```
library(readr)
library(tidyverse)
```

```
## ── Attaching packages ─────────────────────────────────────── tidyverse
1.3.2 ──
## ✓ ggplot2 3.4.0      ✓ dplyr   1.0.10
## ✓ tibble  3.1.8      ✓ stringr 1.5.0
## ✓ tidyr   1.2.1      ✓ forcats 0.5.2
## ✓ purrr   0.3.5
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## ✖ dplyr::filter() masks stats::filter()
## ✖ dplyr::lag()    masks stats::lag()
```

```
library(parsedate)
```

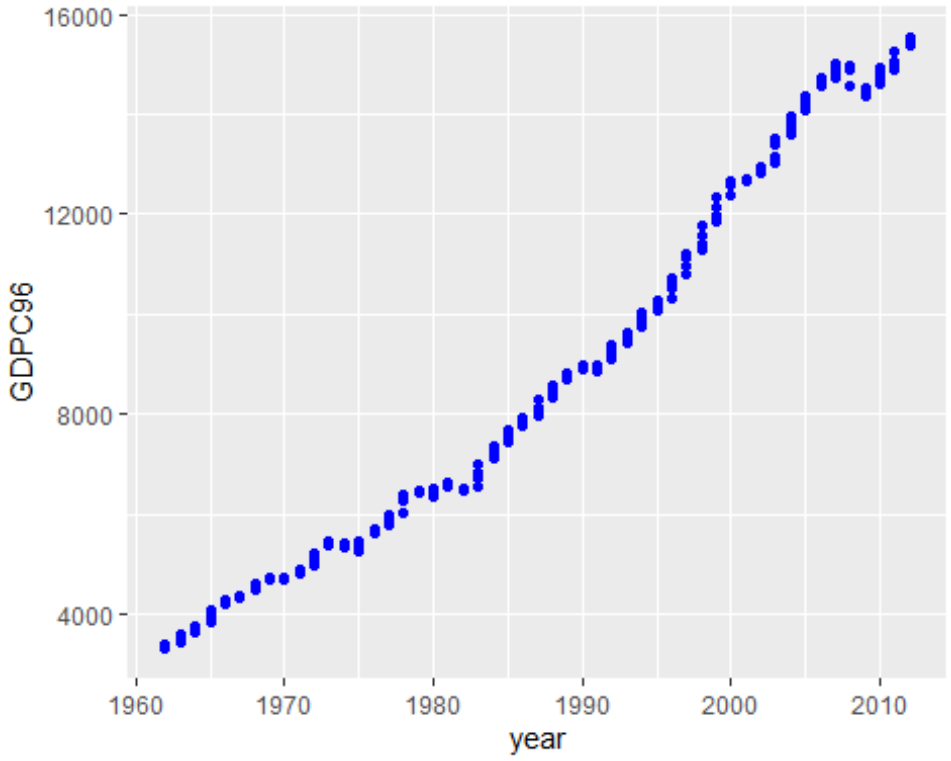
```
##
## Attaching package: 'parsedate'
##
## The following object is masked from 'package:readr':
##
##     parse_date
```

```
library(lubridate)
```

