Visualizing Survey Data Analysis Results:
Marrying the Best from Stata and R

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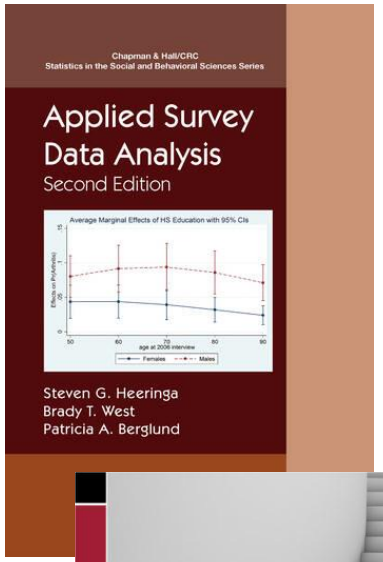
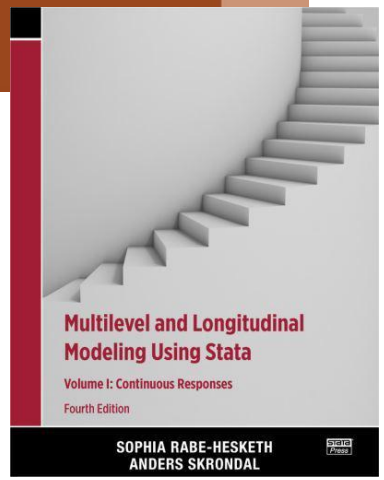
Easy-to-use survey data analysis tools with excellent resources

stata.com/manuals/svy.pdf





Highly flexible execution of the Grammar of Graphics

Image from Kirsten Packer's ggplot2 presentation last February 2019:
http://www.seec.uct.ac.za/ggplot2-grammar-graphics

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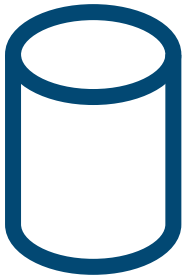
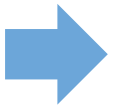
Highly flexible execution of the Grammar of Graphics





Processed survey data

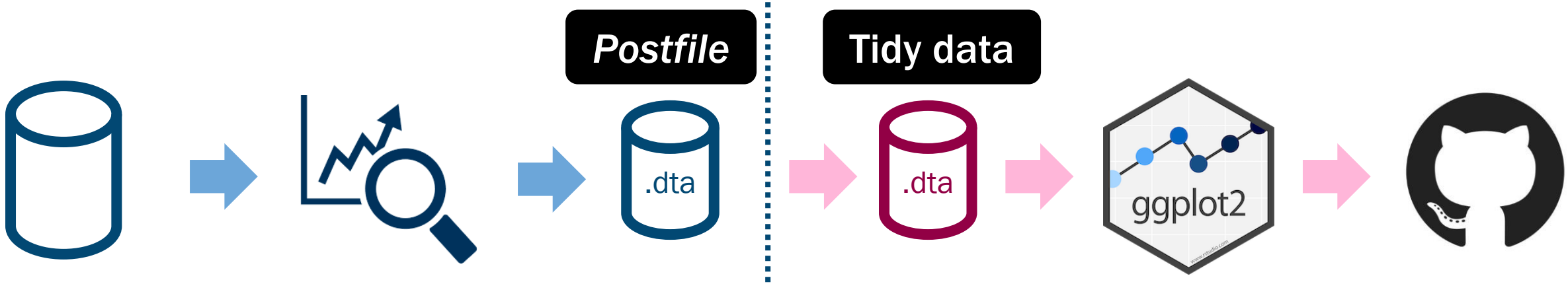
Survey data analysis

Ensure reproducibility during handoff

Create plots using *ggplot2*

Easy-to-use survey data analysis tools with excellent resources

Highly flexible execution of the Grammar of Graphics



Processed survey data

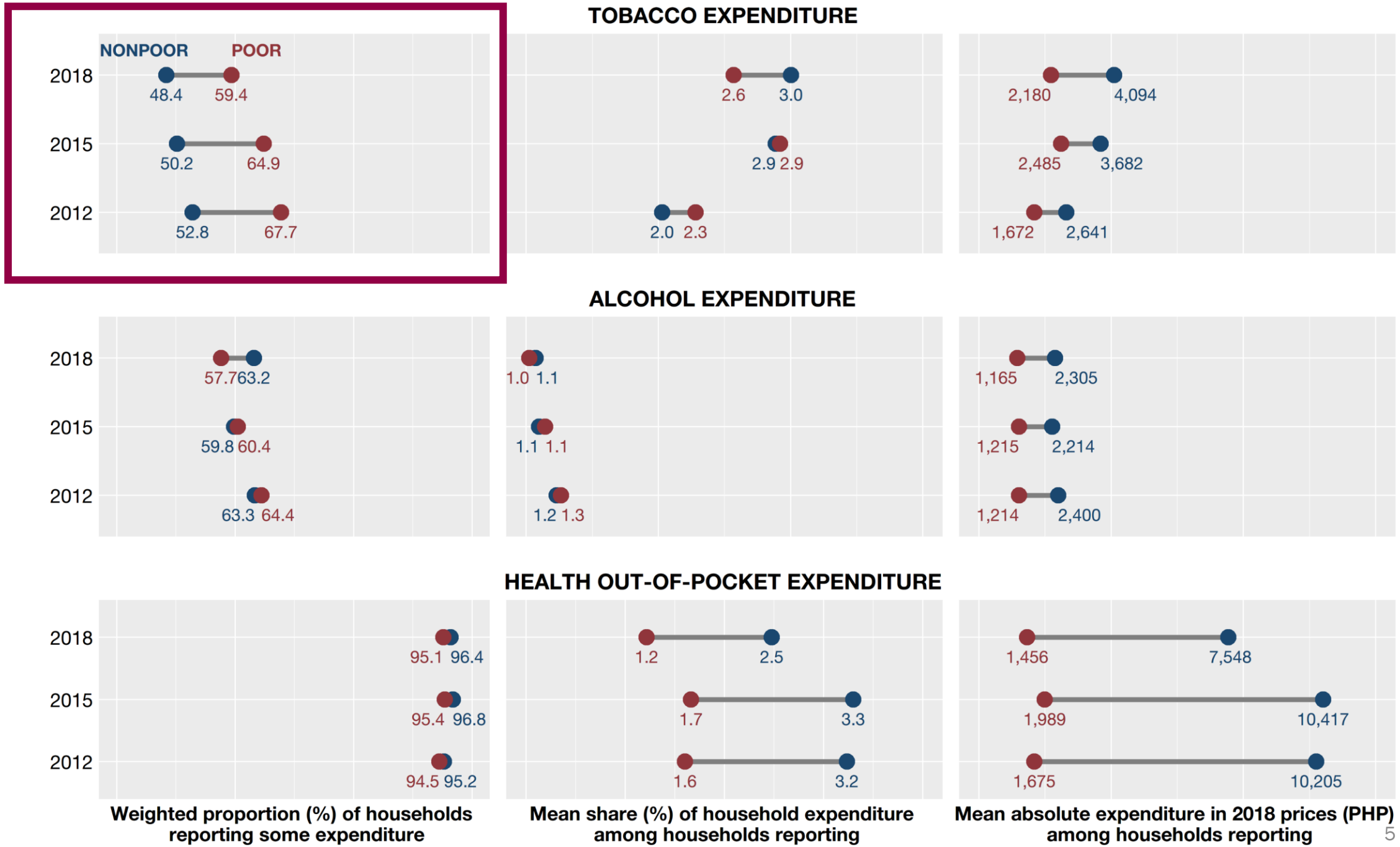
Survey data analysis

Analysis results stored using *postfile*

Read .dta using *haven*

Create plots using *ggplot2*

Upload repository to Github


TOBACCO EXPENDITURE
NONPOOR
POOR
2018
2015
2012
48.4
59.4
50.2
64.9
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HEALTH OUT-OF-POCKET EXPENDITURE
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Weighted proportion (%) of households reporting some expenditure
Mean share (%) of household expenditure among households reporting
Mean absolute expenditure in 2018 prices (PHP) among households reporting

