

## Overview

This independent study was designed to provide advanced study in the real-world business application of the R programming language with emphasis on quantitative finance and portfolio risk management.

The independent study was completed through the Quantitative Solutions Group (QSG) within the South Carolina Retirement System Investment Commission (RSIC). Per their LinkedIn, the RSIC is a “professional investment management organization that manages more than \$29 billion on behalf of over 500,000 plan participants.” The QSG is comprised of business analysts whose focus is to retrieve and manipulate financial data to present investment performance analysis.



## Motivation

With over 13,000 packages available, the capabilities of the R language are so vast that it is impossible to envision all it can do within a classroom setting. With the majority of these packages aligning with quantitative analysis, to dive deeper into the capabilities and use the quantitative packages in a real-world environment, solving real-world problems, it was important to set my independent study with an agency that is heavy with quantitative data.

## First Project: replicate Excel product using R

```
1 # Source on Save
2 # Load required packages
3 # Libraries = c("xlsx", "dplyr")
4 # apply(libraries, require, character.only=TRUE)
5 # Input file = "N:\Investments\Quantitative Solutions Group\OK Projects\Output\South Carolina - daily asset class performance - sep 2018.xlsx"
6 # Input sheet = "Sheet1"
7 # Output file = "N:\Investments\Quantitative Solutions Group\OK Projects\Output\Output - Master - South Carolina - daily asset class performance.xlsx"
8 # Master output file = "N:\Investments\Quantitative Solutions Group\OK Projects\Output\Output - Master - South Carolina - daily asset class performance.xlsx"
9
10 # Read original data file starting at first row to extract broad categories, extract column names
11 input.asset.classes = colnames(read.xlsx(input.file, sheetname = input.sheet, startrow = 1))
12 input.asset.classes
13
14 # Remove the NA's generated by blank cells using grep
15 asset.classes = input.asset.classes[!grep("NA", input.asset.classes)]
16 asset.classes
17
18 # Read original data skipping the first row, second row becomes column names. Note duplicates.
19 input.data = read.xlsx(input.file, sheetname = input.sheet, startrow = 2)
20 head(input.data)
21
22 # Name the data column
23 colnames(input.data)[1] = "date"
24
25 # We're picking up some empty rows at the end. Let's omit any rows that do not have a date to get rid of these.
26 tail(input.data)
27 input.data = input.data[!is.na(input.data$date),]
28
29 # Extract desired column names
30 column.names = c("strategy", "ten_name", colnames(input.data[1:11]))
31
32 # Initialize empty list and data frames
33 my_list = list()
34 my_df = data.frame()
35
36 # Read original data file starting at first row to extract benchmarks, extract benchmarks
37 input.bms = colnames(read.xlsx(input.file, sheetname = input.sheet, startrow = 2))
38 input.bms
39
40 # Isolate the cells containing the bms using grep
41 bnames = input.bms[grep("b", input.bms)]
42 bnames = substr(bnames, 12, nchar(bnames) - 1)
43
44 # Start for loop, running once for each asset class
45 for (i in 1:length(asset.classes)) {
46   count = nrow(input.data[, c(1:(11+10*(i-1)))]
47   strategy = data.frame(c(rep(asset.classes[i], count)), c(rep(bnames[i], count)))
48   names(strategy) = c("strategy", "ten_name")
49   my_list[[i]] = dbind(strategy, input.data[, c(1:(11+10*(i-1)))]
50   # my_list[[i]] = input.data[, c(1:(11+10*(i-1)))]
51 }
52
53 # Set names of data frames within list to asset class strategies
54 names(my_list) = asset.classes
55
56 # Make column names of data frames in list the same
57 my_list = lapply(my_list, setnames, column.names)
58
59 # Bind all data frames in list by row
60 output = do.call("rbind", my_list)
61
62 # Write single month output
63 write.xlsx(output, output.file, row.names = FALSE)
64
65 # Append month to stacked master file
66 master.input = read.xlsx(master.output.file, sheetname = "Sheet1")
67 master.output = rbind(data.frame(master.input, output))
68 master.output = master.output[order(master.output[, 1], master.output[, 3]),]
69 write.xlsx(master.output, master.output.file, row.names = FALSE)
70
```