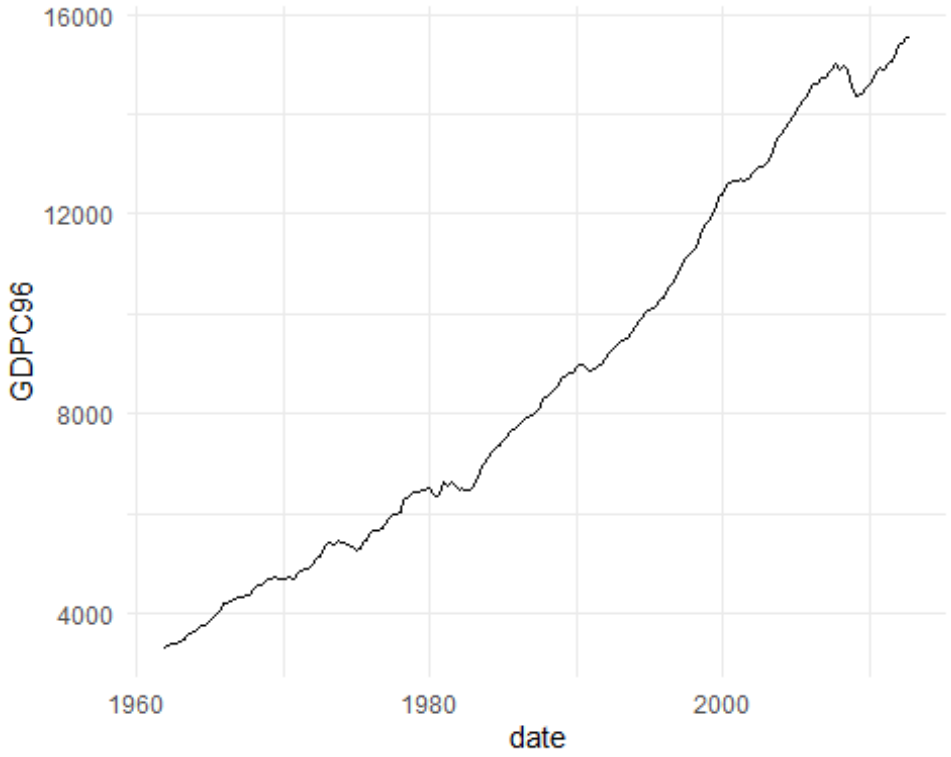
```
## Loading required package: timechange
##
## Attaching package: 'lubridate'
##
## The following objects are masked from 'package:base':
##
##     date, intersect, setdiff, union
```

```
## QUESTION 1
## The code reads the file and manipulates the file by renaming GS10 to
TB10YS. The code calcualtes GDPGR and converts the decimal values in the Date
column to proper dates. Finally, it retains only dates between 1962 and 2012.

us_macro_quarterly = read_rds( "us_macro_quarterly.rds")
us_macro_quarterly = rename(us_macro_quarterly, TB10YS = GS10)
us_macro_quarterly = mutate(us_macro_quarterly,
                            GDPGR = 400 * log(GDPC96/lag(GDPC96)),
                            TSpread = TB10YS - TB3MS,
                            date = date_decimal(Date,tz="UTC"),
                            year = year(date))

us_macro_quarterly = filter(us_macro_quarterly, year>=1962, year<=2012)
```

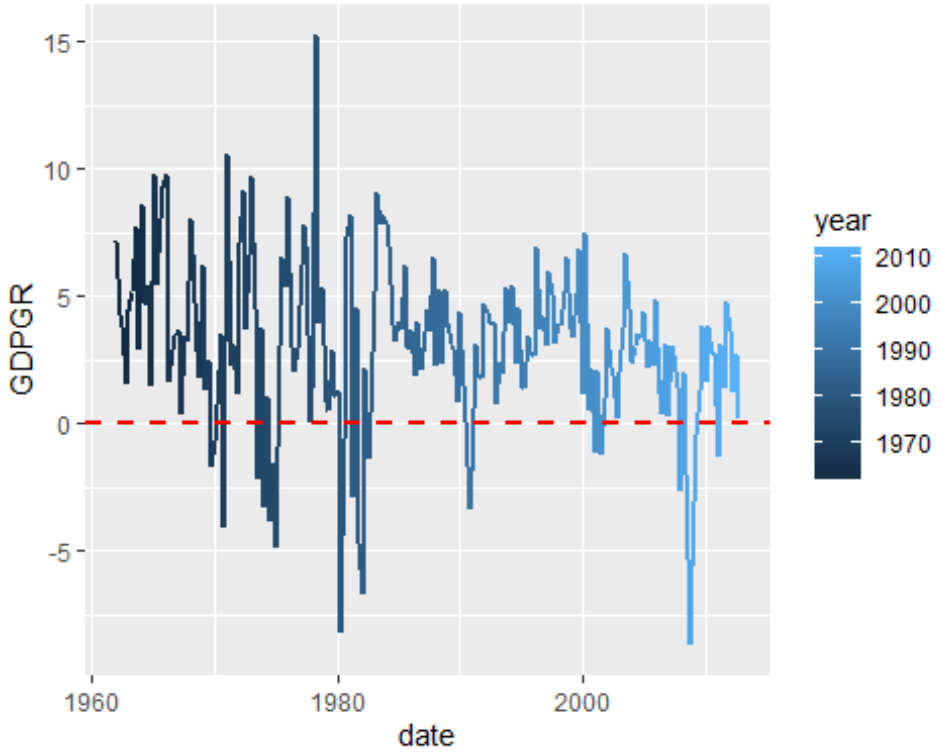
```r
##QUestion 2a(i)
ggplot(data = us_macro_quarterly) +
geom_point(mapping = aes(x = year, y = GDPC96), color = "blue")
```