Easy-to-use survey data analysis tools with excellent resources

Processed survey data

EXAMPLE
Philippines expenditure data from 229,432 households

Survey data analysis

EXAMPLE
Proportion reporting tobacco expenditure between poor and non-poor households

Analysis results stored using *postfile*

Highly flexible execution of the Grammar of Graphics

Read .dta using *haven*

Create plots using *ggplot2*

EXAMPLE
Dumbbell plots

Upload repository to Github

Data description	Stata variable name
• Family Income and Expenditure Survey 2012, 2015, 2018	`survey`
• Two-stage sampling design:	
◦ Primary sampling units (PSU): villages (*barangays*)	`psu`
◦ Secondary sampling units: households within villages	
• Stratified by subnational boundaries (region/province by urban/rural status)	`stratum`
• Post-stratification survey weights	`weight`
• Outcome: reported tobacco expenditure during the year (yes/no)	`prev_tobacco`
• Exposure: Poverty status based on the provincial poverty line (poor/non-poor)	`poverty`

1. Declare survey design using *svyset*

```
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
```

clustering variable **psu** (primary sampling unit)

weight variable **weight**

strata variable **stratum**

single unit stratum are summarized using the overall mean

Stata output

```
Sampling weights: weight
             VCE: linearized
     Single unit: centered
        Strata 1: stratum
 Sampling unit 1: psu
             FPC 1: <zero>
```

2. Calculate proportions of tobacco expenditure over survey round and poverty status

```
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
```

```
svy: mean prev_tobacco, over(survey poverty)
```

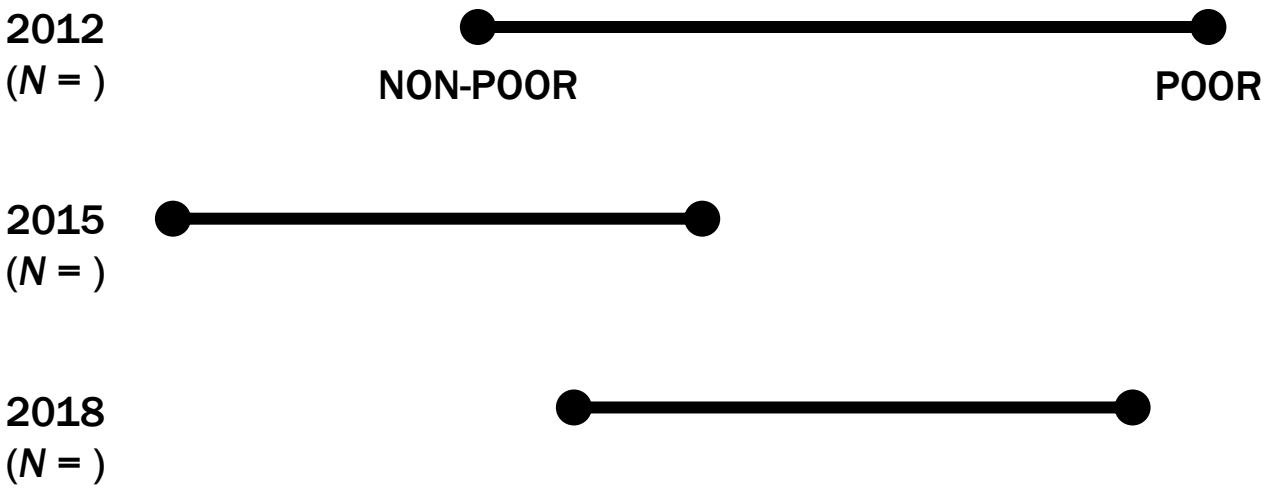
Stata output

```
------------------------------------------------------------------------------
                             |             Linearized
                             |      Mean   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
c.prev_tobacco@survey#poverty|
                      2012#No|   .5281905   .0039855      .5203784    .5360025
                     2012#Yes|   .6774919   .0064277      .6648929    .6900909
                      2015#No|   .5018166   .0037622      .4944423     .509191
                     2015#Yes|   .6485802   .0064525      .6359325    .6612278
                      2018#No|   .4838312   .0025353      .4788616    .4888007
                     2018#Yes|   .5937887   .0050016      .5839849    .6035925
------------------------------------------------------------------------------
```

1. Identify the data structure needed for the plot

Dumbbell plot

visualizes the difference between two groups



Survey	Non-poor	Poor	N
2012			
2015			
2018			

2. Declare the *postfile* dataset

```
postfile dumbbell int survey float (nonpoor poor N) using "dumbbell.dta", replace
```

Name assigned to Stata in internal memory

integer format to new variable **survey** (contains the survey year)

float format to new variables **nonpoor** (value among non-poor), **poor** (value among poor), and **N** (sample size)

filename of resulting file stored on disk

overwrites file every run

3. Declare survey design using *svyset*

```
postfile dumbbell int survey float (nonpoor poor N) using "dumbbell.dta", replace
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
```

clustering variable **psu** (primary sampling unit)

weight variable **weight**

strata variable **stratum**

single unit stratum are summarized using the overall mean

Stata output

```
Sampling weights: weight
             VCE: linearized
     Single unit: centered
        Strata 1: stratum
 Sampling unit 1: psu
             FPC 1: <zero>
```

4. Calculate proportions of tobacco expenditure over survey round and poverty status

```
postfile dumbbell int survey float (nonpoor poor N) using "dumbbell.dta", replace
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
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Stata output

```
------------------------------------------------------------------------------
                             |             Linearized
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c.prev_tobacco@survey#poverty|
                      2012#No|   .5281905   .0039855      .5203784    .5360025
                     2012#Yes|   .6774919   .0064277      .6648929    .6900909
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                     2015#Yes|   .6485802   .0064525      .6359325    .6612278
                      2018#No|   .4838312   .0025353      .4788616    .4888007
                     2018#Yes|   .5937887   .0050016      .5839849    .6035925
------------------------------------------------------------------------------
```

`ereturn list` Stata output (selected)

```
matrices:
                  e(b) :  1 x 6
                  e(V) :  6 x 6
              e(_N_subp) :  1 x 6
             e(V_srssub) :  6 x 6
                e(V_srs) :  6 x 6
                   e(_N) :  1 x 6
```

Contains the means

Stata output

