

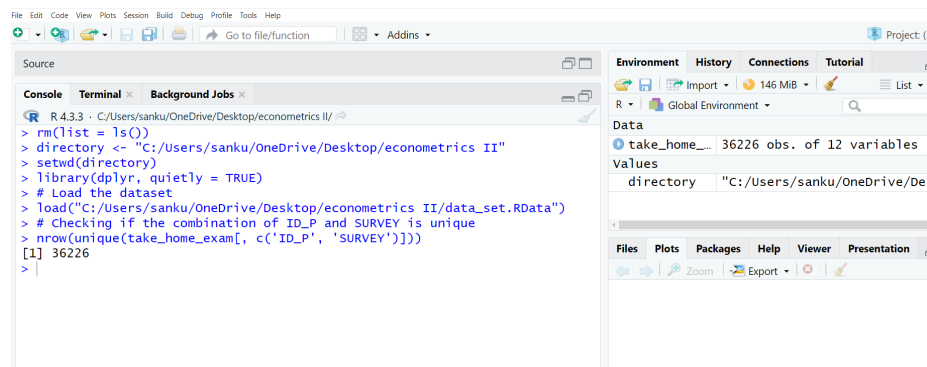
Econometrics Assignment

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20/04/2024

Question 1

The child id and wave number (survey year) is the unique identifier in our dataset. To confirm this using R we can use the unique function of R and find the number of unique combinations of these two variables.



```
R 4.3.3 - C:/Users/sanku/OneDrive/Desktop/econometrics II/
> rm(list = ls())
> directory <- "C:/Users/sanku/OneDrive/Desktop/econometrics II"
> setwd(directory)
> library(dplyr, quietly = TRUE)
> # Load the dataset
> load("C:/Users/sanku/OneDrive/Desktop/econometrics II/data_set.RData")
> # Checking if the combination of ID_P and SURVEY is unique
> nrow(unique(take_home_exam[, c('ID_P', 'SURVEY')]))
[1] 36226
>
```

Number of unique combinations

From the R output, we can verify that the number of unique combinations is indeed equal to the total number of observations.

Question 2

The mean of the binary/dummy variable widow is 0.03621 which means that the probability of finding a household headed by widow is 0.03621 so the rate of widowhood is 3.621 which looks pretty reasonable if we look at any other official stats of widowhood rates in India.

```

R 4.3.3 - C:/Users/sanku/OneDrive/Desktop/econometrics II/
> # table of summary statistics for key variables in our analysis
> summary(take_home_exam[, c('std_edu', 'widow', 'cons_capita')])
      std_edu      widow      cons_capita
Min.   :-3.171  Min.   :0.00000  Min.    :  58.86
1st Qu.: 1.301   1st Qu.:0.00000  1st Qu.: 818.03
Median : 4.225   Median :0.00000  Median : 3886.99
Mean   : 3.974   Mean   :0.03621  Mean    : 8599.03
3rd Qu.: 6.296   3rd Qu.:0.00000  3rd Qu.: 12484.33
Max.   :12.568   Max.   :1.00000  Max.    :240360.53
NA's   :22       NA's   :74       NA's    :15

```

Table of summary stats

Question 3

Note : This solution uses t test which is not covered in R lab sessions but it is covered in lectures so the code is taken from online resources which doesn't break any protocol as per instructions by the instructor.

To check that the households headed by widowed mothers are poorer or not, we can run a t test to find out if the difference in consumption expenditure per capita is statistically significant or not.

```

R 4.3.3 - C:/Users/sanku/OneDrive/Desktop/econometrics II/
> # t-test to check if the difference is statistically significant.
> t.test(cons_capita ~ widow, data = take_home_exam)

Welch Two Sample t-test

data:  cons_capita by widow
t = 8.9953, df = 1423.3, p-value < 2.2e-16
alternative hypothesis: true difference in means between group 0 and group 1
is not equal to 0
95 percent confidence interval:
 2270.296 3536.622
sample estimates:
mean in group 0 mean in group 1
      8702.926      5799.467

```

t test results

The t test results show that the p value is much less than the significance level (generally taken to be 0.05) which indicates that the difference is indeed statistically significant. Now that we know the difference in consumption expenditure per capita between widowed households and non - widowed households

is not 0, we can determine the sign by looking at the confidence interval which lies in the positive region, Therefore the non - widowed households are indeed richer compared to widowed households.

