_Rabi)	-4.859878	1.64e-13

log(Taps_Rabi)	0.693176	4.83e-06***
Cash_Index_Rabi	0.031997	0.069256
Cereal_Index_Rabi	-0.710848	8.79e-05***
Child_Marriage_Rabi	-0.041665	0.034496
Nitrate_Rabi	0.060745	0.323791

N = 2355
R^2 (adjusted) = 0.195

Our Findings



- Child marriage cases year wise
- We see drop in 2014
- Possible reasons is election
- During elections two cases are possible either the state resources are allocated somewhere else so they can’t keep track. Or, state authorities are working overtime so the cases are less. Under-reporting can also be the case.

Factors which are related to an increase in low birth weight include
-Anemia
-Low maternal weight
-Prior experience of stillbirth
-Low food diversity

Factors which are related to decrease in low birth weight include
-Attending ANC sessions
-Taking iron supplements
-Delivering in established health facilities

Socio-economic factors also play a role in incidence of low birth weight, However, none of our variables measure socio-economic conditions

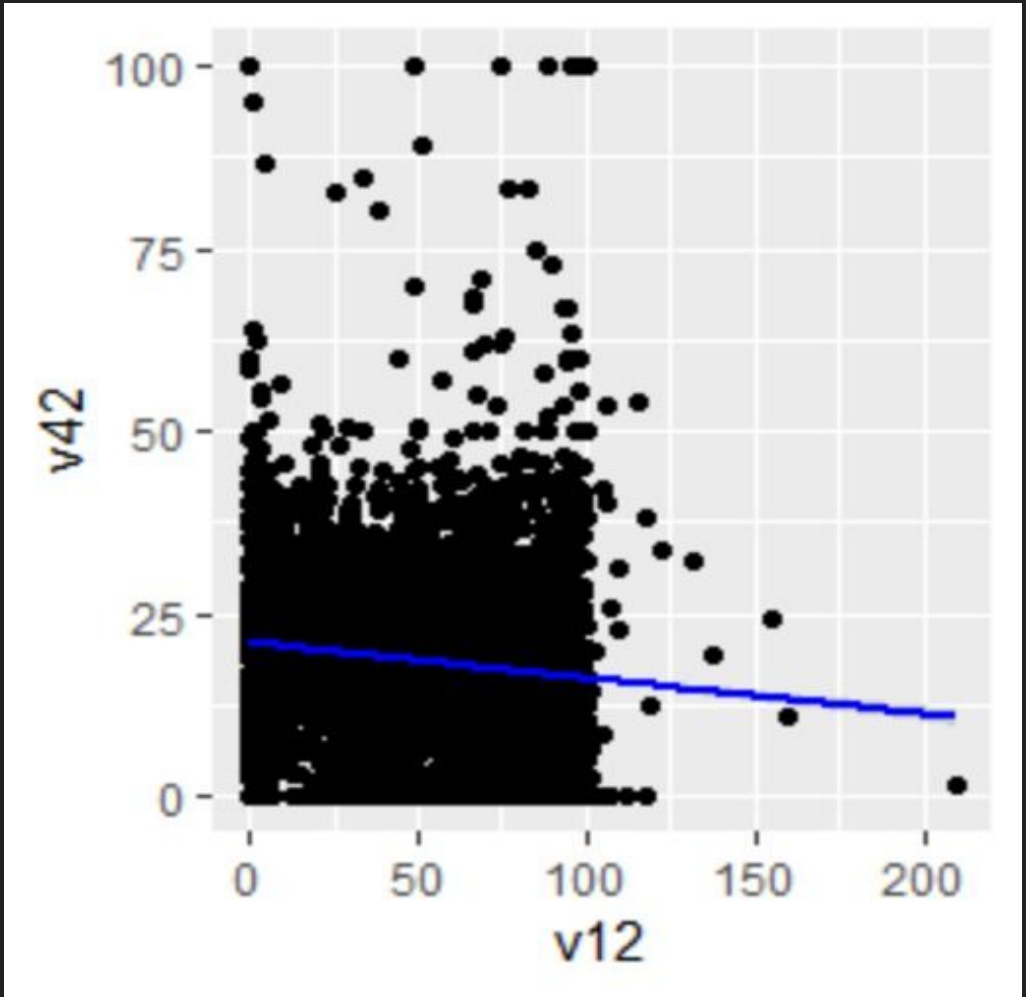
v12 is likely inversely related to v42

V12 is percentage of women discharged in less than 48 hours of delivery
V42 is percentage of infant deaths due to Low Birth Weight

These 2 are likely to have a negative correlation as a women who gave birth to a child with low birth weight is likely to be kept in the hospital for longer for things such as further tests and increased post natal care

This is shown in our regression analysis, where the estimate has negative sign

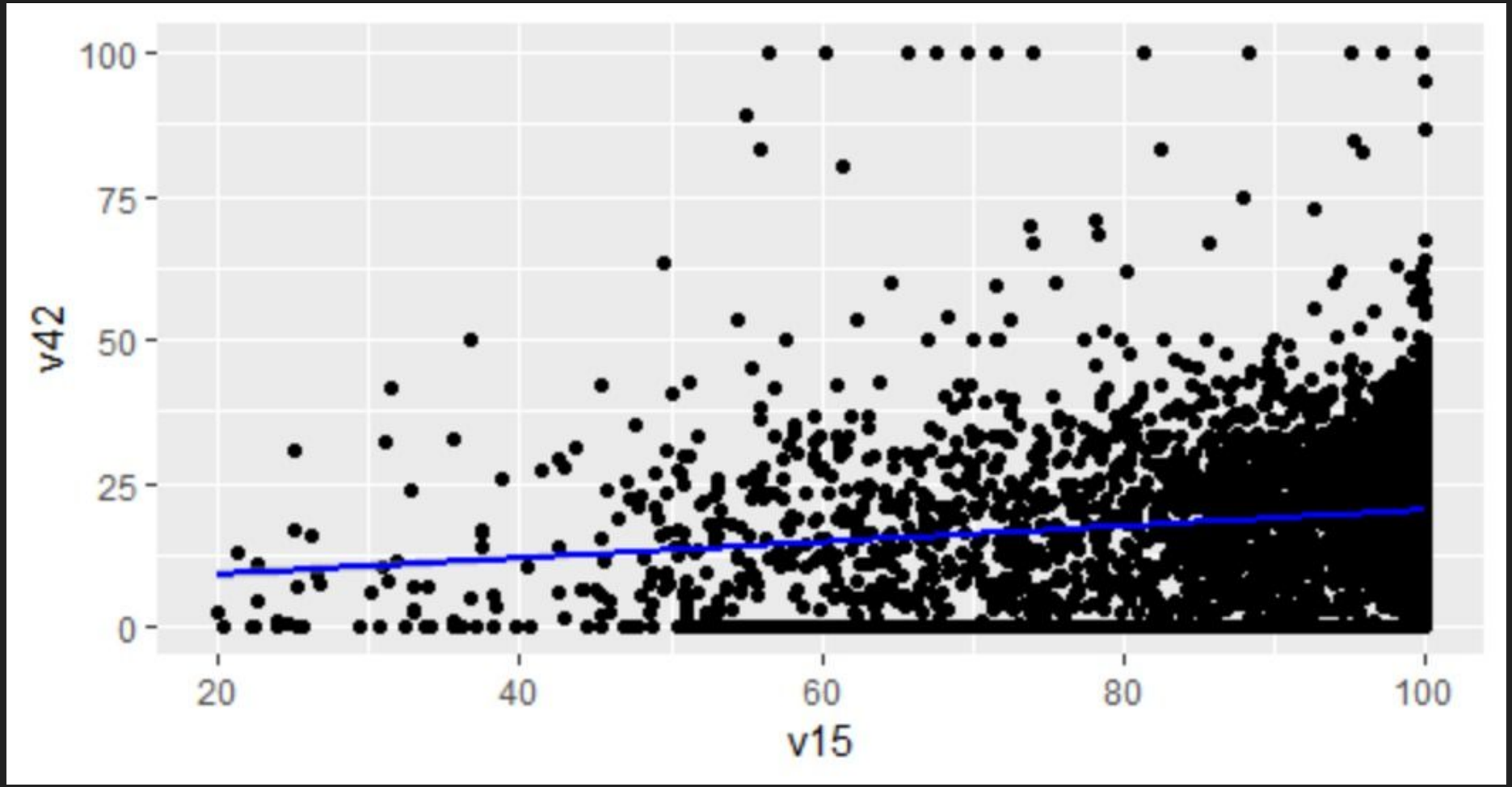
```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -4.613096  35.482503  -0.130  0.89657
v12_kharif  -0.006821   0.008336  -0.818  0.41328
```