```
------------------------------------------------------------------------------
                             |             Linearized
                             |      Mean   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
c.prev_tobacco@survey#poverty|
                      2012#No|   .5281905   .0039855      .5203784    .5360025
                     2012#Yes|   .6774919   .0064277      .6648929    .6900909
                      2015#No|   .5018166   .0037622      .4944423     .509191
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                      2018#No|   .4838312   .0025353      .4788616    .4888007
                     2018#Yes|   .5937887   .0050016      .5839849    .6035925
------------------------------------------------------------------------------
```

matrix list e(b) Stata output

```
 c.prev_tob~o@  c.prev_tob~o@  c.prev_tob~o@  c.prev_tob~o@  c.prev_tob~o@  c.prev_tob~o@
         1.survey#      1.survey#      2.survey#      2.survey#      3.survey#      3.survey#
       0.poverty      1.poverty      0.poverty      1.poverty      0.poverty      1.poverty
y1     .52819046      .67749186      .50181664      .64858015      .48383119       .5937887

         e(b)[1,1]      e(b)[1,2]      e(b)[1,3]      e(b)[1,4]      e(b)[1,5]      e(b)[1,6]
```

Stata output

```
------------------------------------------------------------------------------
                             |             Linearized
                             |      Mean   std. err.      [95% conf. interval]
-----------------------------+------------------------------------------------
c.prev_tobacco@survey#poverty|
                   2012#No   |   .5281905   .0039855       .5203784    .5360025
                  2012#Yes   |   .6774919   .0064277       .6648929    .6900909
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------------------------------------------------------------------------------
```

`ereturn list` Stata output (selected)

```
matrices:
                  e(b) :  1 x 6
                  e(V) :  6 x 6
             e(_N_subp) :  1 x 6
            e(V_srssub) :  6 x 6
               e(V_srs) :  6 x 6
                  e(_N) :  1 x 6
```

Contains the sample size (not in main output)

`matrix list e(_N)` Stata output

	c.prev_tob~o@ 1.survey# 0.poverty	c.prev_tob~o@ 1.survey# 1.poverty	c.prev_tob~o@ 2.survey# 0.poverty	c.prev_tob~o@ 2.survey# 1.poverty	c.prev_tob~o@ 3.survey# 0.poverty	c.prev_tob~o@ 3.survey# 1.poverty
r1	31173	8998	32712	8832	126074	21643

`e(_N)[1,1] + e(_N)[1,2]` for 2012 sample size

`e(_N)[1,3] + e(_N)[1,4]` for 2015 sample size

`e(_N)[1,5] + e(_N)[1,6]` for 2018 sample size

5. Call the results from the relevant matrices and post on the file

```
postfile dumbbell int survey float (nonpoor poor N) using "dumbbell.dta", replace
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
svy: mean prev_tobacco, over(survey poverty)
post dumbbell (2012) (e(b)[1,1]) (e(b)[1,2]) (e(_N)[1,1] + e(_N)[1,2])
post dumbbell (2015) (e(b)[1,3]) (e(b)[1,4]) (e(_N)[1,3] + e(_N)[1,4])
post dumbbell (2018) (e(b)[1,5]) (e(b)[1,6]) (e(_N)[1,5] + e(_N)[1,6])
```

6. *Postclose* when done

```
postfile dumbbell int survey float (nonpoor poor N) using "dumbbell.dta", replace
svyset psu [pweight = weight], strata(stratum) singleunit(centered)
svy: mean prev_tobacco, over(survey poverty)
post dumbbell (2012) (e(b)[1,1]) (e(b)[1,2]) (e(_N)[1,1] + e(_N)[1,2])
post dumbbell (2015) (e(b)[1,3]) (e(b)[1,4]) (e(_N)[1,3] + e(_N)[1,4])
post dumbbell (2018) (e(b)[1,5]) (e(b)[1,6]) (e(_N)[1,5] + e(_N)[1,6])
postclose dumbbell
```

Analysis results stored using *postfile*

Postfile commands post results in a Stata dataset

7. Check output

```
use dumbbell.dta, clear
list
```

Stata output

```
     +-------------------------------------+
     | survey    nonpoor       poor      N |
     |-------------------------------------|
  1. |   2012   .5281904   .6774918   40171 |
  2. |   2015   .5018166   .6485801   41544 |
  3. |   2018   .4838312   .5937887  147717 |
     +-------------------------------------+
```

```
svy: mean prev_tobacco, over(survey poverty)
```

Stata output (selected)

```
------------------------------------------------
                                |
                                |       Mean
--------------------------------+---------------
c.prev_tobacco@survey#poverty   |
                     2012#No    |    .5281905
                    2012#Yes    |    .6774919
                     2015#No    |    .5018166
                    2015#Yes    |    .6485802
                     2018#No    |    .4838312
                    2018#Yes    |    .5937887
------------------------------------------------
```


```
# install.packages("haven")     # install if doing this for the first time
library(haven)                  # For opening Stata dta files
data <- read_dta("dumbbell.dta")
data
```

R console output

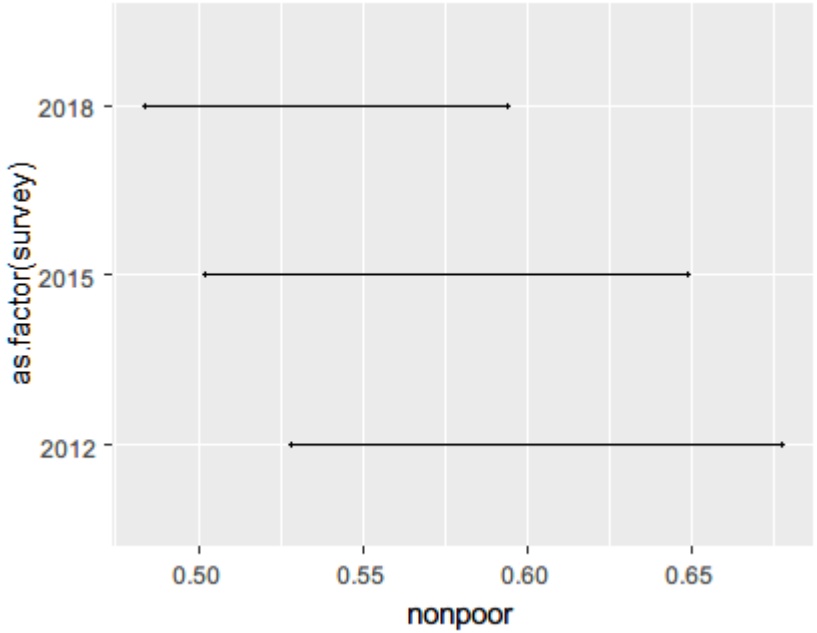
```
# A tibble: 3 × 4
  survey nonpoor  poor      N
   <dbl>   <dbl> <dbl>  <dbl>
1   2012   0.528 0.677  40171
2   2015   0.502 0.649  41544
3   2018   0.484 0.594 147717
```

use dumbbell.dta, clear /// list Stata output

```
     +-------------------------------------+
     | survey    nonpoor       poor        N |
     |-------------------------------------|
  1. |   2012   .5281904   .6774918    40171 |
  2. |   2015   .5018166   .6485801    41544 |
  3. |   2018   .4838312   .5937887   147717 |
     +-------------------------------------+
```

1. Start with the basic plot

