ECON 424 Group 7: Financial Analysis (I)

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Introduction

Data choice & Motivation

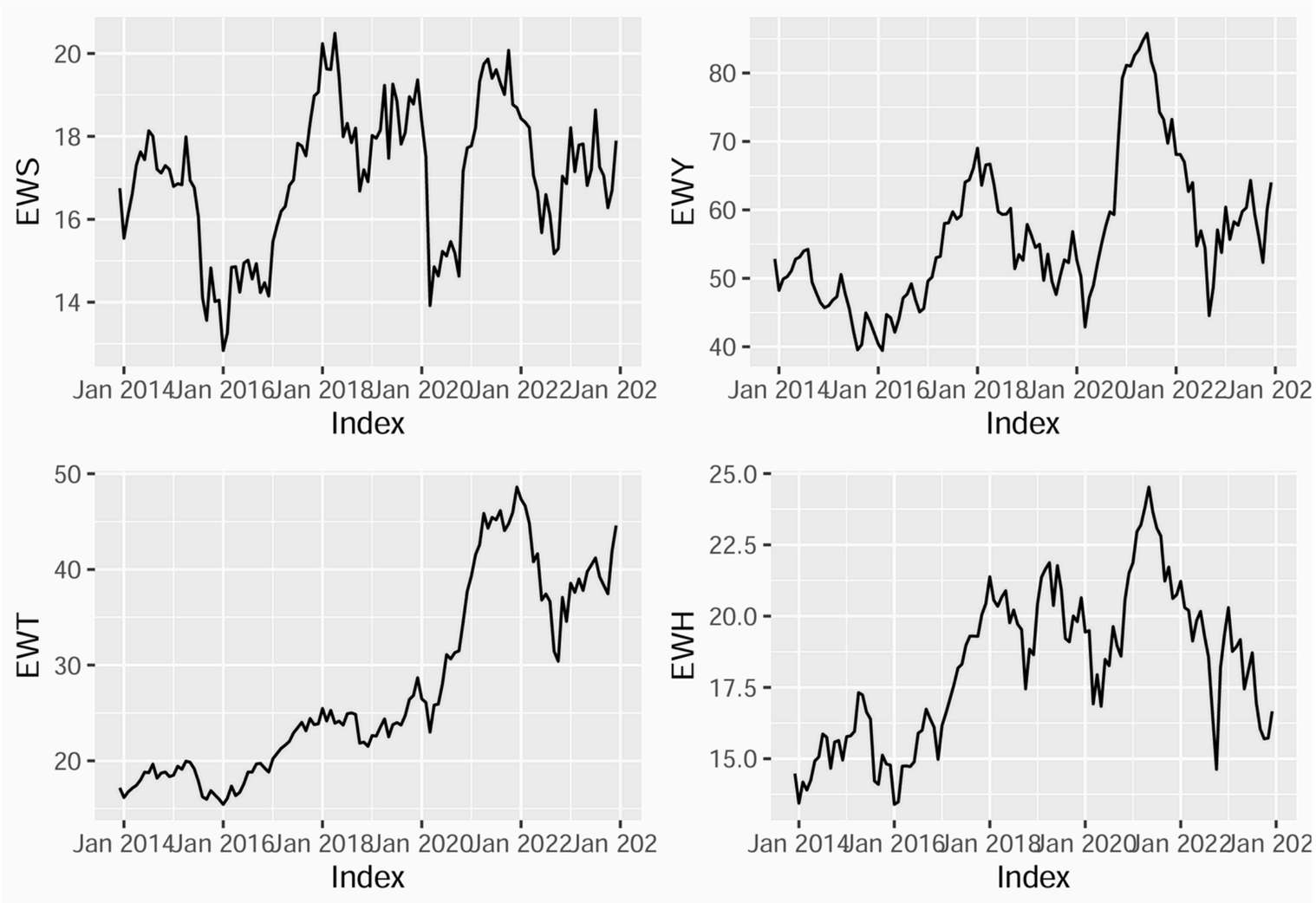
Chosen Assets:

- **EWS: ETF for Singapore**
- **EWY: ETF for South Korea**
- **EWT: ETF for Taiwan**
- **EWH: ETF for Hong Kong**

Reasons why we choose these assets:

- **Each asset is a weighted indexed made up of a particular country's assets**
- **These ETFs can be used to judge overall equity market of that particular country**
  - **Ex: EWY (ETF for South Korea) is made up of ~22% Samsung. In 2022 Samsung attributed to roughly 22% of South Korea's GDP**
- **Four Asian Tigers**
- **Use statistical analysis to uncover stylized facts of asset behavior and overall equity market in these countries**

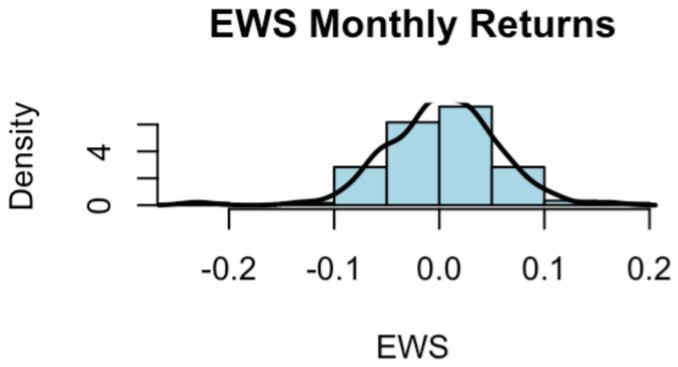
Pricing

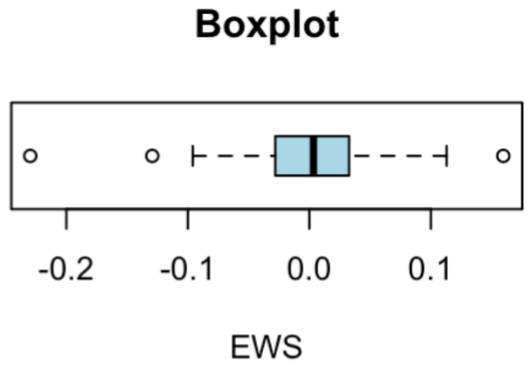

EWS
20
18
16
14
Jan 2014
Jan 2016
Jan 2018
Jan 2020
Jan 2022
Jan 202
Index
EWY
80
70
60
50
40
Jan 2014
Jan 2016
Jan 2018
Jan 2020
Jan 2022
Jan 202
Index
EWT
50
40
30
20
Jan 2014
Jan 2016
Jan 2018
Jan 2020
Jan 2022
Jan 202
Index
EWH
25.0
22.5
20.0
17.5
15.0
Jan 2014
Jan 2016
Jan 2018
Jan 2020
Jan 2022
Jan 202
Index