Sensitive data deleted

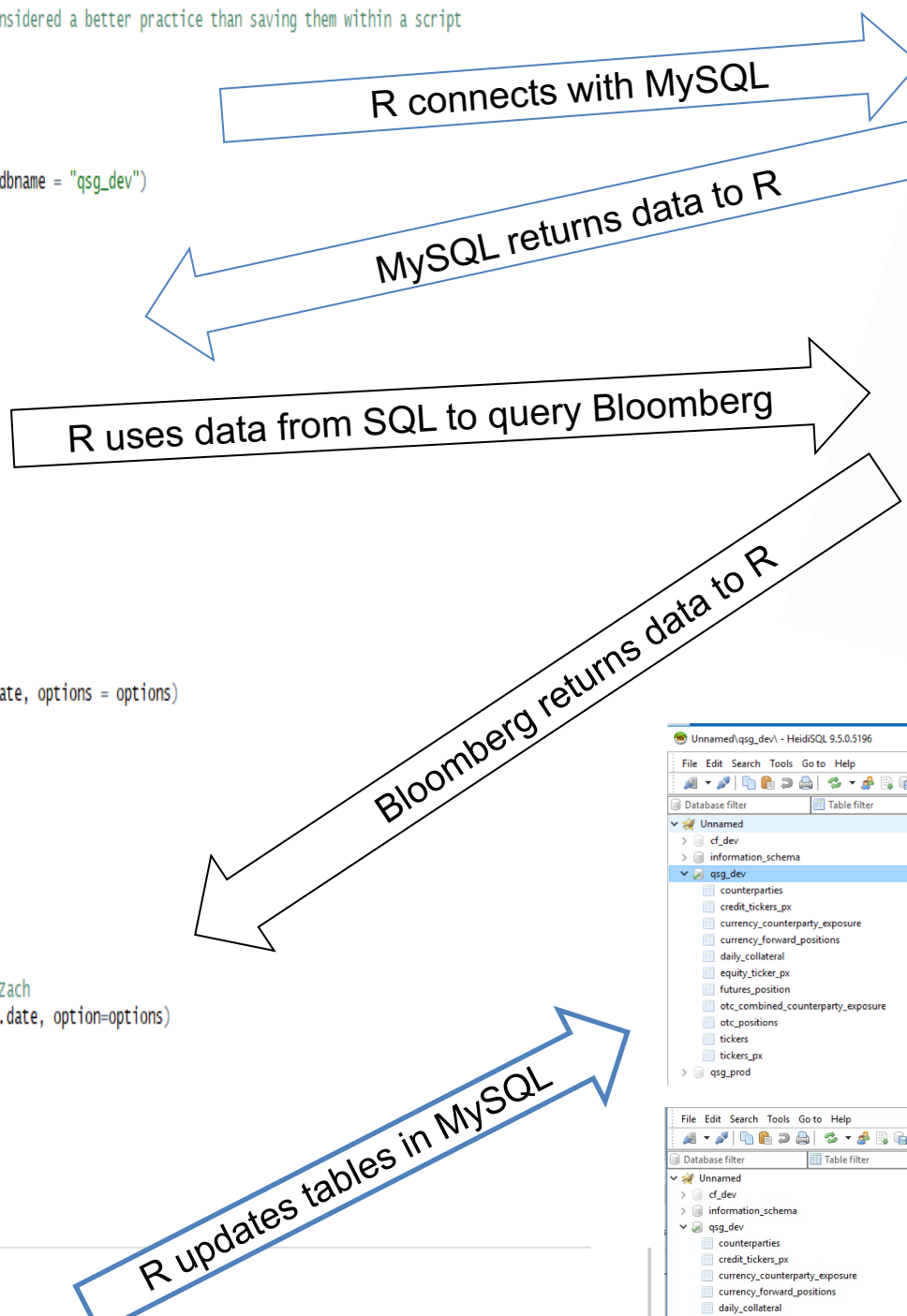
Strategy	RM Name	Date	Gain/Loss	PriorDay	Notional	Trades	Flow	Timing	Performance	Denominator	Notional Return	Cash Return	Total Return	BM Return	XXXXX	Daily Diff
1	Conserv	6/12/2018	1	125489852	0	RM/A	125489852	-0.65487	5.65985	-0.65487	-0.65487	-0.65487	-0.65487	-0.65487	-0.65487	-0.65487
2	Conserv	6/12/2018	2	548796321	0	RM/A	548796321	-0.32059	6.65985	-0.32059	-0.32059	-0.32059	-0.32059	-0.32059	-0.32059	-0.32059
3	Conserv	6/5/2018	3	12547963	0	RM/A	12547963	0.002305	2.30587	0.002305	0.002305	0.002305	0.002305	0.002305	0.002305	0.002305
4	Conserv	6/12/2018	4	986532054	0	RM/A	986532054	-0.0015484	5.32084	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484
5	Conserv	6/7/2018	5	1242784512	0	RM/A	1242784512	0.001897	5.65985	0.001897	0.001897	0.001897	0.001897	0.001897	0.001897	0.001897
6	Conserv	6/12/2018	6	4378059463	0	RM/A	4378059463	-0.02365484	6.65985	-0.02365484	-0.02365484	-0.02365484	-0.02365484	-0.02365484	-0.02365484	-0.02365484
7	Conserv	6/12/2018	7	1346794613	0	RM/A	1346794613	0.054875484	2.30587	0.054875484	0.054875484	0.054875484	0.054875484	0.054875484	0.054875484	0.054875484
8	Conserv	6/12/2018	8	1242784512	0	RM/A	1242784512	0.021015484	5.32084	0.021015484	0.021015484	0.021015484	0.021015484	0.021015484	0.021015484	0.021015484
9	Conserv	6/12/2018	9	1616058795	0	RM/A	1616058795	-0.100515484	5.65985	-0.100515484	-0.100515484	-0.100515484	-0.100515484	-0.100515484	-0.100515484	-0.100515484
10	Conserv	6/12/2018	10	4384645447	0	RM/A	4384645447	-0.0015857	6.65985	-0.0015857	-0.0015857	-0.0015857	-0.0015857	-0.0015857	-0.0015857	-0.0015857
11	Conserv	6/12/2018	11	145879532	0	RM/A	145879532	-0.0015484	2.30587	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484
12	Conserv	6/18/2018	12	125487953	0	RM/A	125487953	-0.0985484	5.32084	-0.0985484	-0.0985484	-0.0985484	-0.0985484	-0.0985484	-0.0985484	-0.0985484
13	Conserv	6/12/2018	13	125487952	0	RM/A	125487952	-0.0015484	5.65985	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484	-0.0015484
14	Conserv	6/20/2018	14	123456456	0	RM/A	123456456	0.0015484	6.65985	0.0015484	0.0015484	0.0015484	0.0015484	0.0015484	0.0015484	0.0015484