```
# install.packages(c("tidyverse", "ggalt"))
library(tidyverse)      # Includes ggplot2
library(ggalt)          # Dumbbell plot extension of ggplot2
dumbbell <- ggplot(data = data,
                   aes(y = as.factor(survey),
                       x = nonpoor,
                       xend = poor)) +
            geom_dumbbell()
dumbbell
```



1. Start with the basic plot

```
# install.packages(c("tidyverse", "ggalt"))
library(tidyverse)      # Includes ggplot2
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dumbbell <- ggplot(data = data,
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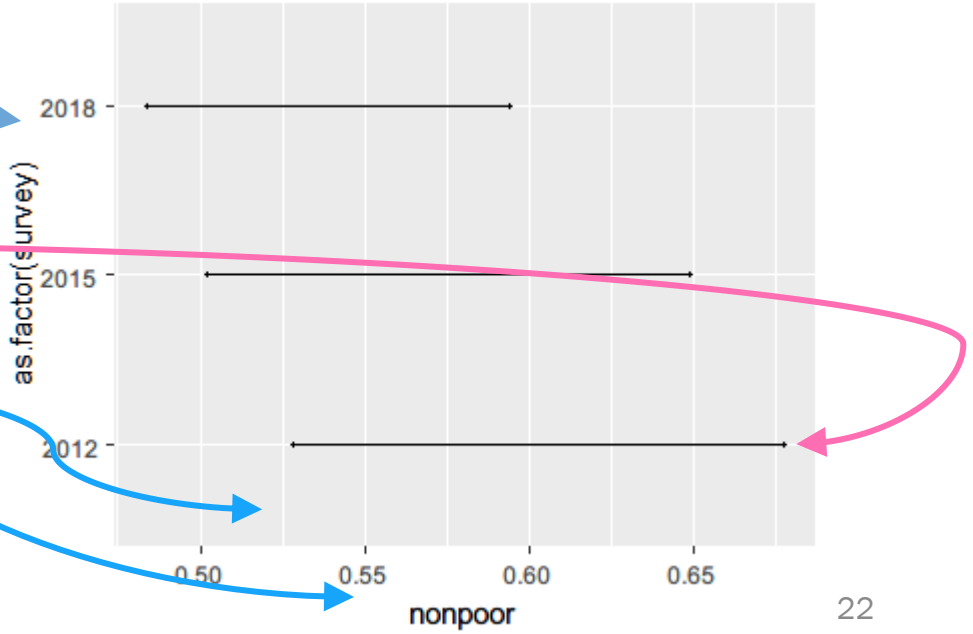
                       x = nonpoor,
                       xend = poor)) +
  geom_dumbbell()

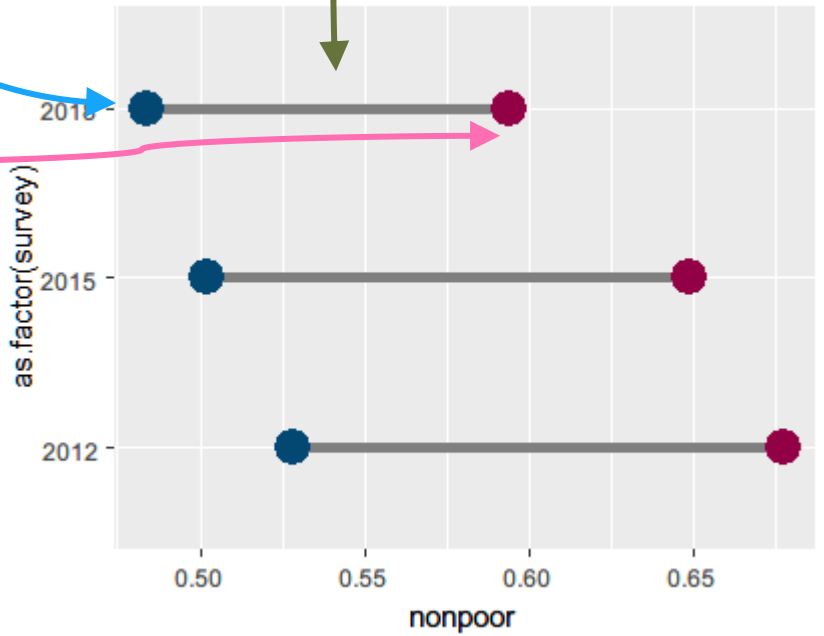
dumbbell
```



2. Emphasize the plot by adjusting aesthetics

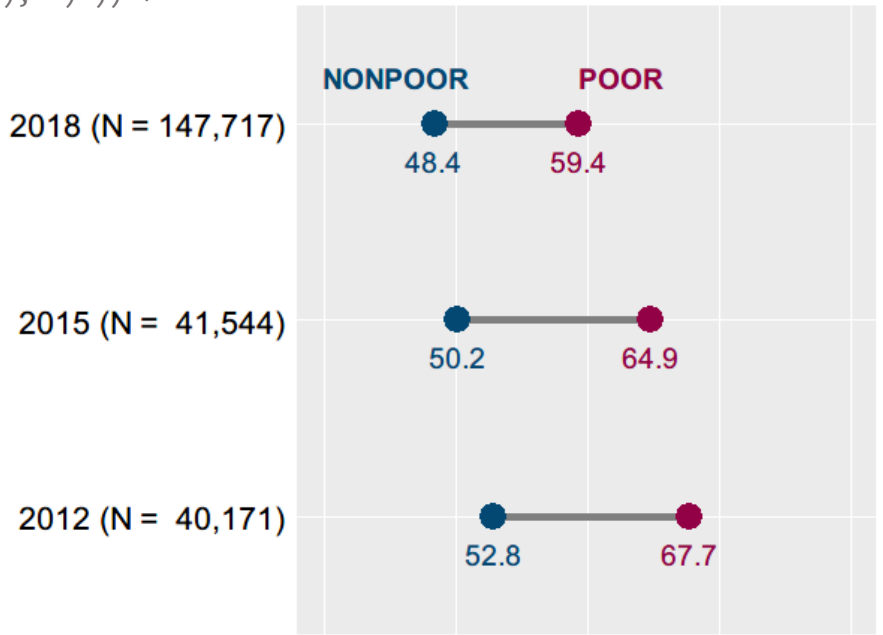
```
dumbbell <- dumbbell +
  geom_dumbbell(size = 2, color = "gray50",
                size_x = 6,
                colour_x = "#024873",
                size_xend = 6,
                colour_xend = "#920045")