Question 4

Standardized years of education is a better measure than completed years of education because it accounts for the age of the child. Completed years of education may vary depending on the child's age, as older children will have had more time to complete their education. Standardized years of education adjusts for this age difference and allows for a more meaningful comparison across children of different ages.

Question 5

To study the association between widowhood and children's educational attainment, you can use a regression model that controls for relevant background characteristics of the household, such as:

- "hh_children": Number of children in the household
- "hh_assets": Household asset index (to capture household wealth)
- "hindu": Indicator for whether the religion is Hinduism or not
- "cons_capita": Household consumption expenditure per capita (a proxy for household wealth/income)
- "ln_cons" : Log consumption exp

Regression specifications : std_edu vs widow + other household control variables (as mentioned above)

Interpretation : First of all observe that the p value of the estimate of the coefficient of widow is much less than the significance level (0.05) indicating that there is a statistically significant positive relationship between being a widow and educational attainment. Specifically, being a widow is associated with an increase in educational attainment of 0.8041 units, on average. Using this result, we can also construct the confidence interval for the coefficient of widow to get a better understanding of the association between children's educational attainment and widowhood.

```

R 4.3.3 - C:/Users/sanku/OneDrive/Desktop/econometrics II/
> # regression of std_edu ~ widow & controlling household background variables
> summary(lm(std_edu ~ widow + cons_capita + hh_children + hh_assets + hindu + ln_cons, data = take_home_exam))

Call:
lm(formula = std_edu ~ widow + cons_capita + hh_children + hh_assets +
    hindu + ln_cons, data = take_home_exam)

Residuals:
    Min       1Q   Median       3Q      Max
-10.9097  -1.9840  -0.0151   1.9604  24.3575

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -1.661e+01  3.074e-01  -54.03  <2e-16 ***
widow         8.041e-01  7.991e-02   10.06  <2e-16 ***
cons_capita  -1.192e-04  1.289e-06  -92.51  <2e-16 ***
hh_children  -4.259e-01  1.031e-02  -41.32  <2e-16 ***
hh_assets     5.005e-01  1.454e-02   34.42  <2e-16 ***
hindu         5.840e-01  3.717e-02   15.71  <2e-16 ***
ln_cons       1.858e+00  2.921e-02   63.60  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 2.832 on 36104 degrees of freedom
(115 observations deleted due to missingness)
Multiple R-squared:  0.3268,    Adjusted R-squared:  0.3267
F-statistic: 2921 on 6 and 36104 DF, p-value: < 2.2e-16

> |

```

Regression Results

Question 6

To check if widowhood affects girls differently than it affects boys, We can use regression with dummy interactions. The idea is to run the regression of `std_edu` on `widow + widow*girl`. Now the coefficient of the `widow*girl` term reflects the difference in how widowhood affects girls and boys. If the coefficient of `widow*girl` term is statistically significant then we can indeed confirm that widowhood affects girls and boys differently.

```

R 4.3.3 - C:/Users/sanku/OneDrive/Desktop/econometrics II/
> # using dummy interactions to find out if widowhood affect girls differently than boys
> summary(lm(std_edu ~ widow + widow*girl, data = take_home_exam))

Call:
lm(formula = std_edu ~ widow + widow * girl, data = take_home_exam)

Residuals:
    Min       1Q   Median       3Q      Max
-7.9294 -2.6876  0.1915  2.3446  8.7122

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  4.03375    0.02532  159.335  < 2e-16 ***
widow         0.50433    0.12864   3.921 8.85e-05 ***
girl        -0.17782    0.03702  -4.803 1.57e-06 ***
widow:girl    0.39839    0.19601   2.032  0.0421 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 3.447 on 36126 degrees of freedom
(96 observations deleted due to missingness)
Multiple R-squared:  0.002038,    Adjusted R-squared:  0.001956
F-statistic: 24.6 on 3 and 36126 DF, p-value: 6.829e-16

> |

```

Regression with dummy interactions

Regression specifications : std_edu vs $\text{widow} + \text{widow} * \text{girl}$

From the results of the regression, we can clearly see that the coefficient of $\text{widow} * \text{girl}$ is indeed statistically significant (p value is less than significance level (0.05)). Now in order to determine the sign of the coefficient, we can find the confidence interval which comes out to lie in the positive region which indicates that widowhood leads to more educational attainment for girls as compared to boys. Therefore we can conclude that widowhood affects girls and boys differently and it affects girls more than it affects boys.