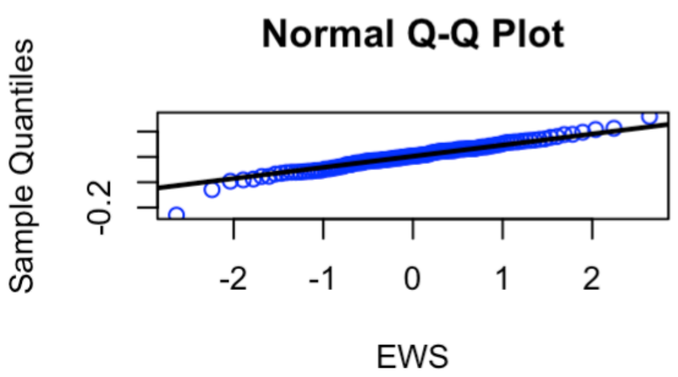
Sample statistics

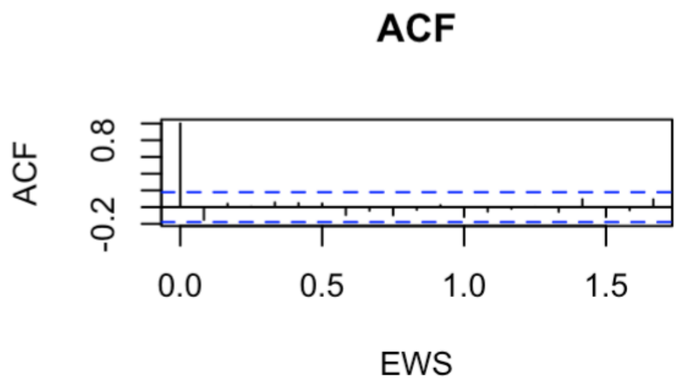
Asset Summary 2015-2025

Study of EWS Monthly Stock Returns



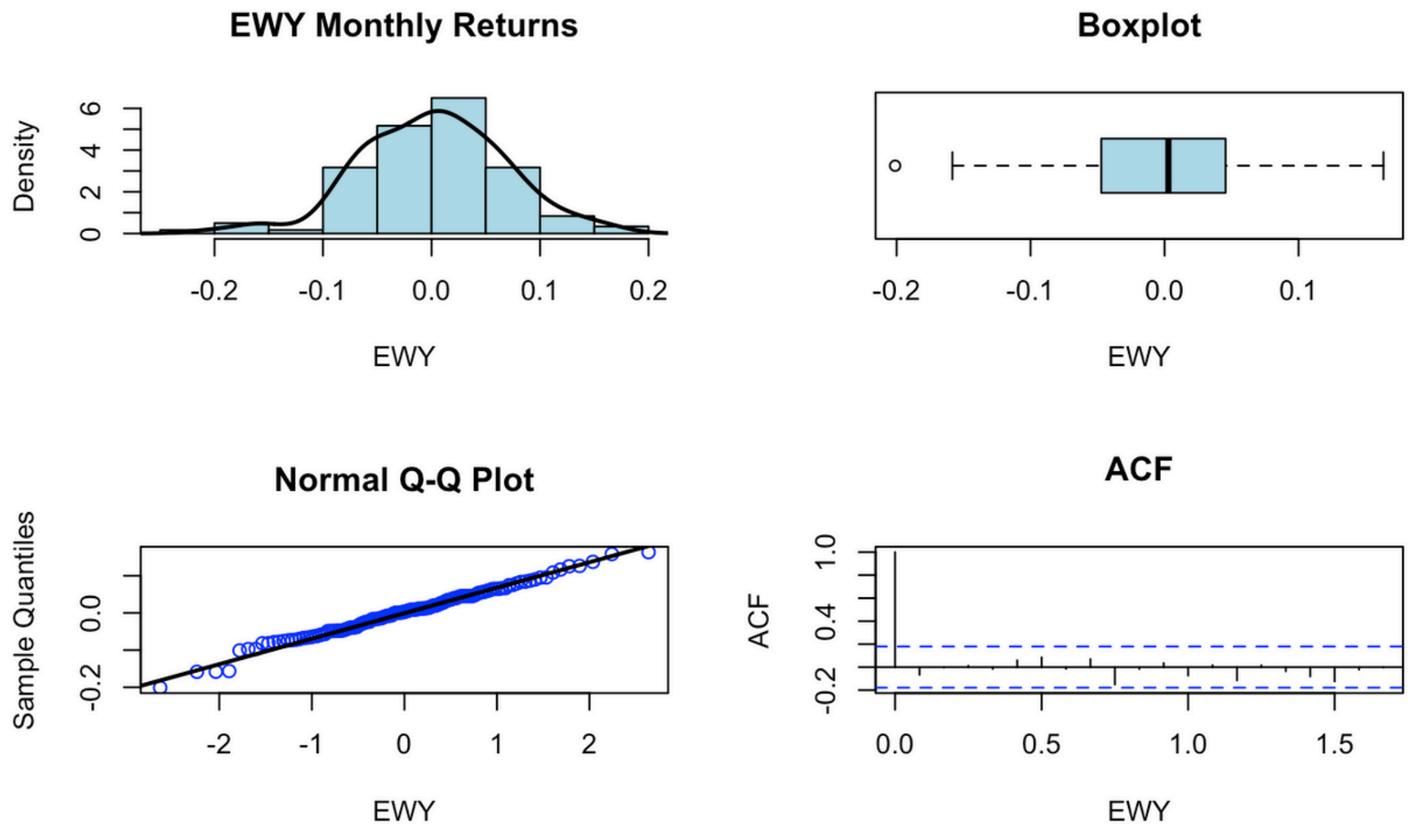






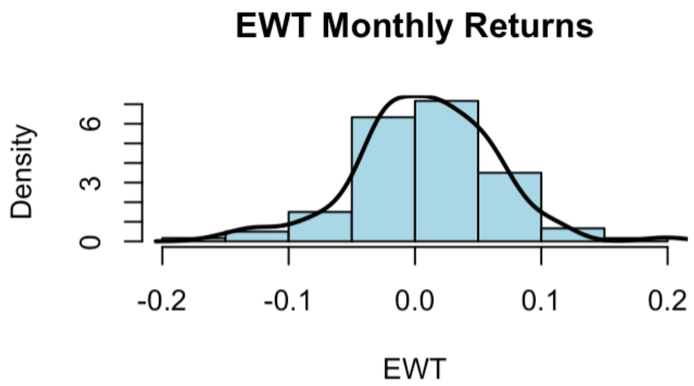
Asset Summary 2015-2025

