

Graded PS3 Alexander Sanderson

ECO374

```
if (!require("quantmod")) install.packages("quantmod")
if (!require("ggplot2")) install.packages("ggplot2")
if (!require("rugarch")) install.packages("rugarch")
if (!require("rmgarch")) install.packages("rmgarch")
if (!require("timetk")) install.packages("timetk")
if (!require("xts")) install.packages("xts")
if (!require("forecast")) install.packages("forecast")

library(quantmod) # functions: getSymbols
library(ggplot2)  # functions: ggplot
library(rugarch)  # functions: ugarchspec
library(rmgarch)  # functions: dccspec, dccfit, dccforecast
library(timetk)   # functions: tk_index, tk_make_future_timeseries
library(xts)      # functions: xts
library(forecast) # functions: auto.arima

IXIC <- getSymbols("^IXIC", src="yahoo", return.class="xts", from="2010-01-01", auto.assign=F)
NSDQ <- IXIC$IXIC.Close
colnames(NSDQ) <- "NS"
NSDQ_r <- na.omit(diff(log(NSDQ)))
```

ARMA(1,1)-GARCH(1,1) Specification

```
model <- ugarchspec(variance.model = list(model="sGARCH", garchOrder=c(1, 1)),
                    mean.model = list(armaOrder=c(1, 1)))
```

model

```
##
## *-----*
## *      GARCH Model Spec      *
## *-----*
##
## Conditional Variance Dynamics
## -----
## GARCH Model      : sGARCH(1,1)
## Variance Targeting : FALSE
##
## Conditional Mean Dynamics
## -----
## Mean Model      : ARFIMA(1,0,1)
## Include Mean    : TRUE
## GARCH-in-Mean   : FALSE
##
## Conditional Distribution
## -----
## Distribution : norm
```

```
## Includes Skew      : FALSE
## Includes Shape     : FALSE
## Includes Lambda    : FALSE
```

Estimate the model

```
model_fit <- ugarchfit(spec=model, data=NSDQ_r)
```

Forecast

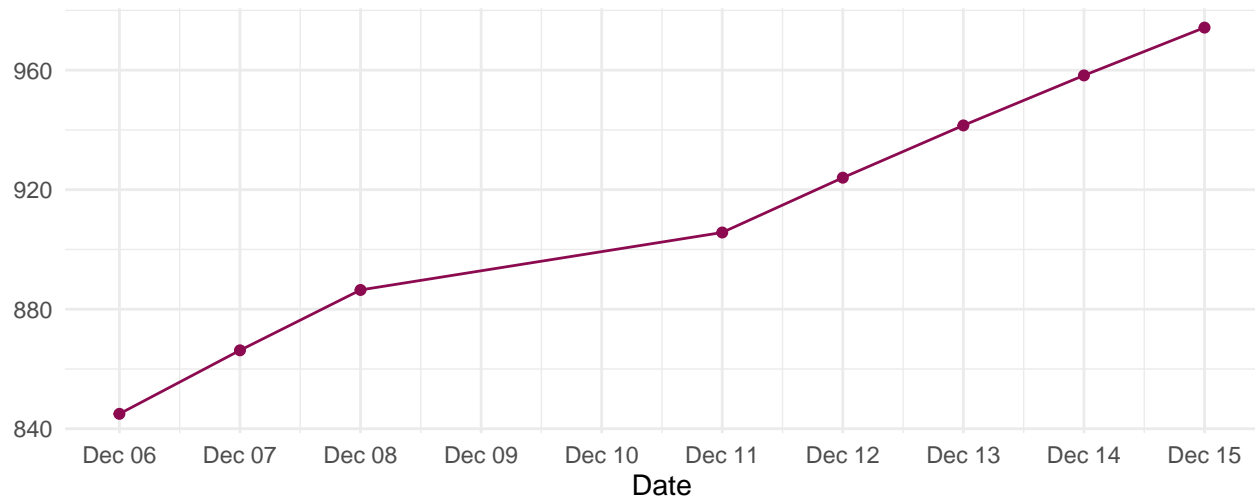
```
n.future <- 8
model_forecast <- ugarchforecast(fit=model_fit, n.ahead=n.future)
id <- tk_index(NSDQ_r)
id.f <- tk_make_future_timeseries(id, length_out=n.future, inspect_weekdays=TRUE)
```

VaR at alpha 1 percent for \$5 million in NASDAQ

```
f_mean <- as.numeric(model_forecast@forecast$seriesFor)
f_std <- as.numeric(model_forecast@forecast$sigmaFor)
VaR_f <- 5e04*abs(f_mean-2.33*f_std)
VaR_f <- xts(VaR_f, order.by=id.f)
colnames(VaR_f) <- "VaR"

ggplot(data=VaR_f, aes(x=index(VaR_f), y=VaR)) +
  geom_line(color="deeppink4") +
  geom_point(color="deeppink4") +
  labs(x="Date", y="", title="Forecast of Value at Risk for a $50,000 in the NASDAQ") +
  theme_minimal() + scale_x_date(date_breaks="1 day", date_labels = "%b %d") +
  theme(plot.title = element_text(size=10))
```

Forecast of Value at Risk for a \$50,000 in the NASDAQ



Expected Shortfall at alpha 1 percent for \$50,000 in NASDAQ

```
ES <- 5e04*abs(f_mean-2.64*f_std)
ES <- xts(ES, order.by=id.f)
colnames(ES) <- "es"

ggplot(data=ES, aes(x=index(ES), y=es)) +
  geom_line(color="springgreen4") +
  geom_point(color="springgreen4") +
  labs(x="Date", y="", title="Expected Shortfall for a $50,000 in NASDAQ") +
```

```
theme_minimal() + scale_x_date(date_breaks="1 day", date_labels = "%b %d") +  
theme(plot.title = element_text(size=10))
```

