

# Adil\_Gokturk\_HW02.R

HAG

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# FIN 659

# HW2 HEDGING AN EQUITY PORTFOLIO
# Textbook Reference:      Section 3.5, pp. 64-66

## Problem
# A fund manager has a portfolio worth $50 million with a beta of 0.87.
# The manager is concerned about the performance of the market over the next two months and
# plans to use three-month futures contracts on a well-diversified index to hedge its risk.
# The current index level is 2,670, one contract is on 250 times the index,
# the risk-free rate is 2.50% per annum, and the dividend yield on the index is 2%.
# The current three-month futures price is 2,677.

# set working directory
setwd("~/Desktop/Spring2020/FIN659/Assignments/hw2")
getwd()

## [1] "/Users/HAG/Desktop/Spring2020/FIN659/Assignments/hw2"

# Load the libraries
library(tidyverse)

## -- Attaching packages ----- tidyverse 1.3.0 --
## v ggplot2 3.2.1    v purrr   0.3.3
## v tibble  2.1.3    v dplyr  0.8.4
## v tidyr   1.0.2    v stringr 1.4.0
## v readr   1.3.1    v forcats 0.4.0

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

spot.index.value <- 2670
contract.index.multiplier <- 250
fund.value <- 50000000
fund.beta <- 0.87
(annual.risk.free.rate <- 2.50 ) # %

## [1] 2.5

(annual.dividend.yield <- 2) # %

## [1] 2
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three.month.futures.price <- 2677

## What position should the fund manager take to hedge exposure
## to the market over the next two months?

## Answer: Short Position

## Number of Future Contracts
contracts <- fund.beta*(fund.value/(contract.index.multiplier*three.month.futures.price))
contracts %>% round(0)

## [1] 65

## Answer: We need 65 futures contract

## Calculate the effect of your strategy on the fund manager's returns
## if the level of the market in two months is
## 2,500, 2,600, 2,700, and 2,800.
## Assume that the one-month futures price is 0.25% higher than the index level at this time.

future.price.index.rate <- .0025 # Percentage that the futures price is higher than the index level

# Let's define the Value of index in two months
(value.of.index.in.two.months <- c(2500, 2600, 2700, 2800))

## [1] 2500 2600 2700 2800

# Calculate the Futures price of index in two months
(futures.price.of.index.in.two.months <- (1+future.price.index.rate) * value.of.index.in.two.months)

## [1] 2506.25 2606.50 2706.75 2807.00

# Calculate the Gain (loss) on futures position ($) and round zero
(gain.loss.on.future.positions.USD <- 65 * (three.month.futures.price - futures.price.of.index.in.two.months))

## [1] 2774687.5 1145625.0 -483437.5 -2112500.0

(gain.loss.on.future.positions.USD <- gain.loss.on.future.positions.USD %>% round(0))

## [1] 2774688 1145625 -483438 -2112500

# Calculate the Expected return on the index in two months (%),
# convert to % and round it to two decimal
(expected.return.on.the.index.in.two.months <- (value.of.index.in.two.months - spot.index.value)/spot.index.value)

## [1] -0.06367041 -0.02621723 0.01123596 0.04868914

(expected.return.on.the.index.in.two.months <- (expected.return.on.the.index.in.two.months *100) %>% round(0))

## [1] -6.37 -2.62 1.12 4.87

# Calculate the Expected return on the index (incl. dividends) in two months (%),
# convert to % and round it to two decimal
(expected.return.on.the.index.incl.div.in.two.months <- (expected.return.on.the.index.in.two.months + (dividend.yield/12)*2))

## [1] -6.036667 -2.286667 1.453333 5.203333

(expected.return.on.the.index.incl.div.in.two.months <- expected.return.on.the.index.incl.div.in.two.months %>% round(0))

## [1] -6.04 -2.29 1.45 5.20

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# Calculate the Excess return on the index (incl. dividends) above risk-free rate (%)
(excess.return.on.the.index.incl.div.above.riskfree.rate <- (expected.return.on.the.index.incl.div.in.t

## [1] -6.46 -2.71  1.03  4.78

# Calculate the Excess return on (unhedged) portfolio above risk-free rate (%)
# Hint: Multiply the excess return on the index (including dividend yield) by the portfolio beta
(excess.return.on.unhedged.portfolio.above.riskfree.rate <- (excess.return.on.the.index.incl.div.above.