dumbbell
```

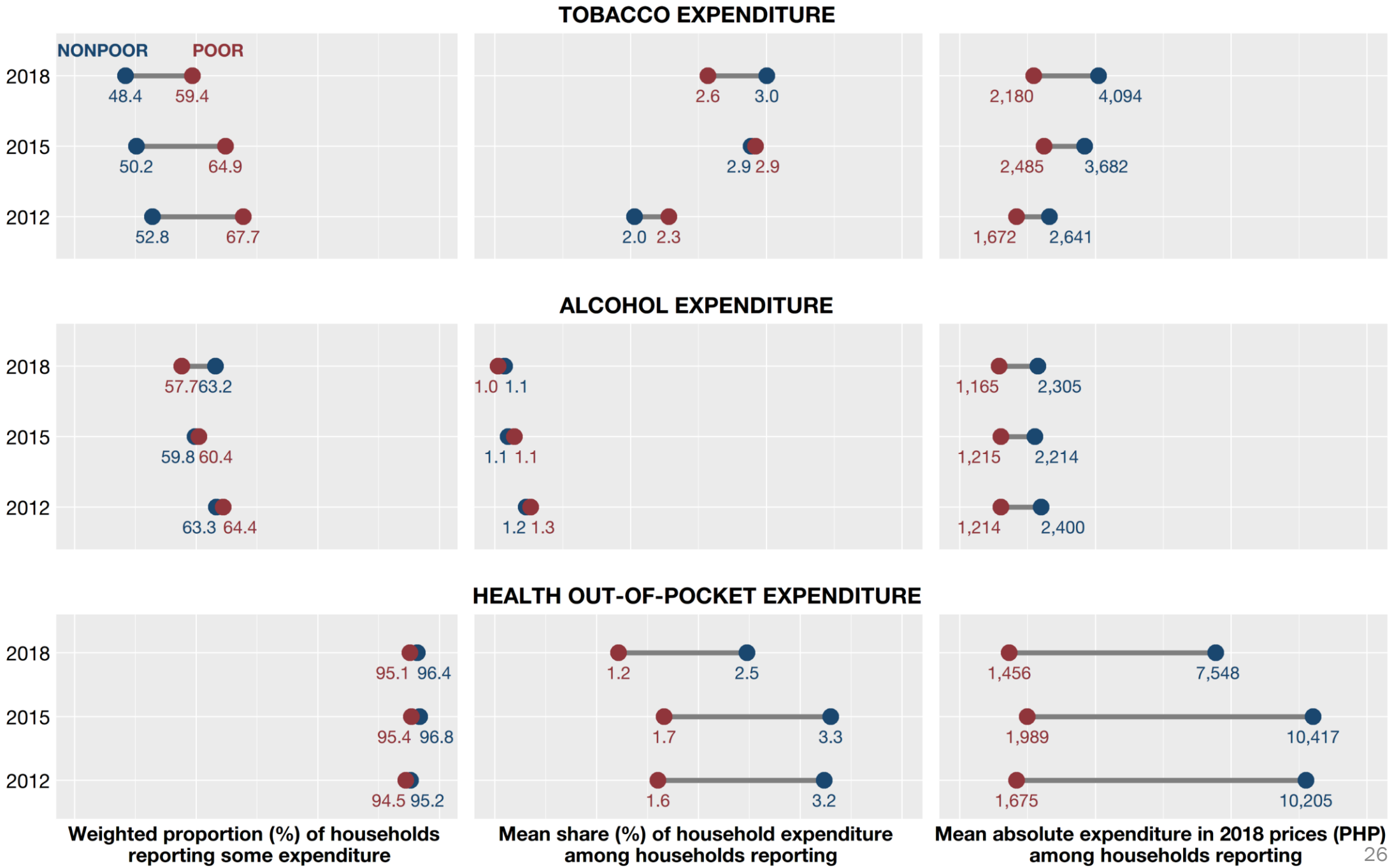


3. Finish the plot by applying a theme and additional modifications

```
dumbbell <- dumbbell +
  # Fix the axes
  scale_y_discrete(name = "“, labels = paste0(data$survey, " (N = ", format(data$N, big.mark = ","), ")")) +
  scale_x_continuous(name = "", limits = c(0.4, 0.8), breaks = seq(0.4, 0.8, 0.2)) +
  # Add percentage labels
  geom_text(aes(x = nonpoor, y = as.factor(survey), label = format(nonpoor*100, digits = 3)),
            color = "#024873", size = 5, vjust = 2) +
  geom_text(aes(x = poor, y = as.factor(survey), label = format(poor*100, digits = 3)),
            color = "#920045", size = 5, vjust = 2) +
   # Add the dot legends
  geom_text(data = filter(data, as.factor(survey) == 2018),
            aes(x = nonpoor, y = 3, label = "NONPOOR"),
            color = "#024873", size = 5, vjust = -1.5, hjust = 0.75, fontface = "bold") +
  geom_text(data = filter(data, as.factor(survey) == 2018),
            aes(x = poor, y = 3, label = "POOR"),
            color = "#920045", size = 5, vjust = -1.5, hjust = 0, fontface = "bold") +
  # Add the theme
  theme(plot.title = element_blank(),
        axis.text.x = element_blank(),
        axis.text.y = element_text(size = 16, color = "black"),
        axis.title.x = element_text(face = "bold", size = 16, color = "black"),
        axis.title.y = element_blank(),
        axis.ticks = element_blank(),
        panel.background = element_blank())
dumbbell
```



