

Question 6: MSCI Funds

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```
knitr::opts_chunk$set(echo = FALSE, message = FALSE, warning = FALSE, fig.width = 6, fig.height = 5, fig.cap = "")
# Note: Include = FALSE implies the code is executed, but not printed in your pdf.
# warning and message = FALSE implies ugly messages and warnings are removed from your pdf.
# These should be picked up when you execute the command chunks (code sections below) in your rmd, not in the pdf.

# load packages
pacman::p_load("MTS", "robustbase")
pacman::p_load("tidyverse", "devtools", "rugarch", "rmgarch",
               "forecast", "tbl2xts", "lubridate", "PerformanceAnalytics",
               "ggthemes", "ks")
pacman::p_load("tidyverse", "rugarch", "rmgarch")

# load functions
list.files('code/', full.names = T, recursive = T) %>% .[grepl('.R', .)] %>% as.list() %>% walk(~source(., encoding = "UTF-8"))

# oad data, and see how this can be stored and later called from your 'data' folder.
msci <- read_rds("data/msci.rds")
bonds <- read_rds("data/bonds_10y.rds")
comms <- read_rds("data/comms.rds")
```

Introduction

Using the MSCI total return indexes, write a short report where you discuss the following (please use your discretion on which returns you want to use to make your argument):

Over the past decade, the return profiles of different asset classes (Equities, Commodities, Real Estate and Bonds) have increased in their convergence (i.e., diversification by holding different asset classes have reduced).

Show how these co-movements have increased in the past decade;

Show to what extent these return profiles have homogenized by considering the commonality of the sources of returns over time.

In your answer, be creative in using visual and statistical measures to convey the issue of how co-movement have changed over time

Data

