

# Data Analytics

Lecture Series: Part 2

# Overview



# Overview

In this section, we will:



# Overview

In this section, we will:

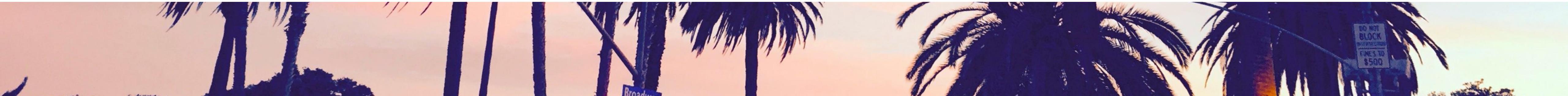
- Navigate and set up R Studio and R Markdown







HORST'19



# Setup



# Directory



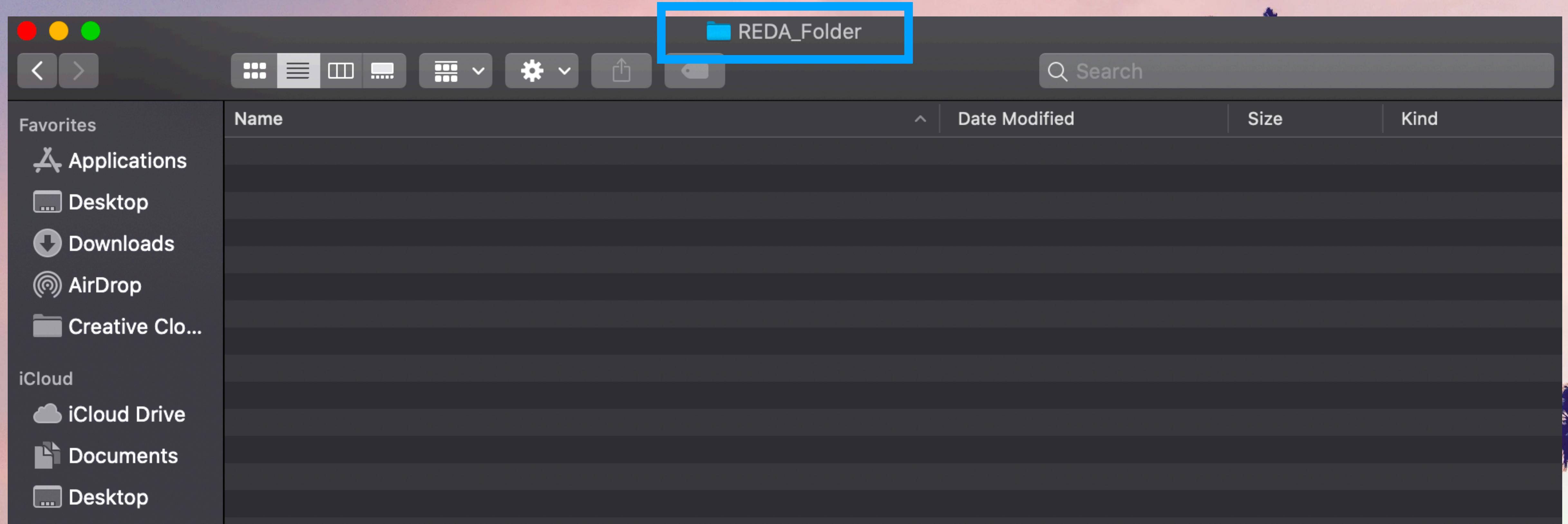
# Setup



# Setup

Directory :

- Create a desktop folder named **“REDA\_Folder”** ... or whatever you like



RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

- New File
- New Project...
- Open File... ⌘O
- Reopen with Encoding...
- Recent Files ▶
- Open Project...
- Open Project in New Session...
- Recent Projects ▶
- Import Dataset
- Save ⌘S
- Save As...
- Save with Encoding...
- Save All ⌘S
- Knit Document ⌘K
- Publish...
- Print...

- R Script ⌘N
- R Notebook
- R Markdown... ▶
- Shiny Web App...
- Text File
- C++ File
- R Sweave
- R HTML
- R Presentation
- R Documentation

editor.Rmd\* outlook\_housing

Insert | Run |

	Environment	History	Connections
	Global Environment	Import Dataset	
■	Name		
■	dailyavg_table		
■	dailyavg_wtmeans		
■	data1990		
■	data1990_2018_race_total		
■	data1990_hisp		
■	data1990_main		
■	data1999_2000		
■	data1999_2000_total		
■	data1999_2018_race_total		
■	data1999_2018_total		
■	f1		
■	geo_northern		
■	geospatial		
■	il		
■	labTheme		
■	logo		
■	model1		
■	monthlyavg_countries		
■	name_region		
■	numbers		

# Setup

Directory :

- Connect R to folder by setting the working directory

RStudio   File   Edit   Code   View   Plots   Session   Build   Debug   Profile   Tools   Window   Help

New Session

Interrupt R  
Terminate R...

Restart R ⌘⌘F10  
Restart R and Clear Output  
Restart R and Run All Chunks

Set Working Directory ►

To Source File Location  
To Files Pane Location

Load Workspace...  
Save Workspace As...