```
*************************************************************************
******** Store summary data in a new Stata .dta file and this will be fed into the R code to generate the dumbbell plot
postfile dumbbell str20 (outcome poverty) int survey float (nonpoor poor N) ///
        using "02_Figures\dumbbell.dta", replace
// Run summary statistics commands for prevalence
foreach var of varlist prev_tobacco prev_alcohol prev_health {
        foreach poor of varlist poor_new2015 poor_old2015 {
                svy: mean `var', over(survey `poor')
                post dumbbell ("`var'") ("`poor'") (2012) (e(b)[1,1]) (e(b)[1,2]) (e(_N)[1,1] + e(_N)[1,2])
                post dumbbell ("`var'") ("`poor'") (2015) (e(b)[1,3]) (e(b)[1,4]) (e(_N)[1,3] + e(_N)[1,4])
                post dumbbell ("`var'") ("`poor'") (2018) (e(b)[1,5]) (e(b)[1,6]) (e(_N)[1,5] + e(_N)[1,6])
        }
}
// Run summary statistics commands for share and absolute value, subsetting on prevalence
local outcomes_group "share_tobacco_totex share_alcohol_totex share_health_totex tobacco_2018 alcohol_2018 health_2018"
local subsets_group "prev_tobacco prev_alcohol prev_health prev_alcohol prev_alcohol prev_health"
local n: word count `outcomes_group'
forvalues i = 1/`n' {
        local outcomes: word `i' of `outcomes_group'
        local subsets: word `i' of `subsets_group'
        foreach poor of varlist poor_new2015 poor_old2015 {