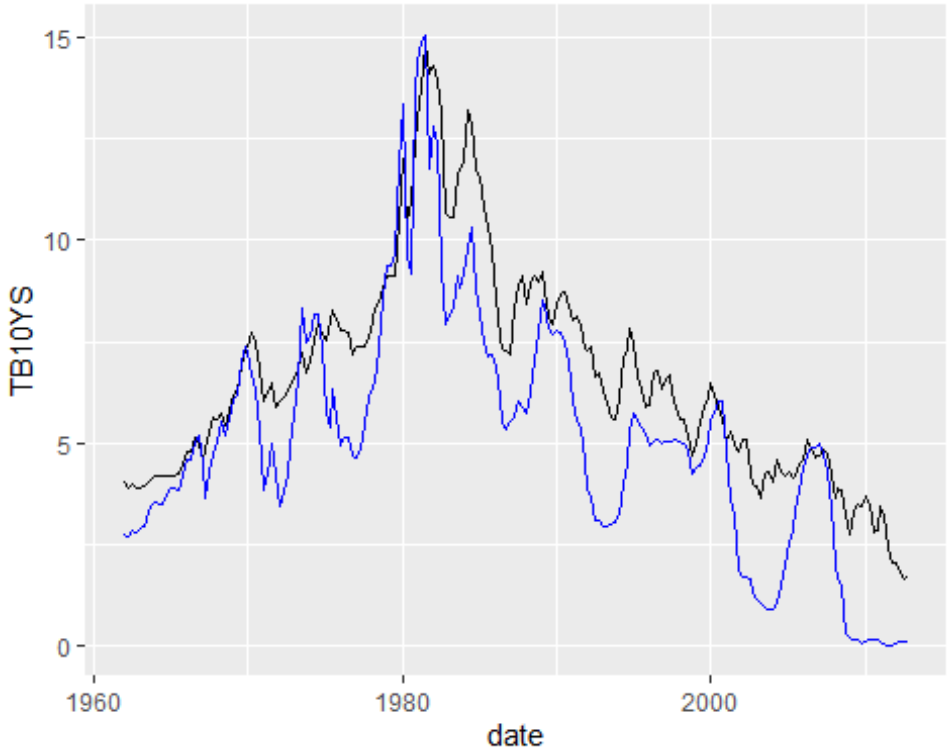

```r
##QUESTION 2a(i)
ggplot(us_macro_quarterly, aes(x = date, y = GDPC96, group=1)) +
    geom_line() +
    scale_color_manual(values = c("#00AFBB", "#E7B800")) +
    theme_minimal()
```



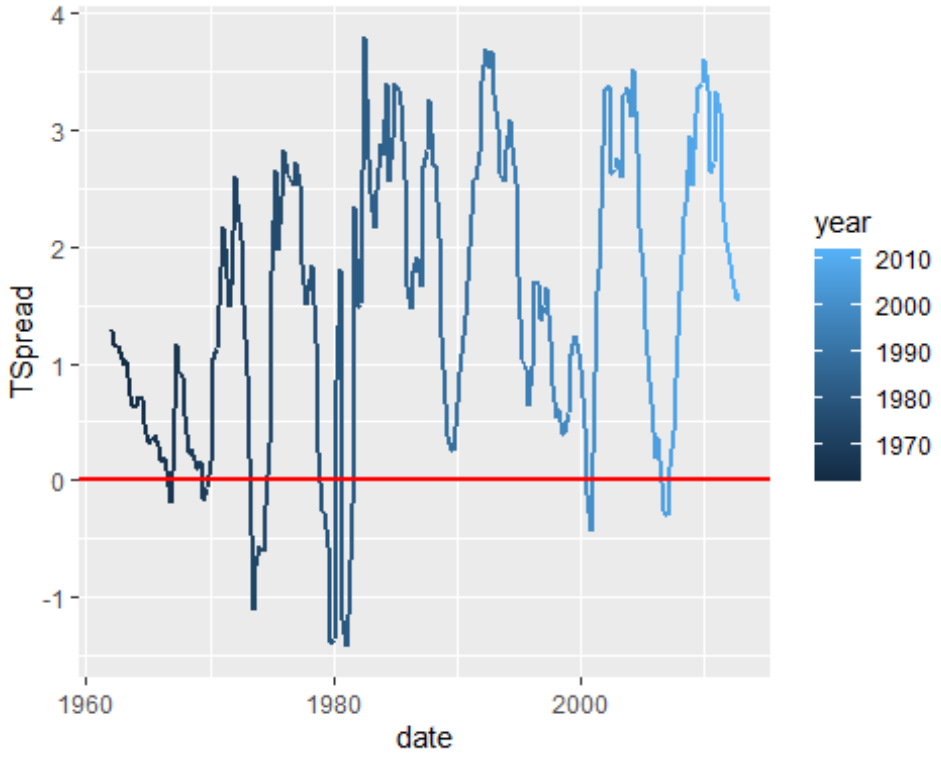

```
##QUESTION 2a(ii)
ggplot(us_macro_quarterly, aes(x = date, y = GDPGR, color = year)) +
  geom_line(lwd=1)+
  geom_hline(yintercept = 0,lwd=1,linetype=2, colour= 'red', )

## Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
## ℹ Please use `linewidth` instead.
```