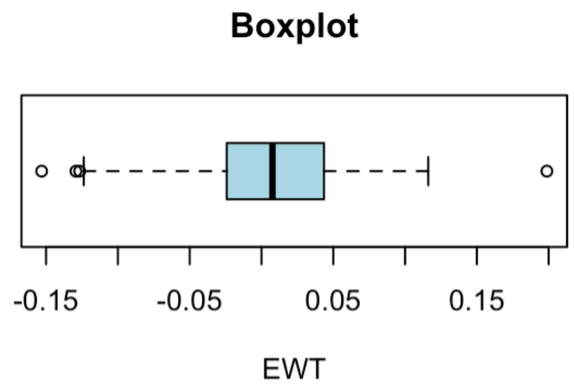
Study of EWY Monthly Stock Returns

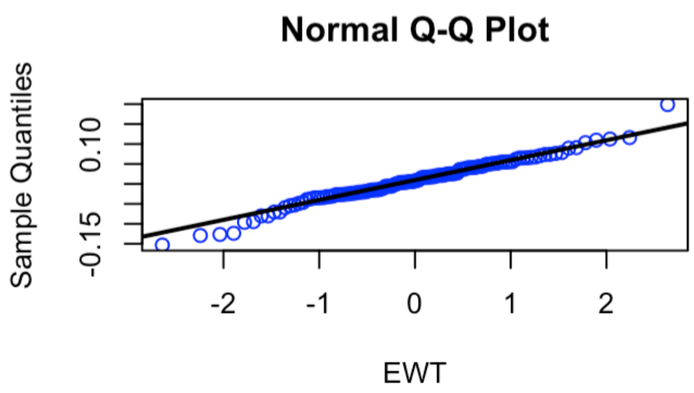


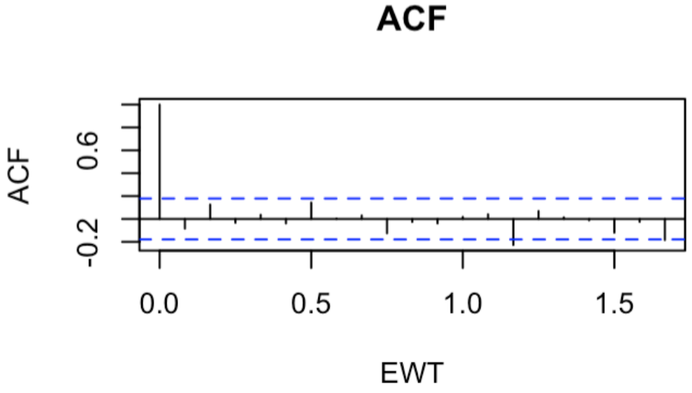
Asset Summary 2015-2025

Study of EWT Monthly Stock Returns



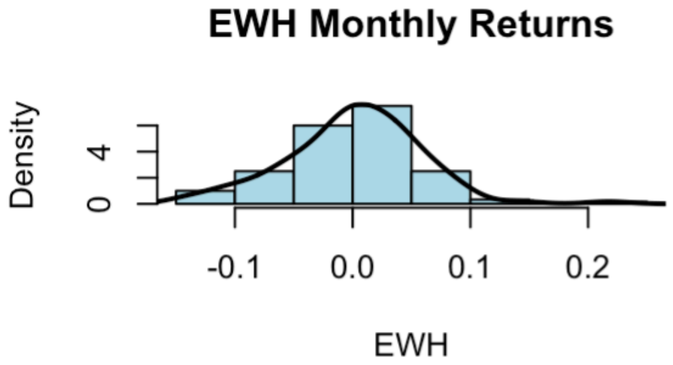


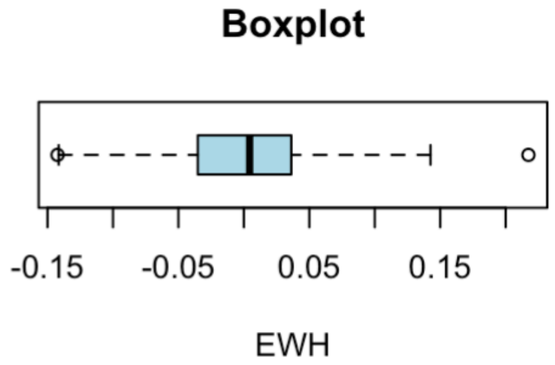