I begin by selecting specific assets from the data sets provided and follow an approach similar to the practical. I select the MSCI_ACWI index to represent Equities, the BCom_Index to represent Commodities, the MSCI_RE to represent Real Estate and the US_10Yr to represent bonds. I calculate returns for the daily price data before combining the data to perform the analysis, followed by log scaling and centering the data. This was tricky to accomplish in one go so I split it up into its parts, wrangled the data and then combined the data.

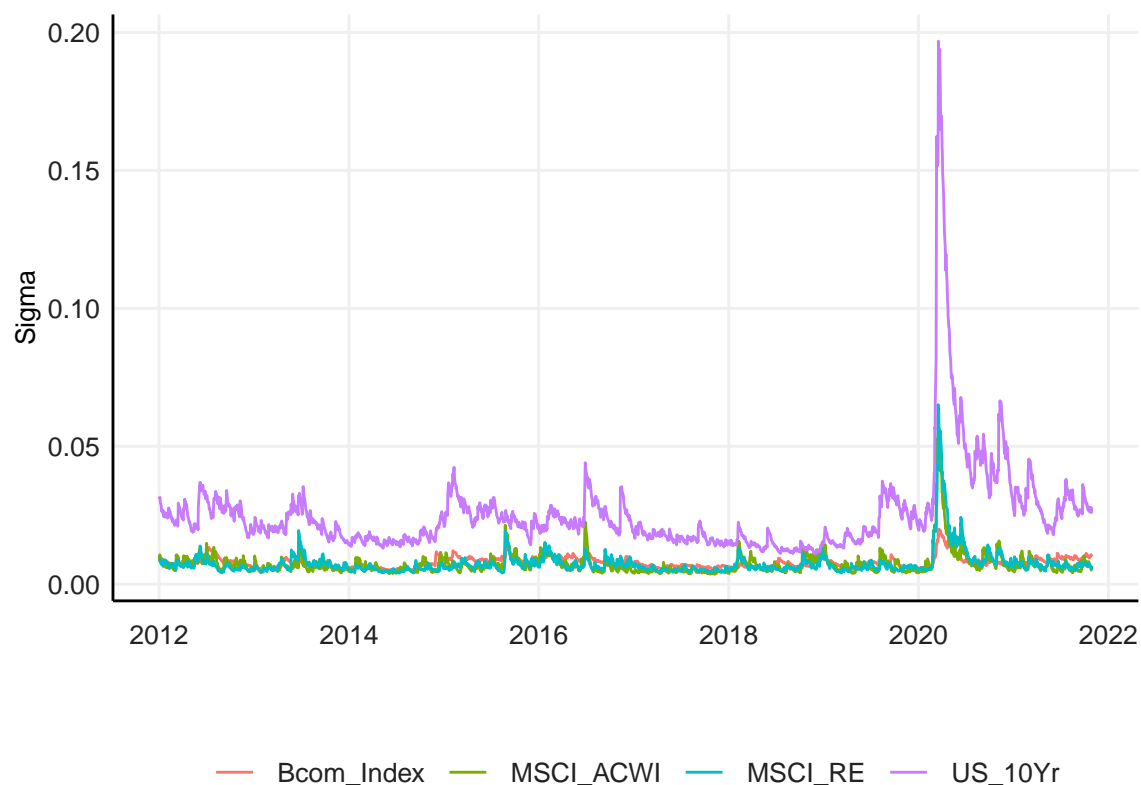
DCC Model

I follow the practical code closely to render the model

```
## Sample mean of the returns:  -0.0001532192  0.0006273741 -0.000122789 -0.0001327623
## Component:  1
## Estimates:  3e-06  0.183428  0.782732
## se.coef   :  0  0.021974  0.022599
## t-value   :  5.585021  8.347446  34.636
## Component:  2
## Estimates:  2e-06  