Clear Workspace...

Choose Directory... ⌘⌃H

Quit Session...

GreatRecession.Rmd x MEC\_0412.Rmd x floodzone\_censu

1 ---  
2 title: "R Tutorial"  
3 author: "Mattingly"  
4 date: "2/10/2020"  
5 output: pdf\_document  
6 ---  
7  
8 getwd()  
9 setwd("/Users/petermattingly/Desktop/")  
10  
11 ## creating a notebook chunk  
12 'control' + 'option', then 'i'  
13  
14 ``{r}  
15  
16 ...  
17  
18 ## running individual lines of code  
19 # mac: 'command' then 'return'  
20 # pc: 'control' then 'enter'  
21  
22 ## assignment operator <-  
23  
24  
25 ## creating pipe operator %>%  
26 'command' 'shift' 'm' =  
27  
28  
29 ## libraries and packages  
30  
31 ``{r}  
32 install.packages('data.table', 'tidyverse')

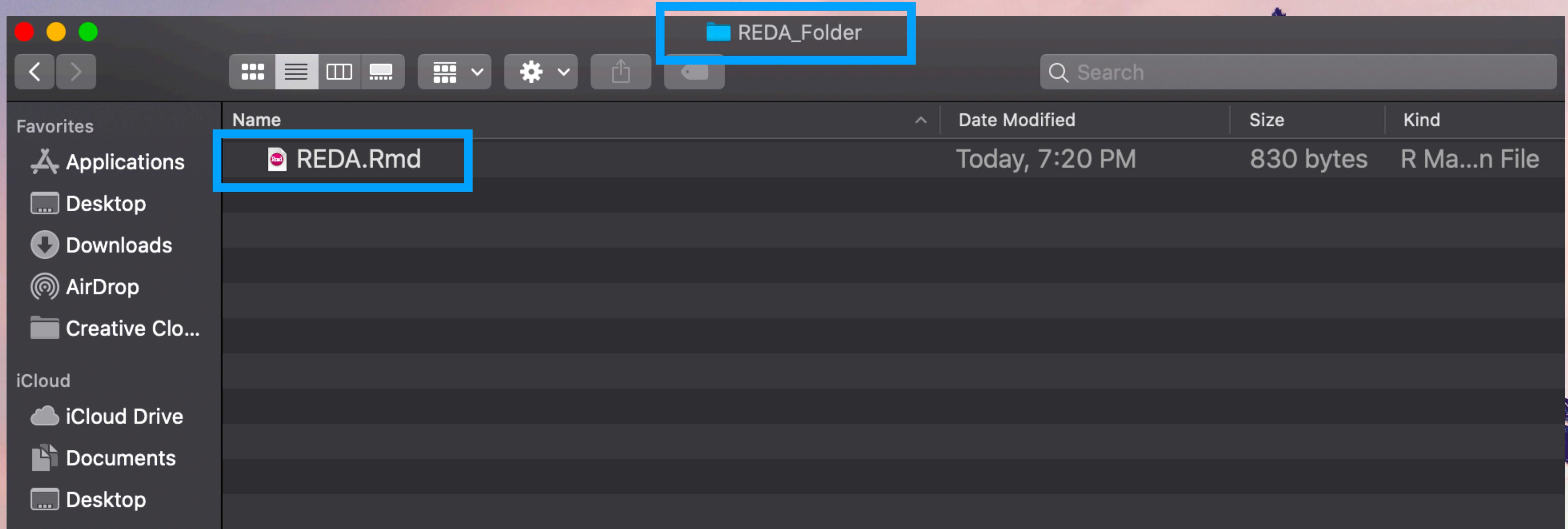
Environment   History   Connection  
Import Dataset  
Global Environment  
Name  
dailyavg\_table  
dailyavg\_wtmeans  
data1990  
1990\_2018\_race\_total  
1990\_hisp  
1990\_main  
999\_2000  
999\_2000\_total  
999\_2018\_race\_total  
data1999\_2018\_total  
f1  
geo\_northern  
geospatial  
il  
labTheme  
logo  
modell  
monthlyavg\_countries  
name\_region  
numbers

Files   Plots   Packages   Help  
Zoom   Export

# Setup

Directory :

- Load and save all files and output to this folder



Directory :

- Global options

# Setup



RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

Install Packages...  
Check for Package Updates...

Version Control ►

Shell...  
Terminal  
Addins ►

Keyboard Shortcuts Help ⌘↑K  
Modify Keyboard Shortcuts...

Project Options... ⌘⌘,

Global Options... (highlighted with a blue box)

GreatRecession.Rmd x MEC\_0412.Rmd x floodzone\_censustract.Rmd x R Tutorial.Rmd x REDA.Rmd x

ABC Knit Insert Run

```
1 ---  
2 title: "REDA"  
3 author: "Mattingly"  
4 date: "10/11/2020"  
5 output: pdf_document  
6 ---  
7  
8 ```{r setup, include=FALSE}  
9 knitr::opts_chunk$set(echo = TRUE)  
10 ```  
11  
12 ## R Markdown  
13  
14 This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and documents. For more details on using R Markdown see <http://rmarkdown.rstudio.com>.  
15  
16 When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:  
17  
18 ```{r cars}  
19 summary(cars)  
20 ```  
21  
22 ## Including Plots  
23
```

Type

- tbl\_df
- grouped\_df
- tbl\_df
- data.frame
- tbl\_df
- tbl\_df
- grouped\_df
- data.frame
- matrix
- data.frame
- function
- data.table
- sf
- function
- rastergrob
- lm
- grouped\_df
- data.table
- integer

## Options

### R General

Code

Appearance

Pane Layout

Packages

R Markdown

Sweave

Spelling

Git/SVN

Publishing

Terminal

#### Default working directory (when not in a project):

~

Browse...