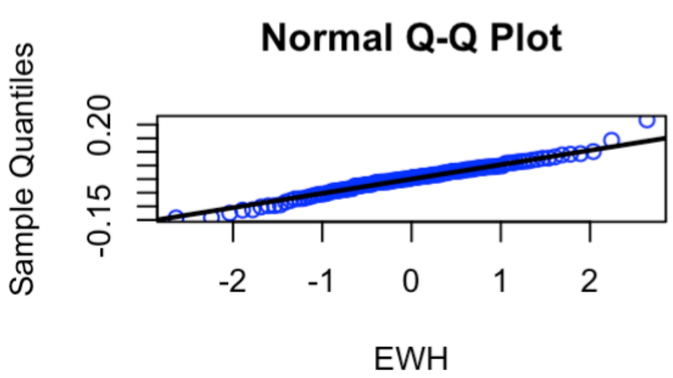


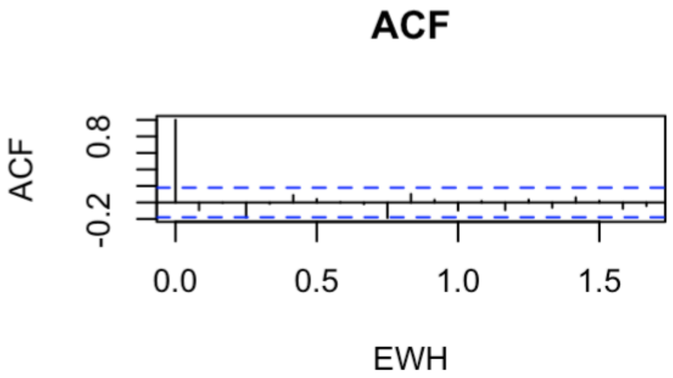
Asset Summary 2015-2025

Study of EWH Monthly Stock Returns



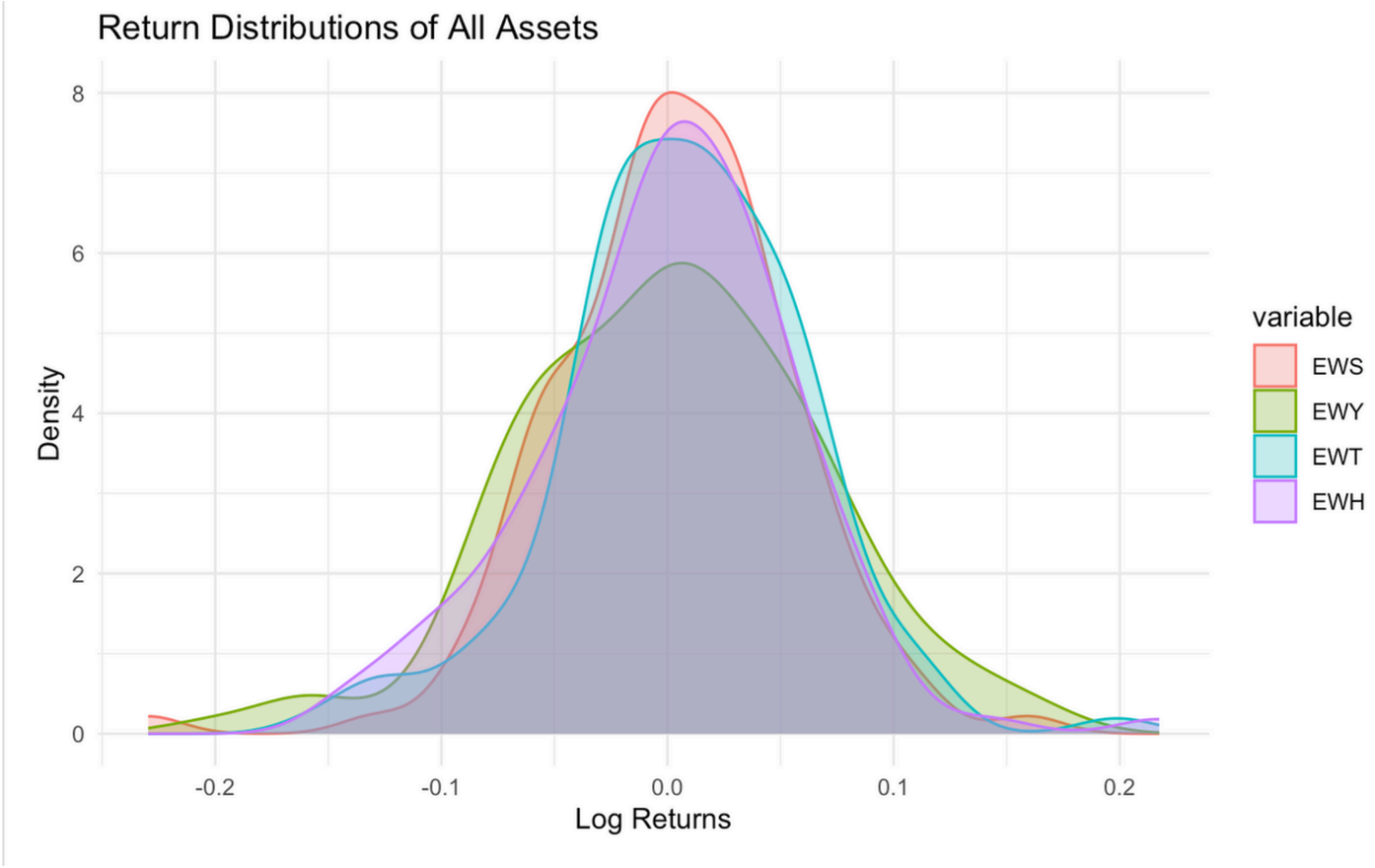






Log Returns

Monthly log returns for EWS, EWY, EWT, and EWH



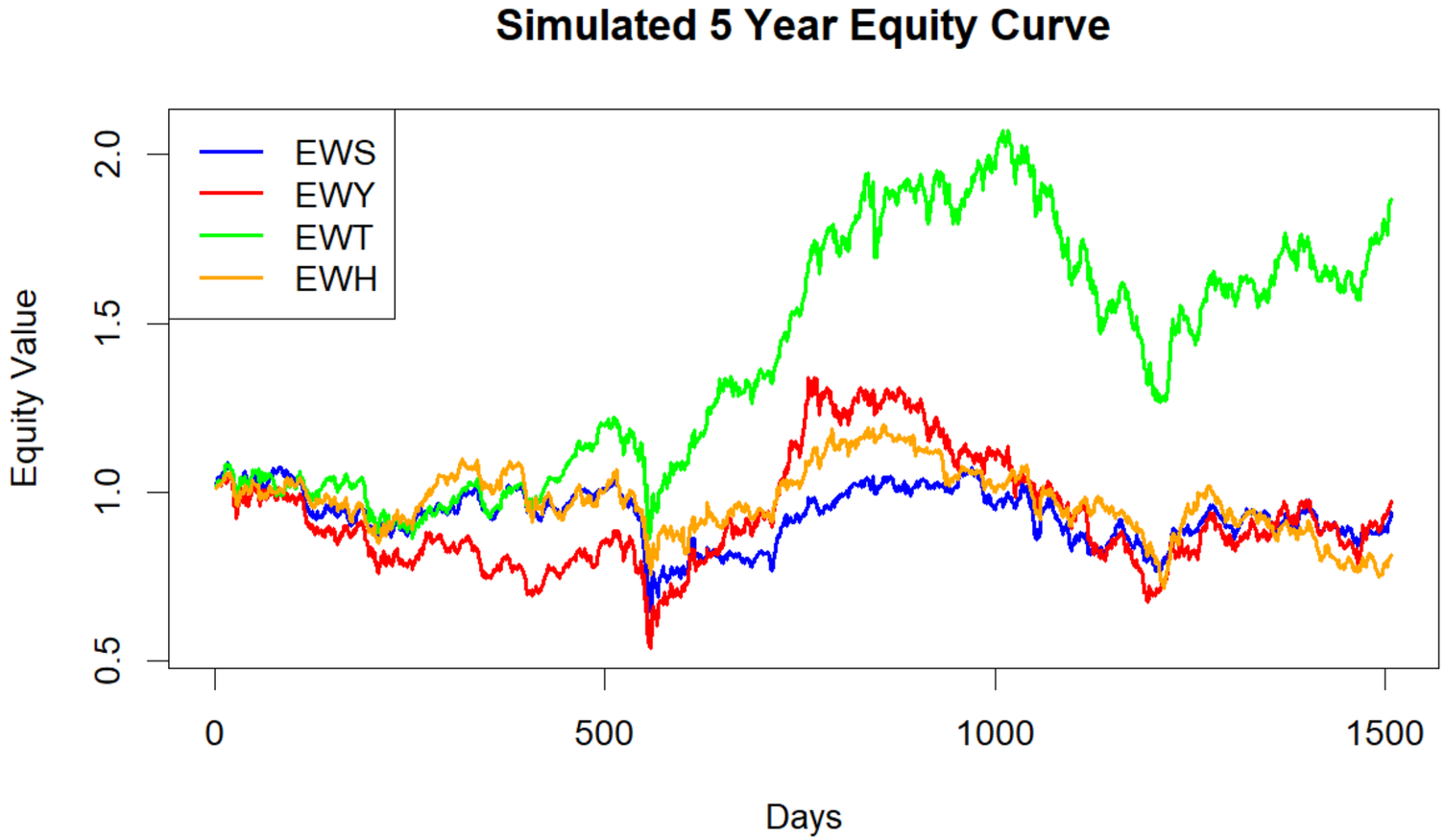
Log Returns

Monthly log returns for EWS, EWY, EWT, and EWH

	EWS	EWY	EWT	EWH
Mean	0.00262	0.00121	0.00801	0.00105
Variance	0.00281	0.00437	0.00295	0.00329
Std Dev	0.05303	0.06608	0.05432	0.05734
Skewness	-0.53089	-0.14852	-0.10861	0.07671
Excess Kurtosis	2.43109	0.32641	1.16006	1.17217

	EWS	EWY	EWT	EWH
1%	-0.12294	-0.15834	-0.12872	-0.13830
5%	-0.07667	-0.09705	-0.08092	-0.09821
25%	-0.02688	-0.04705	-0.02381	-0.03508
50%	0.00337	0.00285	0.00765	0.00441
75%	0.03258	0.04547	0.04354	0.03597
95%	0.08081	0.10908	0.08952	0.08178
99%	0.11204	0.15437	0.11543	0.13474