\*\*not the actual data\*\*

\*script is combined effort of Senior Analyst Jonathan Graab, Intern Zach Allison, and Carla Fant

## Final Project: use R to query MySQL and Bloomberg; update MySQL database

```
1 libraries = c("RMySQL", "zoo", "xts", "RMySQL",
2             "lubridate", "plyr", "openxlsx")
3
4 # If first time running, install necessary libraries - this may take some time
5 # install.packages(libraries, dependencies = TRUE)
6
7 # Load required libraries
8 # apply(libraries, require, character.only=TRUE)
9
10 # Save your credentials to your private network drive and load them, this is generally considered a better practice than saving them within a script
11 db.credentials = read.csv("H:/SQL user data.csv")
12 db.user = as.character(db.credentials[1,1])
13 db.pw = as.character(db.credentials[2,1])
14
15 # Connect to SQL database with above credentials
16 osg_dev_con = dbConnect(RMySQL::MySQL(), host = "osg", user = db.user, password = db.pw, dbname = "osg_dev")
17
18 # Query table for tickers to pass to Bloomberg
19 tickers = dbGetQuery(osg_dev_con, "SELECT * FROM tickers ORDER BY date")
20
21 # Only select the uniques
22 credit_tickers = unique(tickers$credit_ticker)
23 equity_tickers = unique(tickers$equity_ticker)
24
25 # Initialize connection to Bloomberg API
26 blpConnect()
27
28 # Query Bloomberg API using BSH call
29 ffields=c("PRLAST")
30 start.date = as.Date("2016-01-01")
31 end.date = Sys.Date()
32 options = c("periodicityselection"="DAILY",
33           "normaltrading"=1, "option"="NOMTRADING_WEEKENDS",
34           "normaltrading"=1, "option"="PREVIOUS_VALUE")
35 blb_list = bdb(credit_tickers, fields = fields, start.date = start.date, end.date = end.date, options = options)
36
37 # Data monkeying
38 blb_xts = lapply(blb_list, function(d) xts(d[,1], order.by=as.Date(d[,1]))
39 blb_merger = do.call("merge", blb_xts)
40
41 # Check data
42 head(blb_merger)
43 tail(blb_merger)
44
45 # -----EQUITY-----
46 fields.equity=c("PRLAST") #add debt:assets, Current Ratio, cfo:debt, Solvency Ratio per Zach
47 edbh_list=bdb(equity_tickers, fields = fields.equity, start.date=start.date, end.date=end.date, option=options)
48 edbh_xts = lapply(edbh_list, function(d) xts(d[,1], order.by=as.Date(d[,1]))
49 edbh_merger=do.call("merge", edbh_xts)
50 head(edbh_merger)
51 tail(edbh_merger)
52
53 equity_tickers_df=data.frame(date=Index(edbh_merger), coredata(edbh_merger))
54 dbWriteTable(osg_dev_con, "equity_ticker_px", equity_tickers_df, row.names=FALSE)
55
56 # Create data frame from xts where data row names are column
57 credit_tickers_df=data.frame(date = Index(blb_merger), coredata(blb_merger))
58
59 # Write data frame back to SQL server, ignoring row names
60 dbWriteTable(osg_dev_con, "credit_tickers_px", credit_tickers_df, row.names = FALSE)
61
62 # Disconnect from SQL database when done
63 dbDisconnect(osg_dev_con)
64
```



File Edit View Tools Help

MySQL Database Screenshot

Database

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Size

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Engine

Comment

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