- Re-use idle sessions for project links
- Restore most recently opened project at startup
- Restore previously open source documents at startup
- Restore .RData into workspace at startup

Save workspace to .RData on exit: Never

- Always save history (even when not saving .RData)
- Remove duplicate entries in history
- Show .Last.value in environment listing
- Use debug error handler only when my code contains errors
- Automatically expand tracebacks in error inspector
- Wrap around when navigating to previous/next tab
- Automatically notify me of updates to RStudio

OK

Cancel

Apply

R Markdown :

- Code chunks

# Setup



# Script

```

1 --
2 title: "R Tutorial"
3 author: "Mattingly"
4 date: "2/10/2020"
5 output: pdf_document
6 ---
7
8 getwd()
9 setwd("/Users/petermattingly/Desktop/")
10
11 ## creating a notebook chunk
12 'control' + 'option', then
13
14 ``{r}
15
16 ``
17
18 ## running individual lines of code
19 # mac: 'command' then 'return'
20 # pc: 'control' then 'enter'
21
22 ## assignment operator <-
23
24
25 ## creating pipe operator %>%
26 'command' 'shift' 'm' =
27
28
29 ## libraries and packages
30
31 ``{r}
32 install.packages('data.table', 'tidyverse')
33 library(data.table)
34 library(tidyverse)

```

11:30 # creating a notebook chunk

```

Console Terminal R Markdown
~/
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
Error in (function (formula, data = NULL, subset = NULL, na.action = na.fail, :
  invalid type (list) for variable 'strptime(threemonth$value, "%Y-%m-%d")'
> plot(strptime(threemonth$value, "%Y-%m-%d"), strptime(tenyear$value, "%Y-%m-%d"),
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
Error in plot.window(...) : need finite 'xlim' values
In addition: Warning messages:
1: In min(x) : no non-missing arguments to min; returning Inf
2: In max(x) : no non-missing arguments to max; returning -Inf
3: In min(x) : no non-missing arguments to min; returning Inf
4: In max(x) : no non-missing arguments to max; returning -Inf
> plot(threemonth$value, tenyear$value,
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')
> cor(tenyear$value ~ threemonth$value)
Error in cor(tenyear$value ~ threemonth$value) :
  supply both 'x' and 'y' or a matrix-like 'x'
> cor(tenyear$value, threemonth$value)
[1] 0.7608
> threemonth = drop_na(fredr(series_id = "DGS3M0", observation_start = as.Date("2000-01-01")))
> tenyear = drop_na(fredr(series_id = "DGS10", observation_start = as.Date("2000-01-01")))
> plot(threemonth$value, tenyear$value,
+   xlab=TeX("3 Month Yields"), ylab=TeX("10 Year Yields"),
+   main="Daily Interest Rates Since 2000", pch=16, col='blue')

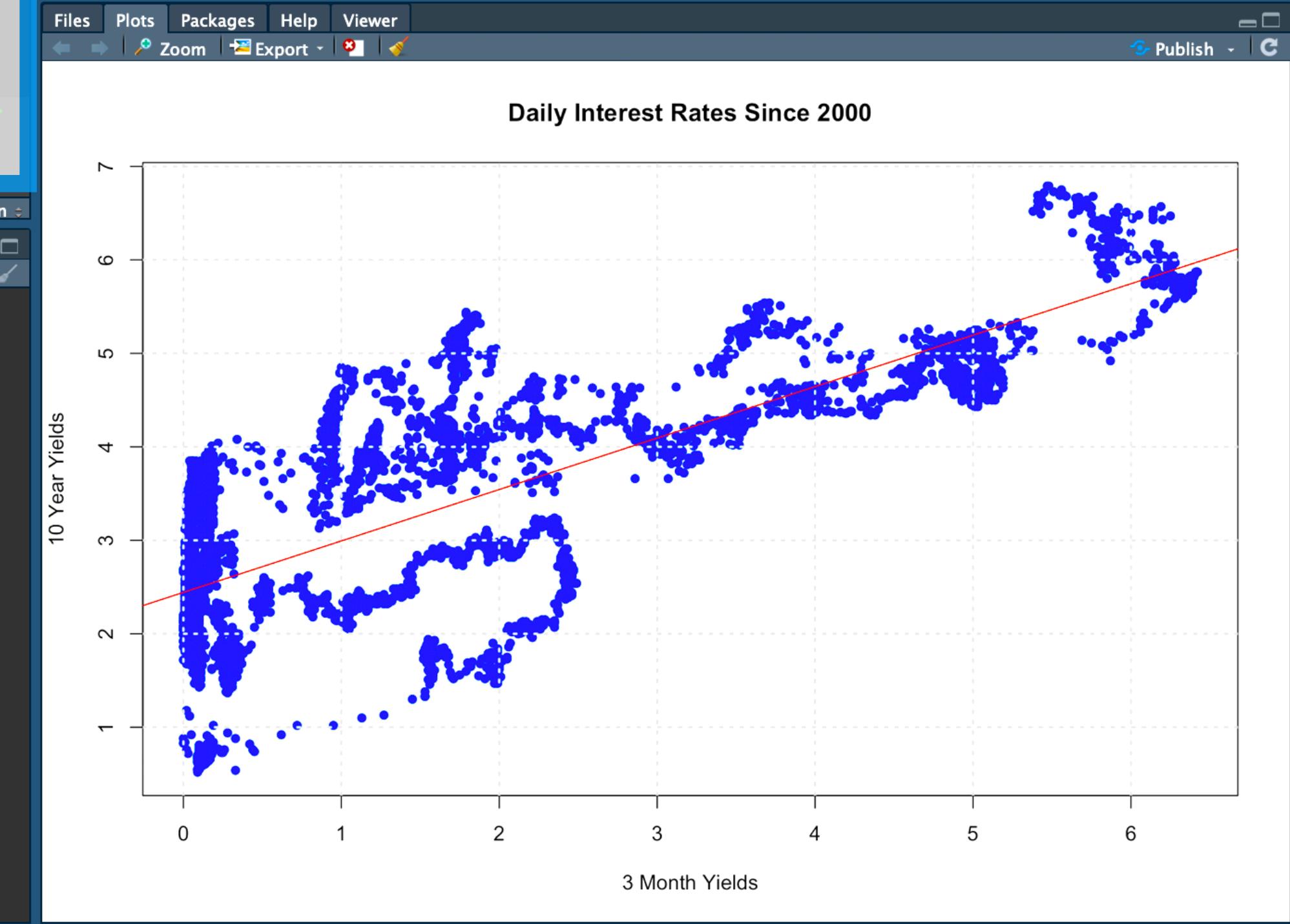
```