100
75
50
25
0
v42
0
50
100
150
200
v12

We guessed that v15 and v42 would have a negative relationship

However upon plotting the data, we found that the 2 variables had a positive correlation.

Some reasons for this might be
-Institutions may be over represented in the data set
-The institutions may not be performing at the required level of competence
-Cause of death may be improperly reported


100
75
50
25
0
v42
20
40
60
80
100
v15

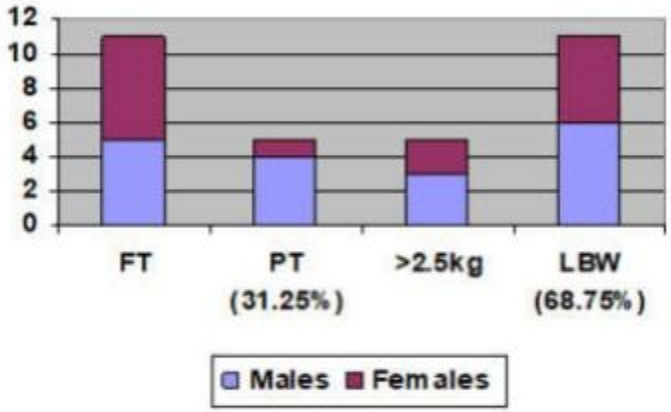


Figure 4. Bar diagram showing prevalence of preterm birth rate & LBW rate in a group of 16 twins in RH, Delhi

Ratio of birth was 1.23 males/female, preterm birth rate was 9.58%, LBW rate was 11.23%

This follows our regression analysis, which shows that at best, sex ratio is weakly correlated with incidence of low birth weight

What our data and analysis could not account for

- Socio-Economic factors like income, food diversity, societal status.
- Government policies that affect maternal health within the 2011-16 time frame.Could only find policies at the beginning of the time period
- GDP state wise is in another time period. So it becomes difficult to draw conclusions about that.
- Tried to make our data homoskedastic but it was becoming very difficult to determine the groups that our data was in(assigning weights).
- Could not analyse the structural breaks within the country any further than we did in data assignment 2.
- We don’t know what percentage of the births that took place were single,twins,triplets,etc(according to literature increases chances of LBW)
- We could not find any policy in the give time period to account for nitrate. Although it did act in the way that we did expect.

References

1. For the water quality(nitrate) variable we used the nitrate data from the following source: - https://cpcb.nic.in/nwmp-data-2019/
2. For the data on child marriage(child_marriage) in various states in India across time, our source is: - https://data.gov.in/resource/stateut-wise-number-child-marriage-cases-prohibition-child-marriage-act-2006-2013-2017
3. We chose to include the sex ratio because of this study (https://pubmed.ncbi.nlm.nih.gov/25096219/).
4. We chose *nitrate* (water quality) to consider environmental factors that could possibly affect the mother's health (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1392223/
5. We chose *child marriage* as that increases the risk of premature birth which in turn is the single biggest cause of low birth weight(https://onlinelibrary.wiley.com/doi/full/10.1002/ajhb.23709).
6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2761784/
   Gives data regarding maternal health
7. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0244562#sec006
   Gives data regarding the link between maternal health and low birth weight
8. http://journalcra.com/sites/default/files/issue-pdf/38684_0.pdf
   Gives further data on low birth weight and sex ratio