                svy, subpop(`subsets'): mean `outcomes', over(survey `poor')
                post dumbbell ("`outcomes'") ("`poor'") (2012) (e(b)[1,1]) (e(b)[1,2]) (e(_N)[1,1] + e(_N)[1,2])
                post dumbbell ("`outcomes'") ("`poor'") (2015) (e(b)[1,3]) (e(b)[1,4]) (e(_N)[1,3] + e(_N)[1,4])
                post dumbbell ("`outcomes'") ("`poor'") (2018) (e(b)[1,5]) (e(b)[1,6]) (e(_N)[1,5] + e(_N)[1,6])
        }
}
postclose dumbbell
```


TOBACCO EXPENDITURE
NONPOOR
POOR
2018
2015
2012
48.4
59.4
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67.7
2.6
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HEALTH OUT-OF-POCKET EXPENDITURE
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96.4
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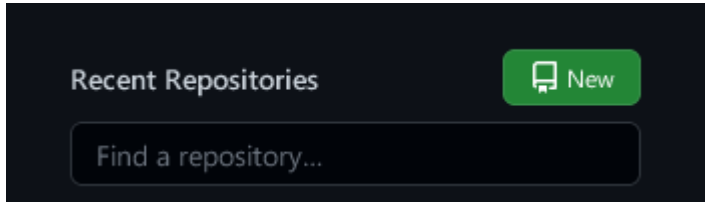
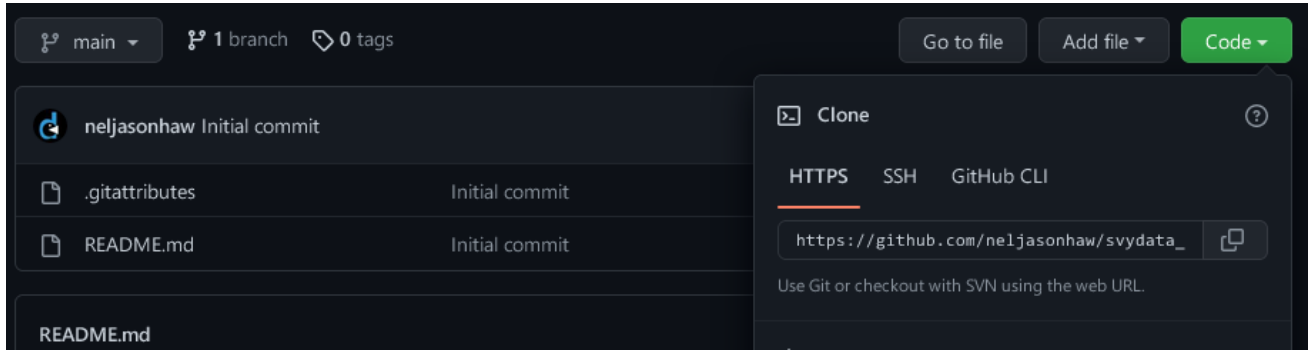
10,417
1,675
10,205
Weighted proportion (%) of households reporting some expenditure
Mean share (%) of household expenditure among households reporting
Mean absolute expenditure in 2018 prices (PHP) among households reporting

1 Set up pre-requisites

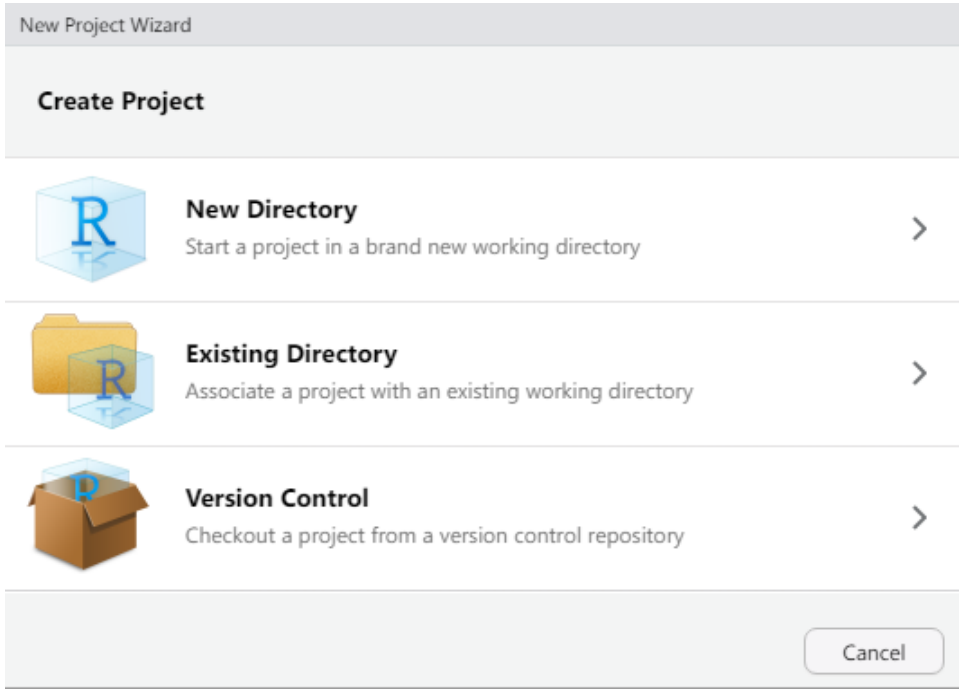
a. Install Git (git-scm.com/downloads)
b. Check for the installation of Git in the shell
   `where git (Windows) / which git (Linux/Mac)`
c. Register / sign in on Github (github.com)
d. Create a new repository



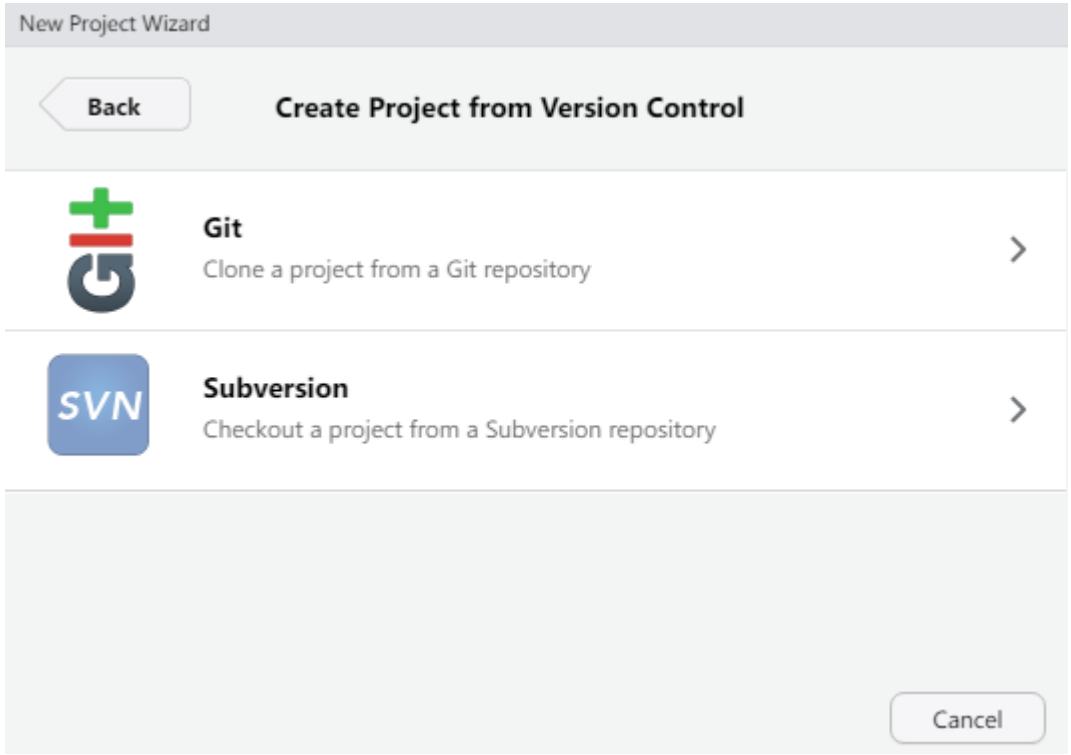
e. Copy the URL via the “Code” button