Environment History Connections

Import Dataset Grid C

Global Environment

Name	Type	Length	Size	Value
dailyavg_table	tbl_df	7	2 KB	3 obs. of 7 variables
dailyavg_wtmeans	grouped_df	4	66.4 KB	1095 obs. of 4 variables
data1990	tbl_df	6	22 KB	373 obs. of 6 variables
data1990_2018_race_total	data.frame	5	8.7 KB	174 obs. of 5 variables
data1990_hisp	tbl_df	6	7 KB	62 obs. of 6 variables
data1990_main	tbl_df	6	19.1 KB	311 obs. of 6 variables
data1999_2000	grouped_df	5	4.4 KB	12 obs. of 5 variables
data1999_2000_total	data.frame	5	4.3 KB	66 obs. of 5 variables
data1999_2018_race_total	matrix	10	7.9 KB	List of 10
data1999_2018_total	data.frame	5	8.6 KB	174 obs. of 5 variables
f1	function	1	10.1 KB	function (x, y, p = 0)
geo_northern	data.table	9	30.6 KB	97 obs. of 9 variables
geospatial	data.table	9	73.7 KB	246 obs. of 9 variables
il	sf	6	1.4 MB	408 obs. of 6 variables
labTheme	function	1	18 KB	function (base_size = 48)
logo	rastergrob	12	1.8 MB	Large rastergrob (12 elements, 1.8 Mb)
model1	lm	12	1.3 MB	Large lm (12 elements, 1.3 Mb)
monthlyavg_countries	grouped_df	7	47 KB	730 obs. of 7 variables
name_region	data.table	5	38.5 KB	246 obs. of 5 variables
numbers	integer	10	96 B	int [1:10] 1 2 3 4 5 6 7 8 9 10
numlist	numeric	10	176 B	num [1:10] 1 2 3 4 5 6 7 8 9 10
open_daily_graph	gg	9	24.7 KB	List of 9



RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

RStudio

Go to file/function Addins

R Tutorial.Rmd R Tutorial Part 2.Rmd REDA.Rmd GreatRecession.Rmd

ABC Knit Insert Run

6

```
7
8 ## creating a notebook chunk
9 # on a mac: 'control' + 'option', then 'i'
10 # on a pc: 'control' + 'alt', then 'i'
11
12 ``{r}
13 install.packages(c("tidyverse", "devtools", "tidycensus"))
14 ```

Error in install.packages : Updating loaded packages

15
16 ``{r}
17 library(tidyverse)
18 library(devtools)
19 library(tidycensus)
20 ```
21
22 ``{r}
23 devtools::install_github("sboysel/fredr")
24 library(fredr)
25 ```
26
27
```

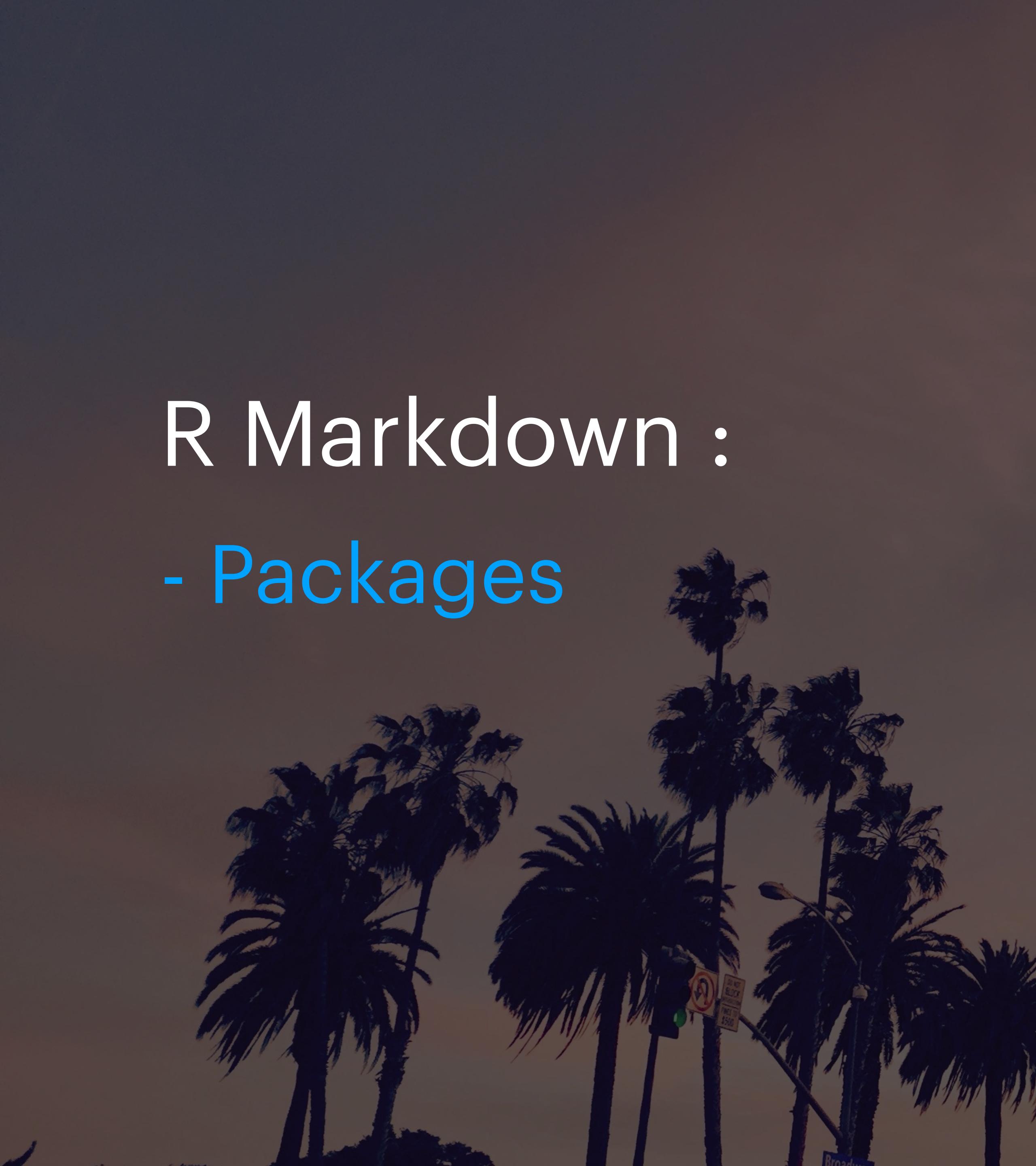
25:1 C Chunk 34 R Markdown

Console Terminal R Markdown

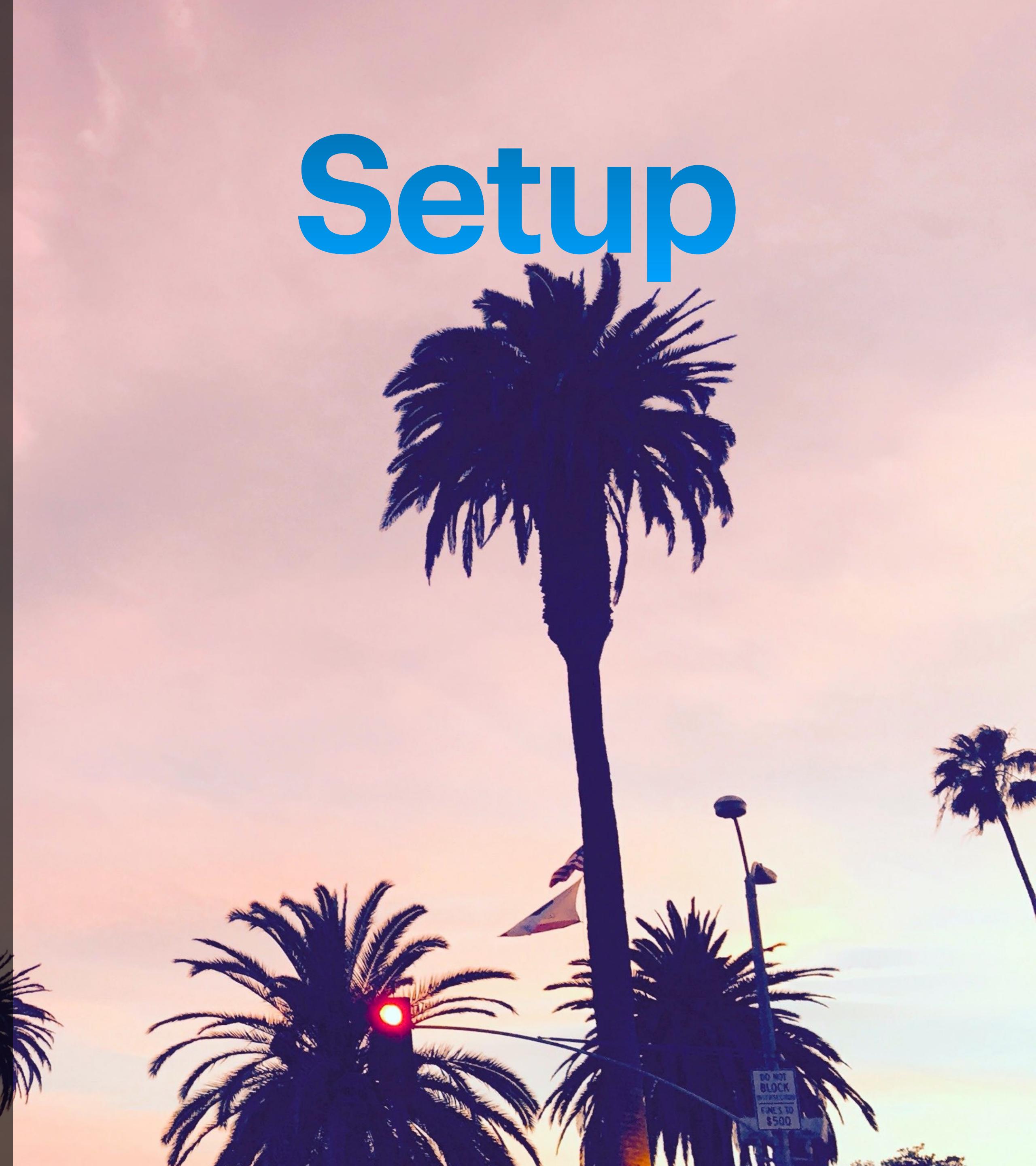
```
~/
> library(tidyverse)
> library(devtools)
> library(tidycensus)
> devtools::install_github("sboysel/fredr")
Skipping install of 'fredr' from a github remote, the SHA1 (97b244ed) has not changed since last install.
  Use `force = TRUE` to force installation
> library(fredr)
>
```

R Markdown :

- Packages



# Setup



The image shows the RStudio IDE running on a Mac OS X desktop. The background features a scenic sunset with palm trees silhouetted against a pink and orange sky. The RStudio interface includes a menu bar with File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, Window, and Help. A toolbar above the editor has icons for file operations like New, Open, Save, Print, and Go to file/function. Below the toolbar, five R Markdown files are listed: R Tutorial.Rmd (active), R Tutorial Part 2.Rmd, REDA.Rmd, and GreatRecession.Rmd. The main editor area contains R code for setting up a notebook chunk, installing packages, and loading libraries. An error message is displayed in a modal window. The console at the bottom shows the command-line output of the R session, including package installations.

```
RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help
```

```
RStudio
```

```
R Tutorial.Rmd x R Tutorial Part 2.Rmd x REDA.Rmd x GreatRecession.Rmd x
```

```
6
7
8 ### creating a notebook chunk
9 # on a mac: 'control' + 'option', then 'i'
10 # on a pc: 'control' + 'alt', then 'i'
11
12 ```{r}
13 install.packages(c("tidyverse", "devtools", "tidycensus"))
14 ```
15
16 ```{r}
17 library(tidyverse)
18 library(devtools)
19 library(tidycensus)
20 ```
21
22 ```{r}
23 devtools::install_github("sboysel/fredr")
24 library(fredr)
25 ```
26
27
```

25:1 C Chunk 34 R Markdown

```
Console Terminal x R Markdown x
~/
> library(tidyverse)
> library(devtools)
> library(tidycensus)
> devtools::install_github("sboysel/fredr")
Skipping install of 'fredr' from a github remote, the SHA1 (97b244ed) has not changed since last install.
  Use `force = TRUE` to force installation
> library(fredr)
>
```

The image shows the RStudio IDE running on a computer screen. The background features a scenic sunset with palm trees silhouetted against a pink and orange sky. A blue rectangular box highlights the number '1st' in white text, positioned near the top right of the RStudio window.