0.136209  0.826154
## se.coef   :  0  0.017766  0.022081
## t-value   :  4.61807  7.666786  37.41462
## Component:  3
## Estimates:  5e-06  0.079257  0.914998
## se.coef   :  2e-06  0.010207  0.01074
## t-value   :  3.076316  7.764681  85.19931
## Component:  4
## Estimates:  1e-06  0.049531  0.936488
## se.coef   :  0  0.006571  0.008666
## t-value   :  3.466549  7.537786  108.0608
```

Volatility of Returns for the past decade

Different Asset Classes

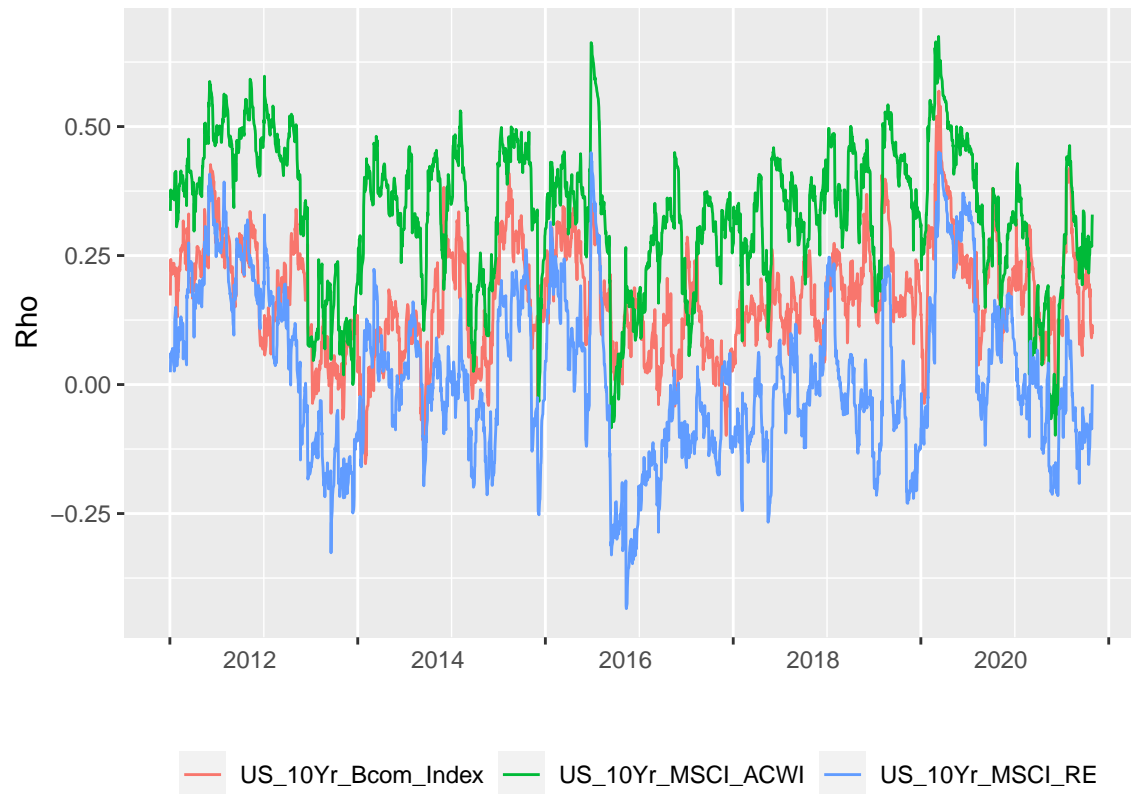


Commodities, Equities, Real Estate and Bonds

```
## Sample mean of the returns: -0.0001532192 0.0006273741 -0.000122789 -0.0001327623
## Component: 1
## Estimates: 3e-06 0.183428 0.782732
## se.coef : 0 0.021974 0.022599
## t-value : 5.585021 8.347446 34.636
## Component: 2
## Estimates: 2e-06 0.136209 0.826154
## se.coef : 0 0.017766 0.022081
## t-value : 4.61807 7.666786 37.41462
## Component: 3
## Estimates: 5e-06 0.079257 