## [1] -5.62 -2.36  0.90  4.16

# Calculate the Expected return on (unhedged) portfolio over two months (%)
# Hint: Excess return on the (unhedged) portfolio over two months plus the risk-free rate over two mont
(expected.return.on.unhedged.portfolio.over.two.months <- (excess.return.on.unhedged.portfolio.above.ri

## [1] -5.20 -1.94  1.32  4.58

# Calculate the Value of (unhedged) portfolio in two months ($)
# Hint: Use the original value of the (unhedged) portfolio and the associated expected return over two m
(value.of.the.unhedged.portfolio.in.two.months.USD <- (fund.value %*% (1 + (expected.return.on.unhedged.p

##           [,1]      [,2]      [,3]      [,4]
## [1,] 47400000 49030000 50660000 52290000

# Calculate the Total value of position in two months ($)
(total.value.of.position.in.two.months_USD <- gain.loss.on.future.positions.USD + value.of.the.unhedged

##           [,1]      [,2]      [,3]      [,4]
## [1,] 50174688 50175625 50176562 50177500

# Calculate the Expected return on (hedged) portfolio over two months (%)
(expected.return.on.hedged.portfolio.in.two.months<- ((total.value.of.position.in.two.months_USD - fund

##           [,1]      [,2]      [,3]      [,4]
## [1,] 0.00349376 0.0035125 0.00353124 0.00355

(expected.return.on.hedged.portfolio.in.two.months<- (expected.return.on.hedged.portfolio.in.two.months

##           [,1] [,2] [,3] [,4]
## [1,] 0.35 0.35 0.35 0.36

# Let's put it in a table
(analysis <- rbind(value.of.index.in.two.months,
                  futures.price.of.index.in.two.months,
                  gain.loss.on.future.positions.USD,
                  expected.return.on.the.index.in.two.months,
                  expected.return.on.the.index.incl.div.in.two.months,
                  excess.return.on.unhedged.portfolio.above.riskfree.rate,
                  expected.return.on.unhedged.portfolio.over.two.months,
                  value.of.the.unhedged.portfolio.in.two.months.USD,
                  total.value.of.position.in.two.months_USD,
                  expected.return.on.hedged.portfolio.in.two.months))

##           [,1]      [,2]
## value.of.index.in.two.months      2500.00      2600.00
## futures.price.of.index.in.two.months      2506.25      2606.50
## gain.loss.on.future.positions.USD      2774688.00 1145625.00
## expected.return.on.the.index.in.two.months      -6.37      -2.62
## expected.return.on.the.index.incl.div.in.two.months      -6.04      -2.29

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## excess.return.on.unhedged.portfolio.above.riskfree.rate	-5.62	-2.36
## expected.return.on.unhedged.portfolio.over.two.months	-5.20	-1.94
##	47400000.00	49030000.00
##	50174688.00	50175625.00
##	0.35	0.35
##	[,3]	[,4]
## value.of.index.in.two.months	2700.00	2800.00
## futures.price.of.index.in.two.months	2706.75	2807.00
## gain.loss.on.future.positions.USD	-483438.00	-2112500.00
## expected.return.on.the.index.in.two.months	1.12	4.87
## expected.return.on.the.index.incl.div.in.two.months	1.45	5.20
## excess.return.on.unhedged.portfolio.above.riskfree.rate	0.90	4.16
## expected.return.on.unhedged.portfolio.over.two.months	1.32	4.58
##	50660000.00	52290000.00
##	50176562.00	50177500.00
##	0.35	0.36