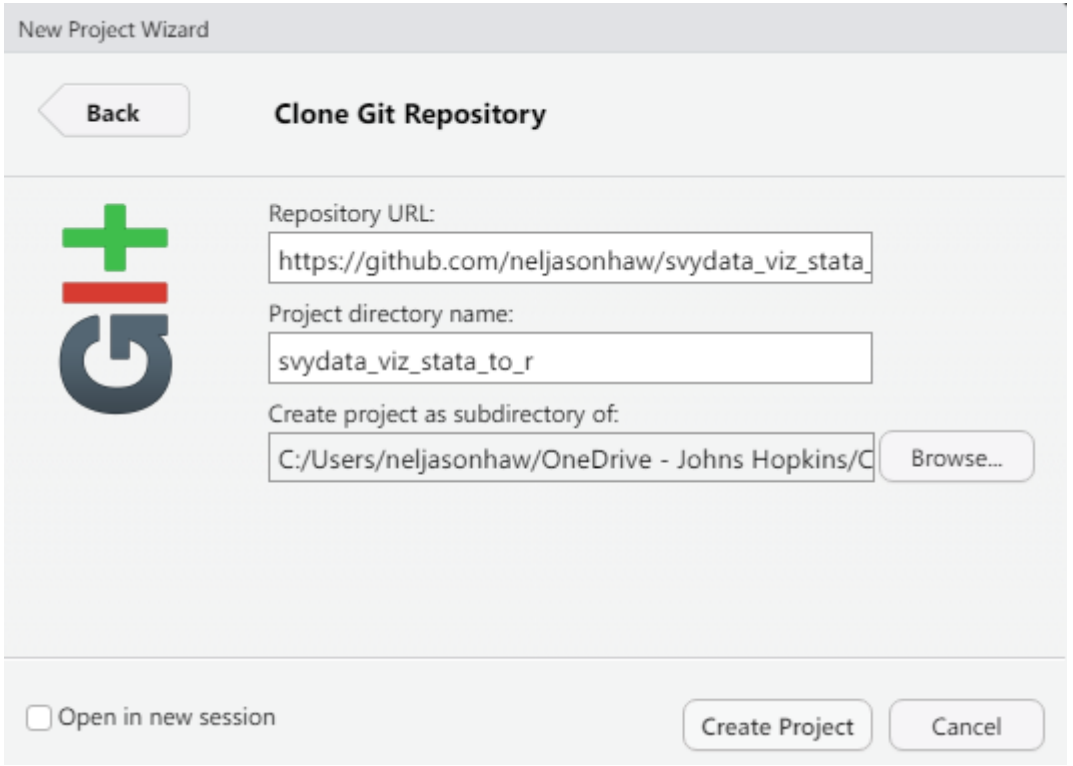
2 On RStudio, File > New Project… then select Version Control



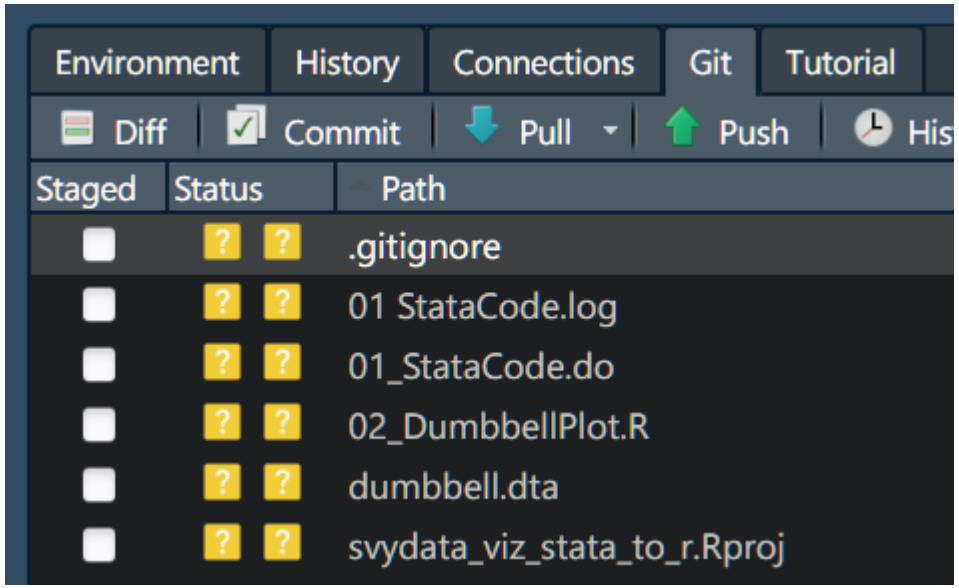
3 Select Git –
Clone a project from a Git repository



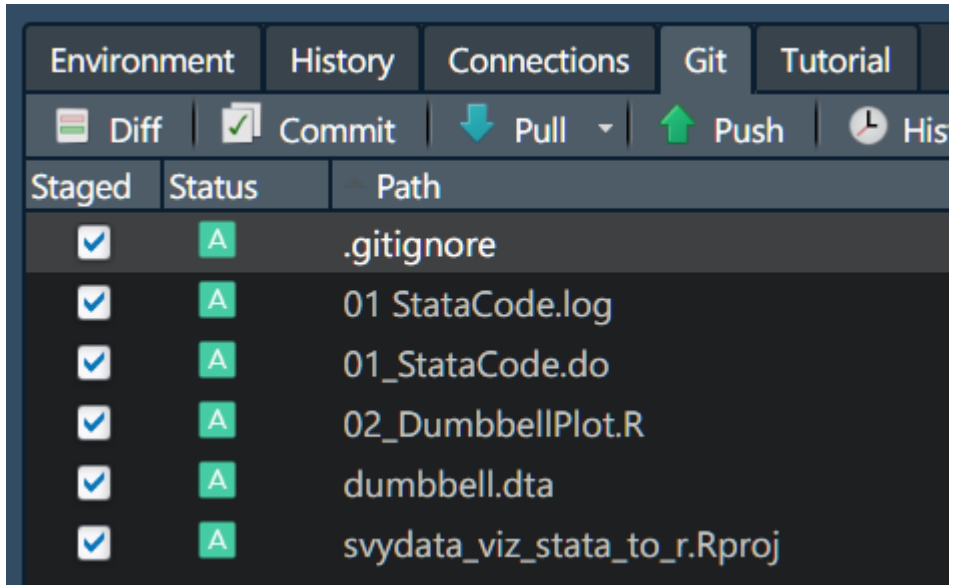
4 Copy the repository URL and identify the local subfolder where the files are housed and click Create Project



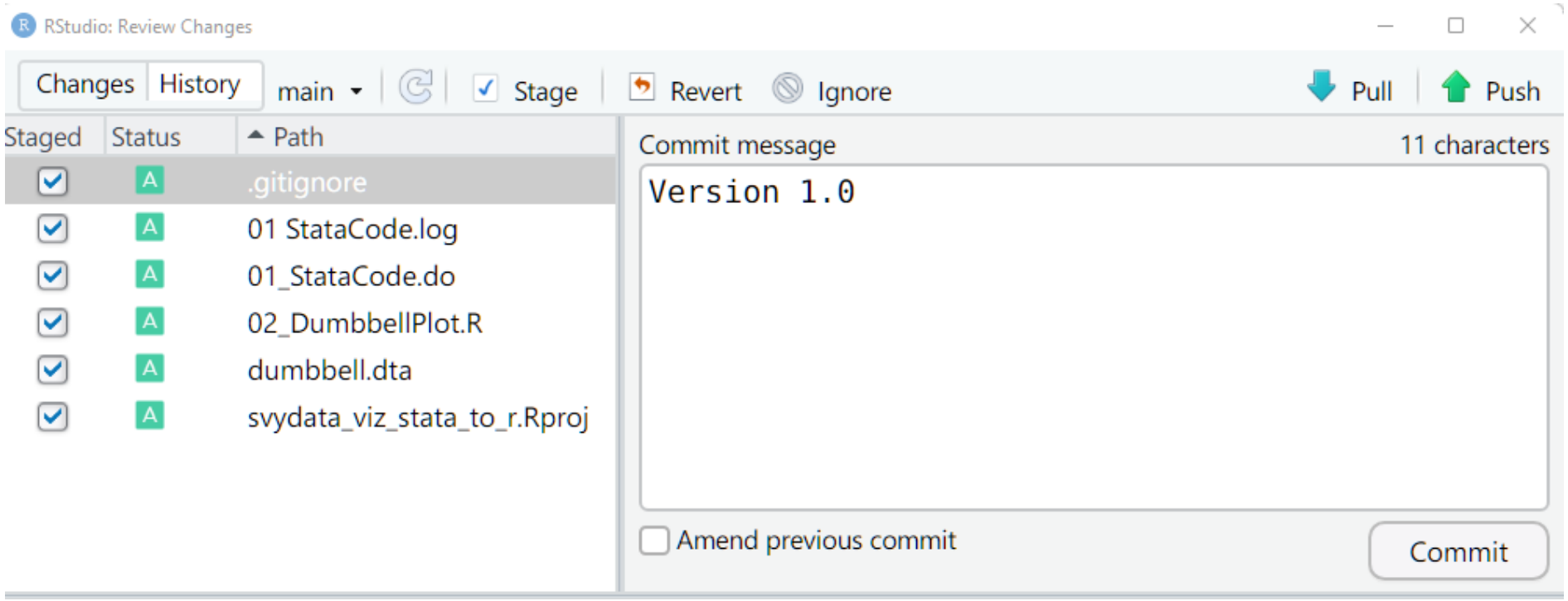
5 Copy any relevant local files into the local subdirectory of the Git repository and they will all appear on the Git tab on RStudio



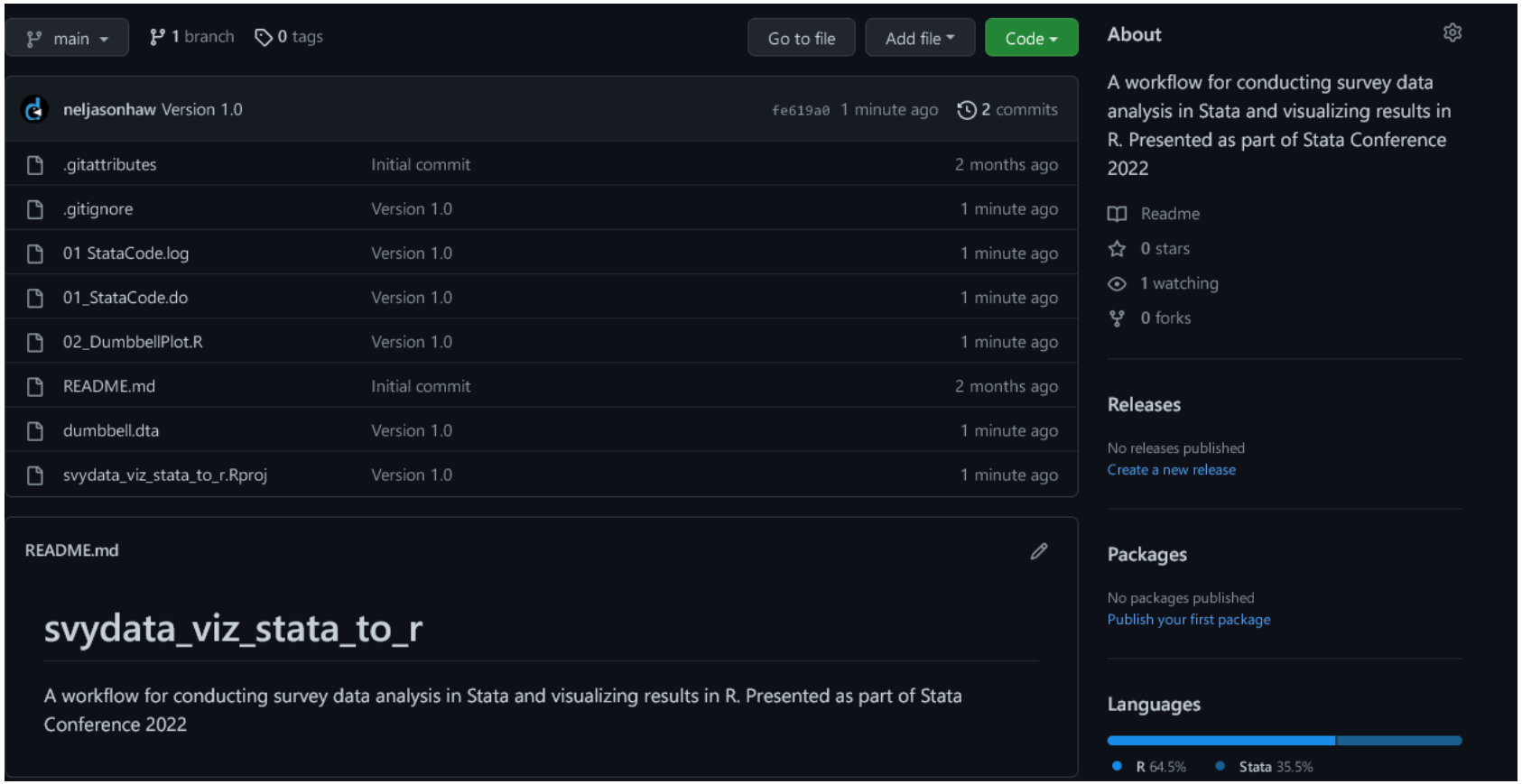
6 Stage any file to be uploaded on Github then click Commit



7 Add a commit message the click Commit then Push



8 The files will appear on your Github repository



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Processed survey data

Survey data analysis

Analysis results stored using *postfile*

Highly flexible execution of the Grammar of Graphics

Read .dta using *haven*

Create plots using *ggplot2*

Upload repository to Github

Visualizing Survey Data Analysis Results:
Marrying the Best from Stata and R

The Github repository for this demonstration is found at github.com/neljasonhaw/svydata_viz_stata_to_r

The Github repository for the entire research project used in this demonstration is found at github.com/neljasonhaw/fies_health_inequalities

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