0.914998
## se.coef : 2e-06 0.010207 0.01074
## t-value : 3.076316 7.764681 85.19931
## Component: 4
## Estimates: 1e-06 0.049531 0.936488
## se.coef : 0 0.006571 0.008666
## t-value : 3.466549 7.537786 108.0608
## Estimates: 0.9439883 0.02805751 7.628358
## st.errors: 0.009865406 0.004106348 0.4391585
## t-values: 95.68672 6.832717 17.3704
```

Now the DCC model has been estimated.

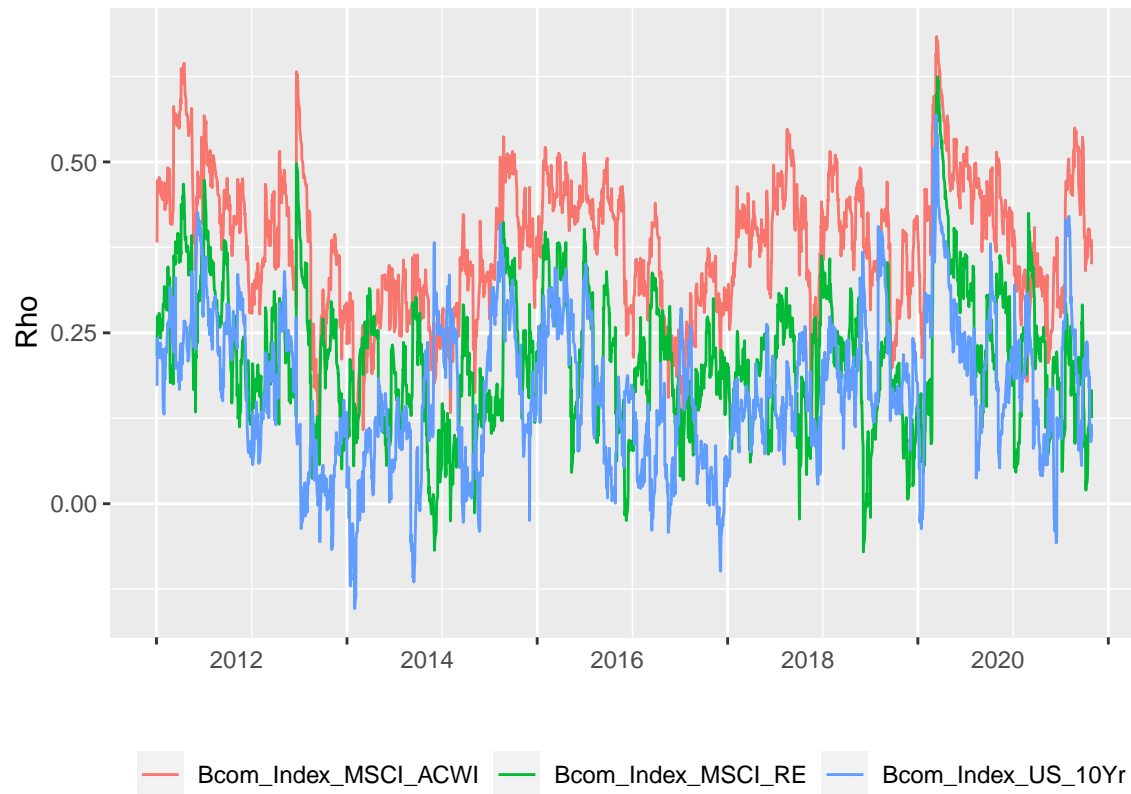
Dynamic Conditional Correlations: US_10Yr



Commodities, Equities, Real Estate and Bonds

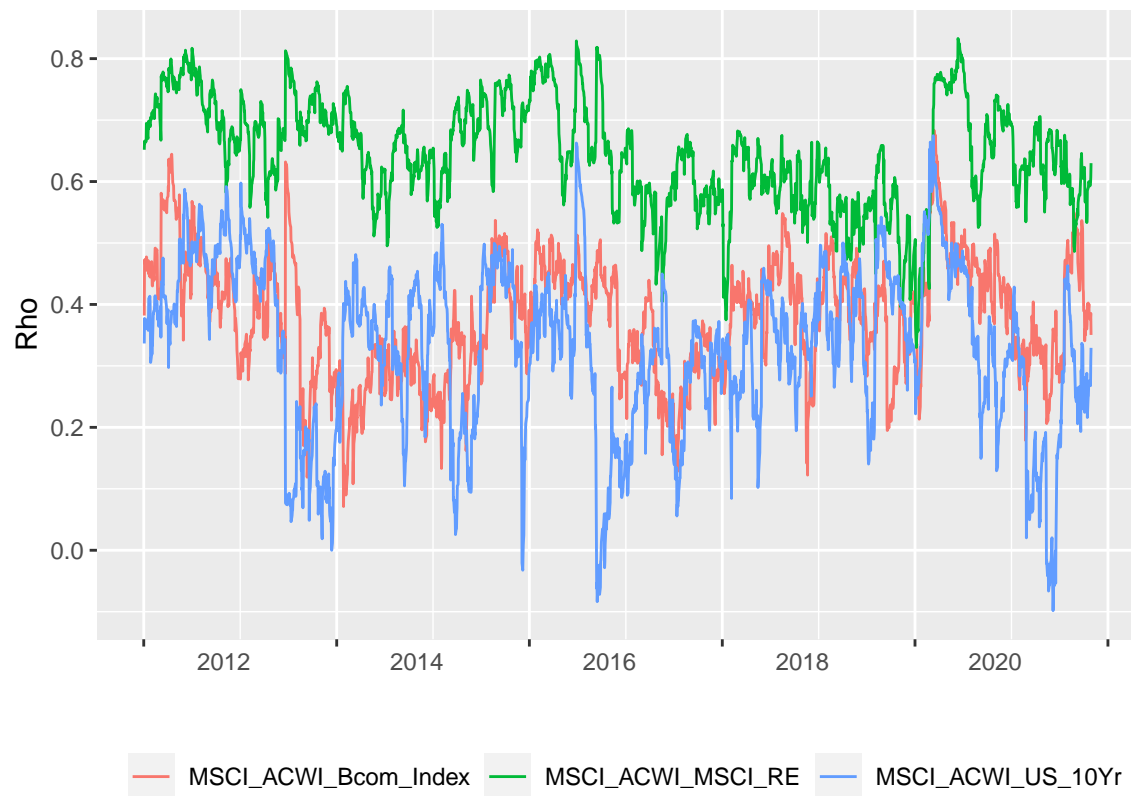
Dynamic Conditional Correlations: Bcom_Index

Plot of Total Cases and Deaths per Continent



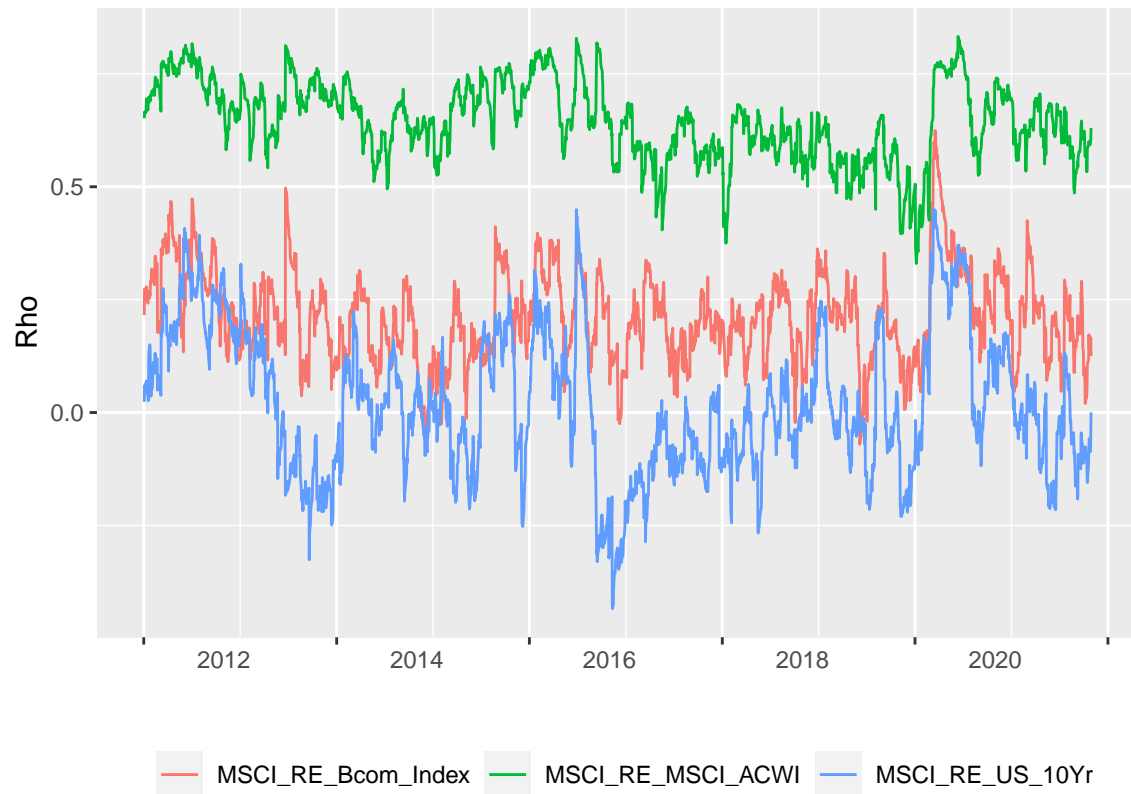
Commodities, Equities, Real Estate and Bonds

Dynamic Conditional Correlations: MSCI_ACWI



Commodities, Equities, Real Estate and Bonds

Dynamic Conditional Correlations: MSCI_RE



Commodities, Equities, Real Estate and Bonds