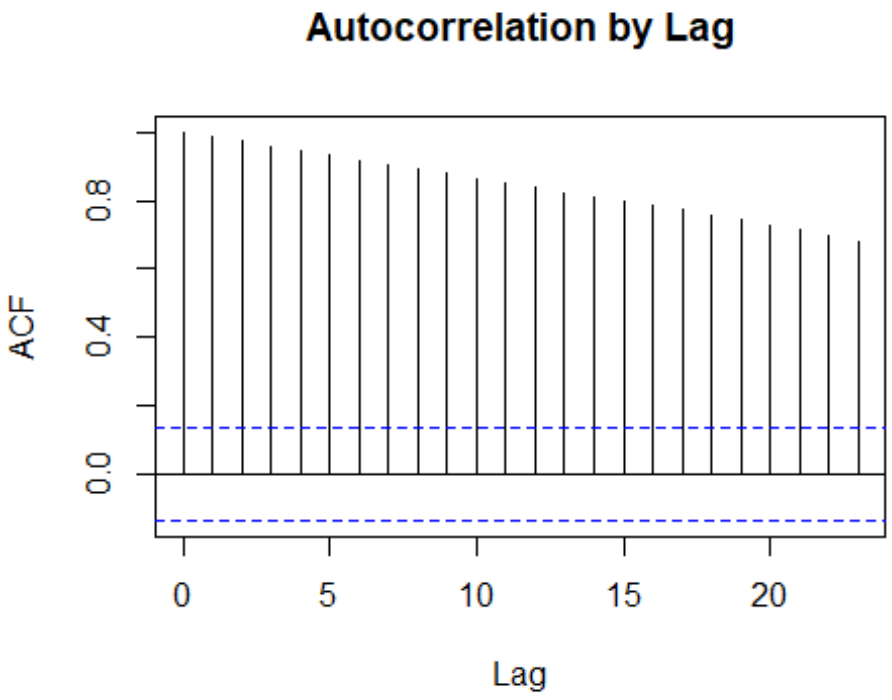

```
##QUESTION 2b(i)

ggplot(data = us_macro_quarterly) +
  geom_line(aes(x = date, y = TB10YS), color = "black") +
  geom_line(aes(x = date, y= TB3MS), colour = "blue")
```




```r
##QUESTION b(ii)
ggplot(us_macro_quarterly, aes(x = date, y = TSpread, color = year)) +
  geom_line(lwd=1)+
  geom_hline(yintercept = 0,lwd=1,linetype=1, colour= 'red', )
```




```
##QUESTION 3
library(tseries)

## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo

acf(us_macro_quarterly$GDPC96, pl=FALSE)

##
## Autocorrelations of series 'us_macro_quarterly$GDPC96', by lag
##
##     0     1     2     3     4     5     6     7     8     9    10    11
12
## 1.000 0.987 0.973 0.959 0.946 0.932 0.919 0.905 0.892 0.878 0.865 0.851
0.838
##    13    14    15    16    17    18    19    20    21    22    23
## 0.825 0.812 0.799 0.786 0.772 0.758 0.743 0.728 0.713 0.697 0.682

##The autocorrelation at lag 0 is 1, the autocorrelation at lag 1 is 0.987.
This shows the degree of similarity between the time series and the lagged
values of GDPR96.

acf(us_macro_quarterly$GDPC96, main='Autocorrelation by Lag')
```




```
#acf(us_macro_quarterly$GDPC96, lag=8, pl=FALSE)

## QUESTION 4
library(huxtable)

##
## Attaching package: 'huxtable'

## The following object is masked from 'package:dplyr':
##
##     add_rownames

## The following object is masked from 'package:ggplot2':
##
##     theme_grey

library(estimatr)
library(flextable)

##
## Attaching package: 'flextable'

## The following objects are masked from 'package:huxtable':
##
##     align, as_flextable, bold, font, height, italic, set_caption,
##     valign, width
```

```
## The following object is masked from 'package:purrr':
##
##     compose

library(dynlm)

## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric

AR1 <- dynlm(ts(us_macro_quarterly$GDPGR) ~ L(ts(us_macro_quarterly$GDPGR)) +
L(ts(us_macro_quarterly$GDPGR), 1))

AR2 <- dynlm(ts(us_macro_quarterly$GDPGR) ~ L(ts(us_macro_quarterly$GDPGR)) +
L(ts(us_macro_quarterly$GDPGR), 2))


AR3 <- dynlm(ts(us_macro_quarterly$GDPGR) ~ L(ts(us_macro_quarterly$GDPGR)) +
L(ts(us_macro_quarterly$GDPGR), 3))


AR4 <- dynlm(ts(us_macro_quarterly$GDPGR) ~ L(ts(us_macro_quarterly$GDPGR)) +
L(ts(us_macro_quarterly$GDPGR), 4))


##4b

huxreg(AR1, AR2, AR3, AR4)

## Warning: The `tidy()` method for objects of class `dynlm` is not
maintained by the broom team, and is only supported through the `lm` tidier
method. Please be cautious in interpreting and reporting broom output.
##
## This warning is displayed once per session.
```

