Historical approach to estimating the volatility parameter

In [88]:
```
library("tidyverse")
library("lubridate")
```

In [89]:
```
MSFT_orig <- read_csv("StockPrice.csv")

MSFT <- MSFT_orig

MSFT <- MSFT %>% mutate(Date = dmy(Date))
```

```
── Column specification ────────────────────────────────────────────────────────
cols(
  Date = col_character(),
  Close = col_double()
)
```

In [90]:
```
MSFT %>% glimpse()
```

```
Rows: 61
Columns: 2
$ Date  <date> 2001-11-12, 2001-11-09, 2001-11-08, 2001-11-07, 2001-11-06, 20…
$ Close <dbl> 65.79, 65.21, 64.42, 64.25, 64.78, 63.27, 61.40, 61.84, 58.15, …
```

In [92]:
```
MSFT <- MSFT %>% mutate(LagClose = lag(Close),  #get the lag 1 Close da
                RatioPriceChange = Close / LagClose,
                logPriceRat = log(RatioPriceChange, base = exp(1)),
                        Xi = logPriceRat) # calculate the price ratio

MSFT %>% head(10)
```

A tibble: 10 × 6

Date	Close	LagClose	RatioPriceChange	logPriceRat	Xi
<date>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
2001-11-12	65.79	NA	NA	NA	NA
2001-11-09	65.21	65.79	0.9911841	-0.008855020	-0.008855020
2001-11-08	64.42	65.21	0.9878853	-0.012188688	-0.012188688
2001-11-07	64.25	64.42	0.9973611	-0.002642420	-0.002642420
2001-11-06	64.78	64.25	1.0082490	0.008215190	0.008215190
2001-11-05	63.27	64.78	0.9766903	-0.023585631	-0.023585631

Date	Close	LagClose	RatioPriceChange	logPriceRat	Xi
<date>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
2001-11-02	61.40	63.27	0.9704441	-0.030001448	-0.030001448

In [93]:
```
Xi <- MSFT$logPriceRat  #Create an array of all independent variables

Xi

X_bar <- mean(Xi, na.rm = TRUE) #this is the average of the iid RVs

X_bar

MSFT <- MSFT %>% mutate(DevFromMean = Xi - X_bar) #calculate how far ea
```

<NA> · -0.00885501969279577 · -0.012188687502058 · -0.00264242012772366 · 0.00821518996785407 · -0.0235856305843902 · -0.0300014480056963 · 0.00714056912606979 · -0.0615245253144932 · 0.0124755954559475 · 0.0128250154759168 · 0.0420285098485961 · 0.00577109649192187 · -0.0200200422334423 · -0.0146203836301462 · -0.00447799073188281 · -0.0382902950626349 · -0.0198855322871077 · -0.0129445907146487 · 0.0422844263408844 · -0.00669472932159364 · -0.0293624729105174 · -0.00106477383617953 · -0.0144865271477171 · -0.0172621711668632 · 0.0618314144807804 · -0.00552869411031694 · -0.0188882845202057 · -0.00726502708135401 · -0.0582155572441182 · -0.024037784624192 · -0.0120436576187996 · -0.0239307375596236 · 0.00618579244710699 · 0.0202822744722398 · 0.0137452556082572 · -0.0452298876783998 · 0.0209025227396055 · 0.0594650938462554 · 0.00831874655799834 · -0.0263001263344004 · 0.0845829282679896 · -0.0385956914307917 · 0.0111291760787245 · 0.0302414044028266 · -0.0288143617061385 · 0.0167922637794339 · -0.00192999445819315 · 0.0565044905208729 · 0.00809988724683835 · 0.0255194669385279 · -0.00418141490551447 · -0.0483712350106699 · 0.0257152256204888 · 0.00197628522821196 · 0.031100660150228 · -0.0131644219340096 · 0.0433269346914869 · -0.0222196592435405 · 0.0233023289030823 · 0.0174690314238913

1.01301730313107e-05

In [104…
```
n = length(Xi) -1 # we have 61 observations and we subtract 1 to remove

Ssquared = sum(MSFT$DevFromMean, na.rm = TRUE) / n

sigma = sqrt(Ssquared)

print(paste("Volatilitaty using the historical method is", sigma))
```

```
[1] "Volatilitaty using the historical method is 3.23737872370429e-10"
```

Standard Approach

Lets quickly remind our selves of the closing prices, the ratio of price change, and the Xi iid R.V.

In [107…

```
MSFT %>% head()

MSFT %>% write_csv("MSFT_Transform.csv")
```

A tibble: 6 × 7

Date	Close	LagClose	RatioPriceChange	logPriceRat	Xi	DevFromMe
<date>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dl
2001-11-12	65.79	NA	NA	NA	NA	
2001-11-09	65.21	65.79	0.9911841	-0.00885502	-0.00885502	-0.00886
2001-11-08	64.42	65.21	0.9878853	-0.01218869	-0.01218869	-0.01219
2001-11-07	64.25	64.42	0.9973611	-0.00264242	-0.00264242	-0.00265
2001-11-06	64.78	64.25	1.0082490	0.00821519	0.00821519	0.00820
2001-11-05	63.27	64.78	0.9766903	-0.02358563	-0.02358563	-0.02359

In [106…

```
# calculate a new standard deviation

sigma <- S*sqrt(252)

print(paste("Volatilitaty using the standard method is", sigma))
```

```
[1] "Volatilitaty using the standard method is 5.13917940159194e-09"
```

In [ ]: