MATH60633A - TP1

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PART 1 - Static VaR estimation

```
#1) Load data
load("indices.rda")
prices <- prices["2005-01-01/"]
rets <- CalculateReturns(prices, method = "log")
rets <- rets[-1,]

#Vectorize returns for code efficiency
sp500_rets <- as.numeric(as.character(unlist(rets$SP500)))
ftse100_rets <- as.numeric(as.character(unlist(rets$FTSE100)))

#2) Compute the next-step ahead static VaR forecast with a 95% level confidence
level=0.95
f_forecast_var(sp500_rets[1:1000], level)$VaR_Forecast #SP500 VaR

## [1] 7.246424e-05

f_forecast_var(ftse100_rets[1:1000], level)$VaR_Forecast #FTSE100 VaR</pre>
```

[1] 6.186707e-05

Since the static VaR estimation for the SP500 is larger than that of FTSE100, it is the riskier index at the T+1 horizon.

Part 2.1 - Rolling VaR estimation

```
#1) Backtesting

VaR_SP500 <- rep(NA,1000)

VaR_FTSE100 <- rep(NA,1000)

for (i in 1 : 1000) {
```

```
#Create rolling windows
window_SP500 <- sp500_rets[i : (1000 + i)]
window_FTSE100 <- ftse100_rets[i : (1000 + i)]

#Get VaR for rolling windows and store in their lists
VaR_SP500[i] <- f_forecast_var(window_SP500, level)$VaR_Forecast
VaR_FTSE100[i] <- f_forecast_var(window_FTSE100, level)$VaR_Forecast
}</pre>
```

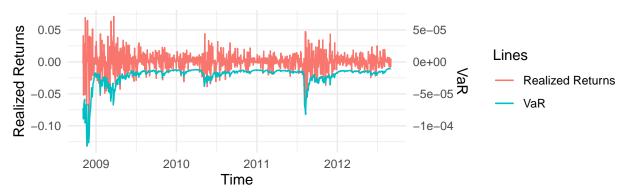
Part 2.2 - Plotting the results

```
#1) Display results (using GGPlot)
#Set variables for x & y axis
realized_rets <- CalculateReturns(prices)</pre>
dates <- as.Date(index(realized_rets), "%Y-%m-%d")</pre>
x <- dates[1001:2000]
y1 <- realized_rets$SP500[1001:2000]</pre>
y2 <- -VaR_SP500
y3 <- -VaR_FTSE100
df_SP500 <- data.frame(x, y1, y2)</pre>
df_FTSE100 <- data.frame(x, y1, y3)</pre>
#2) Create subplot for SP500
plot1 <- ggplot(df_SP500, aes(x = x)) +
  geom_line(aes(y = y1, color = "Realized Returns")) +
  geom_line(aes(y = y2 * 1000, color = "VaR")) +
  scale_y_continuous(
   name = "Realized Returns",
    sec.axis = sec_axis(~./1000, name = "VaR")
  labs(color = "Lines") +
  ggtitle("Realized returns and VaR estimates for SP500")+
 xlab("Time")+
 theme_minimal()
#3) Create subplot for FTSE100
plot2 <- ggplot(df_FTSE100, aes(x = x)) +</pre>
  geom_line(aes(y = y1, color = "Realized Returns")) +
  geom\_line(aes(y = y3 * 1000, color = "VaR")) +
  scale_y_continuous(
    name = "Realized Returns",
    sec.axis = sec_axis(~./1000, name = "VaR")) +
 labs(color = "Lines") +
```

^{*}For code with progress tracker, see main.r

```
ggtitle("Realized returns and VaR estimates for FTSE100")+
    xlab("Time")+
    theme_minimal()
grid.arrange(plot1, plot2, ncol = 1)
```

Realized returns and VaR estimates for SP500



Realized returns and VaR estimates for FTSE100