	(1)	(2)	(3)	(4)
(Intercept)	1.995 ***	1.632 ***	1.907 ***	1.728 ***
	(0.301)	(0.329)	(0.341)	(0.352)
L(ts(us_macro_quarterly$GDPGR))	0.338 ***	0.278 ***	0.328 ***	0.326 ***
	(0.066)	(0.070)	(0.070)	(0.067)

L(ts(us_macro_quarterly$GDPGR), 1)				
L(ts(us_macro_quarterly$GDPGR), 2)		0.179 *		
		(0.070)		
L(ts(us_macro_quarterly$GDPGR), 3)			0.039	
			(0.069)	
L(ts(us_macro_quarterly$GDPGR), 4)				0.102
				(0.067)
N	203	202	201	200
R2	0.115	0.143	0.116	0.125
logLik	-520.592	-515.236	-516.295	-513.074
AIC	1047.184	1038.472	1040.590	1034.148

*** p < 0.001; ** p < 0.01; * p < 0.05.

```
##Question 5

submacro = select(us_macro_quarterly, date, GDPGR)
reg = lm(GDPGR ~ date, data = submacro)
submacro$new = predict(reg)




Average_squared_error <- mean((submacro$GDPGR-predict(reg))^2)

##QUESTION 6
library(broom)
reg2 = lm(GDPGR ~ date, data = submacro)
regtab = glance(reg2)
regtab
```

adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	df.res
0.0406	3.29	9.6	0.00223	1	-531	1.07e+03	1.08e+03	2.18e+03	

```
regtab$r.squared

## [1] 0.04535291
```

```r
regtab$adj.r.squared
```

```
## [1] 0.04062694
```

```r
## Lower AIC gives a better model
## AIC penalises the inclusion of additional variables
## BIC results in negations for inclusion of additional variables
## Both aic and BIC help determine model quality

##QUESTION 7

library(dynlm)
gdp_ts <- ts(us_macro_quarterly$GDPGR,
                  start = c(1960, 1),
                  end = c(2012, 10),
                  frequency = 4)

spread <- ts(us_macro_quarterly$TSpread,
                 start = c(1960, 1),
                 end = c(2012, 4),
                 frequency = 4)

# ts objects
ADLdata <- ts.union(gdp_ts, spread)


GDPGR_ADL21 <- dynlm(gdp_ts ~ L(gdp_ts) + L(gdp_ts, 2) + L(spread),
      start = c(1962, 1), end = c(2012, 4))
```