RStudio

File Edit Code View Plots Session Build Debug Profile Tools Window Help

RStudio

Go to file/function Addins

R Tutorial.Rmd x R Tutorial Part 2.Rmd x REDA.Rmd x GreatRecession.Rmd x

ABC Knit Insert Run

```
6
7
8 ### creating a notebook chunk
9 # on a mac: 'control' + 'option', then 'i'
10 # on a pc: 'control' + 'alt', then 'i'
11
12 ```{r}
13 install.packages(c("tidyverse", "devtools", "tidycensus"))
14 ```
15
16 ```{r}
17 library(tidyverse)
18 library(devtools)
19 library(tidycensus)
20 ```
21
22 ```{r}
23 devtools::install_github("sboysel/fredr")
24 library(fredr)
25 ```
26
27
```

25:1 C Chunk 34 R Markdown

Console Terminal R Markdown

```
~/
> library(tidyverse)
> library(devtools)
> library(tidycensus)
> devtools::install_github("sboysel/fredr")
Skipping install of 'fredr' from a github remote, the SHA1 (97b244ed) has not changed since last install.
  Use `force = TRUE` to force installation
> library(fredr)
>
```

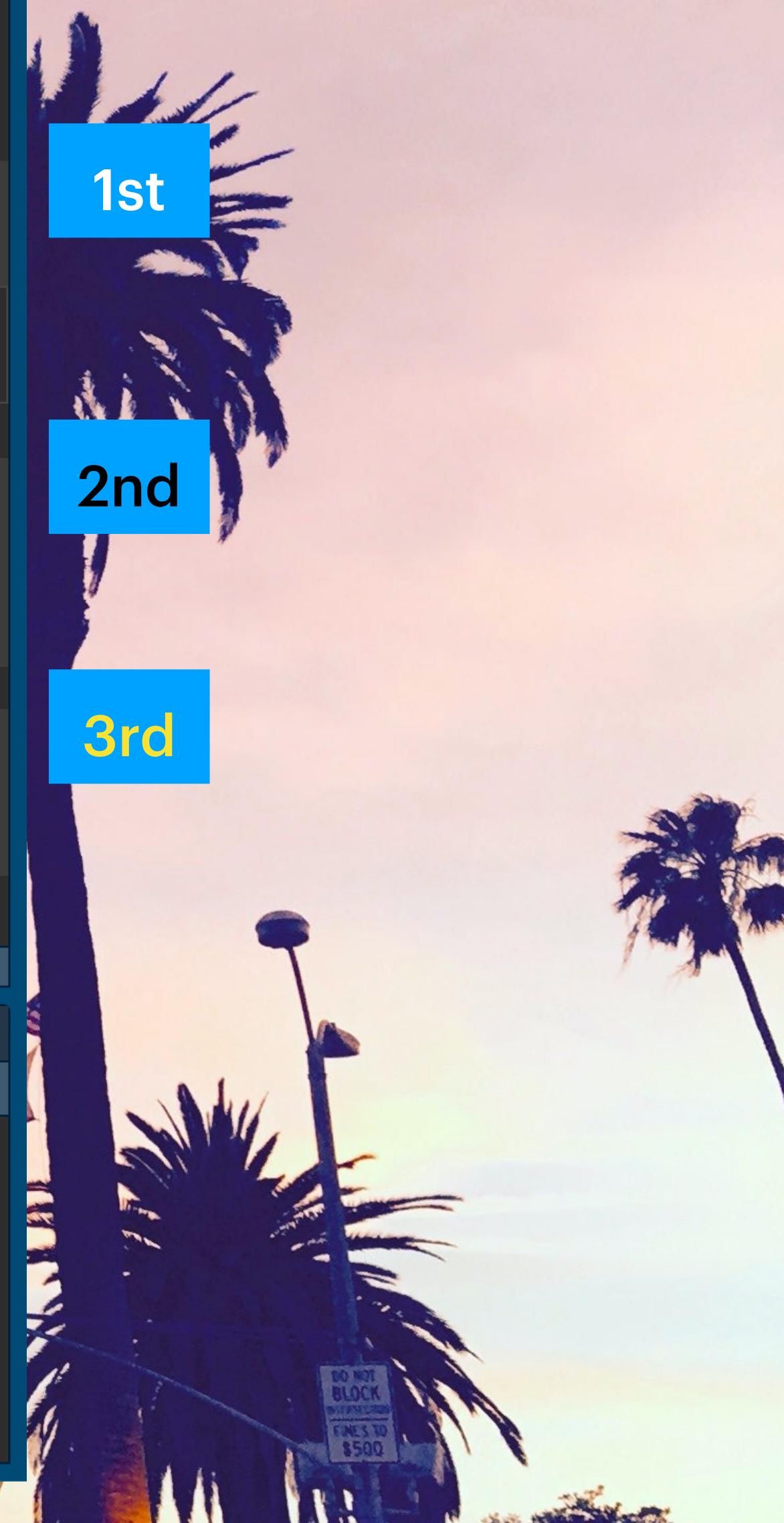
The code editor has three execution panes. The first pane (row 12) shows an error message: 'Error in install.packages : Updating loaded packages'. The second pane (row 16) shows the loading of tidyverse, devtools, and tidycensus packages. The third pane (row 23) shows the installation of fredr from GitHub. The status bar at the bottom indicates '25:1' and 'Chunk 34'. The bottom panel shows the 'Console' tab active, displaying the same R code and its execution results.

```
~/
> library(tidyverse)
> library(devtools)
> library(tidycensus)
> devtools::install_github("sboysel/fredr")
Skipping install of 'fredr' from a github remote, the SHA1 (97b244ed) has not changed since last install.
  Use `force = TRUE` to force installation
> library(fredr)
>
```



The code editor has three execution panes below it, each with a blue border and a play button icon. The first pane contains the error message 'Error in install.packages : Updating loaded packages'. The second and third panes contain the library loading code. The status bar at the bottom indicates '25:1' and 'Chunk 34'. The bottom navigation bar shows tabs for 'Console', 'Terminal', and 'R Markdown', with 'R Markdown' currently selected. The console tab shows the command-line history:

```
> library(tidyverse)
> library(devtools)
> library(tidycensus)
> devtools::install_github("sboysel/fredr")
Skipping install of 'fredr' from a github remote, the SHA1 (97b244ed) has not changed since last install.
  Use `force = TRUE` to force installation
> library(fredr)
>
```



# RStudio

Function |

**REDA.Rmd\***

**Updating Loaded Packages**

One or more of the packages that will be updated by this installation are currently loaded. Restarting R prior to updating these packages is strongly recommended.

RStudio can restart R and then automatically continue the installation after restarting (all work and data will be preserved during the restart).

Do you want to restart R prior to installing?

then 'i'  
'i'  
  
`devtools", "tidycensus"))`

History Connections  
Import Dataset   
Environment  
Type Length

Type	Length
tbl_df	6
01...	data.frame 5
isp	tbl_df 6
data1990_main	tbl_df 6
data1999_2000	grouped_df 5
data1999_200...	data.frame 5
data1999_201...	matrix 10
data1999_201...	data.frame 5
f1	function 1
geo_northern	data.table 9

# Console

The RStudio interface showing various components:

- Top Bar:** Go to file/funct, Addins, Project: (None).
- Left Panel:** A code editor window showing R Markdown code for a "R Tutorial". It includes sections for creating a notebook chunk, running individual lines of code, assignment operator, pipe operator, libraries and packages, and creating a notebook chunk again.
- Environment Tab:** Shows the Global Environment with a table of objects:
 

Name	Type	Length	Size	Value
dailyavg_table	tbl_df	7	2 KB	3 obs. of 7 variables
dailyavg_wtmeans	grouped_df	4	66.4 KB	1095 obs. of 4 variables
data1990	tbl_df	6	22 KB	373 obs. of 6 variables
data1990_2018_race_total	data.frame	5	8.7 KB	174 obs. of 5 variables
data1990_hisp	tbl_df	6	7 KB	62 obs. of 6 variables
data1990_main	tbl_df	6	19.1 KB	311 obs. of 6 variables
data1999_2000	grouped_df	5	4.4 KB	12 obs. of 5 variables
data1999_2000_total	data.frame	5	4.3 KB	66 obs. of 5 variables
data1999_2018_race_total	matrix	10	7.9 KB	List of 10
data1999_2018_total	data.frame	5	8.6 KB	174 obs. of 5 variables
f1	function	1	10.1 KB	function (x, y, p = 0)
geo_northern	data.table	9	30.6 KB	97 obs. of 9 variables
geospatial	data.table	9	73.7 KB	246 obs. of 9 variables
il	sf	6	1.4 MB	408 obs. of 6 variables
labTheme	function	1	18 KB	function (base_size = 48)
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model1	lm	12	1.3 MB	Large lm (12 elements, 1.3 Mb)
monthlyavg_countries	grouped_df	7	47 KB	730 obs. of 7 variables
name_region	data.table	5	38.5 KB	246 obs. of 5 variables
numbers	integer	10	96 B	int [1:10] 1 2 3 4 5 6 7 8 9 10
numlist	numeric	10	176 B	num [1:10] 1 2 3 4 5 6 7 8 9 10
open_daily_graph	gg	9	24.7 KB	List of 9
- Plots Tab:** A scatter plot titled "Daily Interest Rates Since 2000" showing "10 Year Yields" on the y-axis versus "3 Month Yields" on the x-axis. The plot includes a red regression line.

19  
14:1 C Chunk 34 R Markdown

Console Terminal R Markdown

~/

```
(as LID is unspecified)
also installing the dependency 'covr'

There are binary versions available but the source versions are later:
  binary source needs_compilation
covr      3.5.0  3.5.1          TRUE
devtools   2.2.2  2.3.2         FALSE
tidycensus 0.9.6 0.10.2        FALSE

Do you want to install from sources the package which needs compilation? (Yes/no/cancel) Yes
```

API Keys :

- fredr
- tidycensus

# Setup



RStudio File Edit Code View Plots Session Build Debug Profile Tools Window Help

RStudio

+ | Go to file/function | Addins

R Tutorial.Rmd R Tutorial Part 2.Rmd REDA.Rmd GreatRecession.Rmd

ABC Knit Insert Run

```
18 library(devtools)
19 library(tidyCensus)
20 ``
21 ``
22 ``{r}
23 devtools::install_github("sboysel/fredR")
24 library(fredR)
25 ``
26 
27 **FRED API KEY**
28 
29 ``{r}
30 fredr_set_key('YOUR API KEY HERE')
31 ``
32 
33 **CENSUS API KEY**
34 
35 ``{r}
36 census_api_key('YOUR API KEY HERE')
37 ````
```

1:1 # REDA R Markdown