Equity Curves

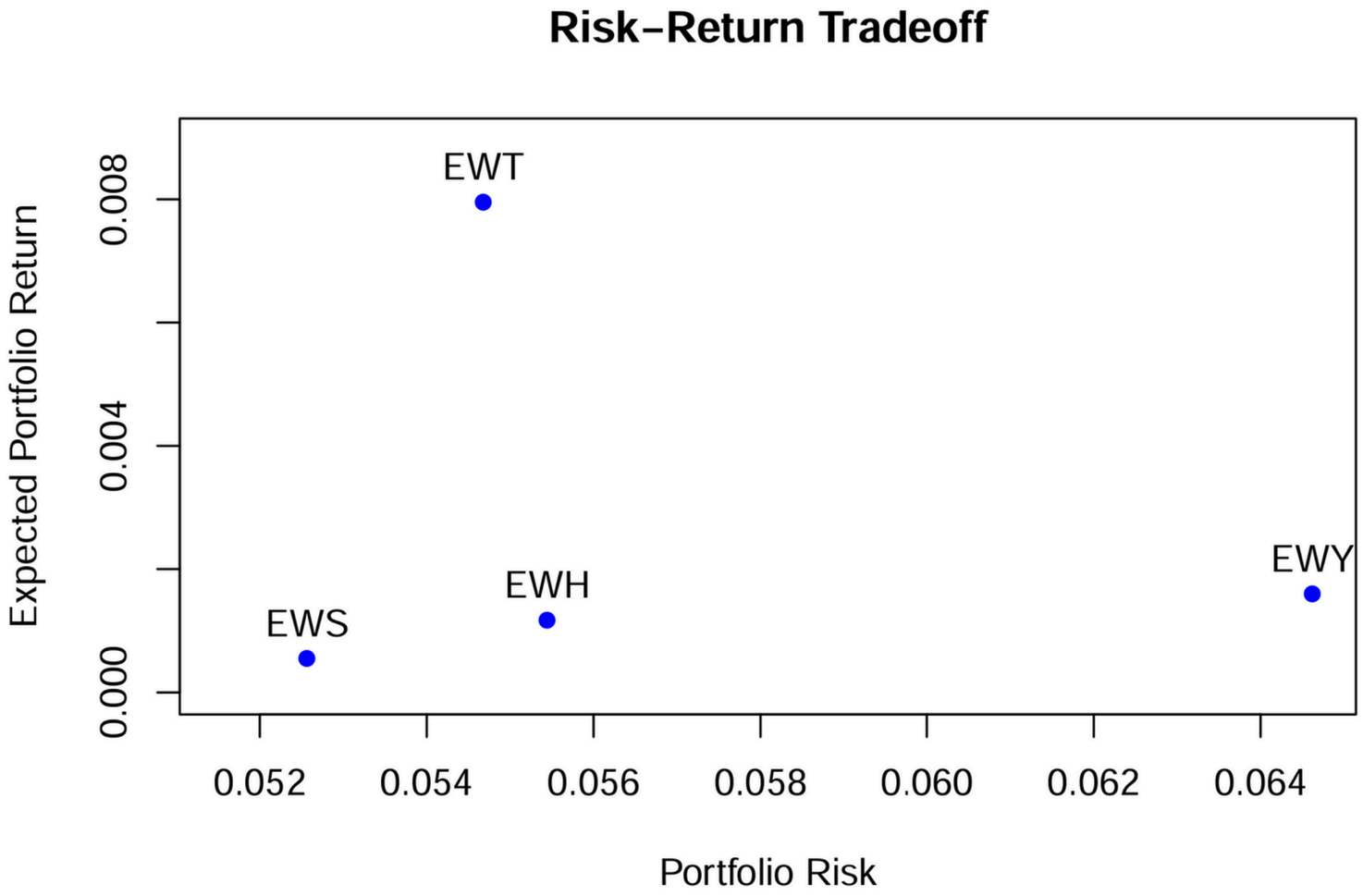


Simulated 5-Year Equity Curve Analysis

Study of EWS, EWY, EWT, EWH Monthly Stock Returns

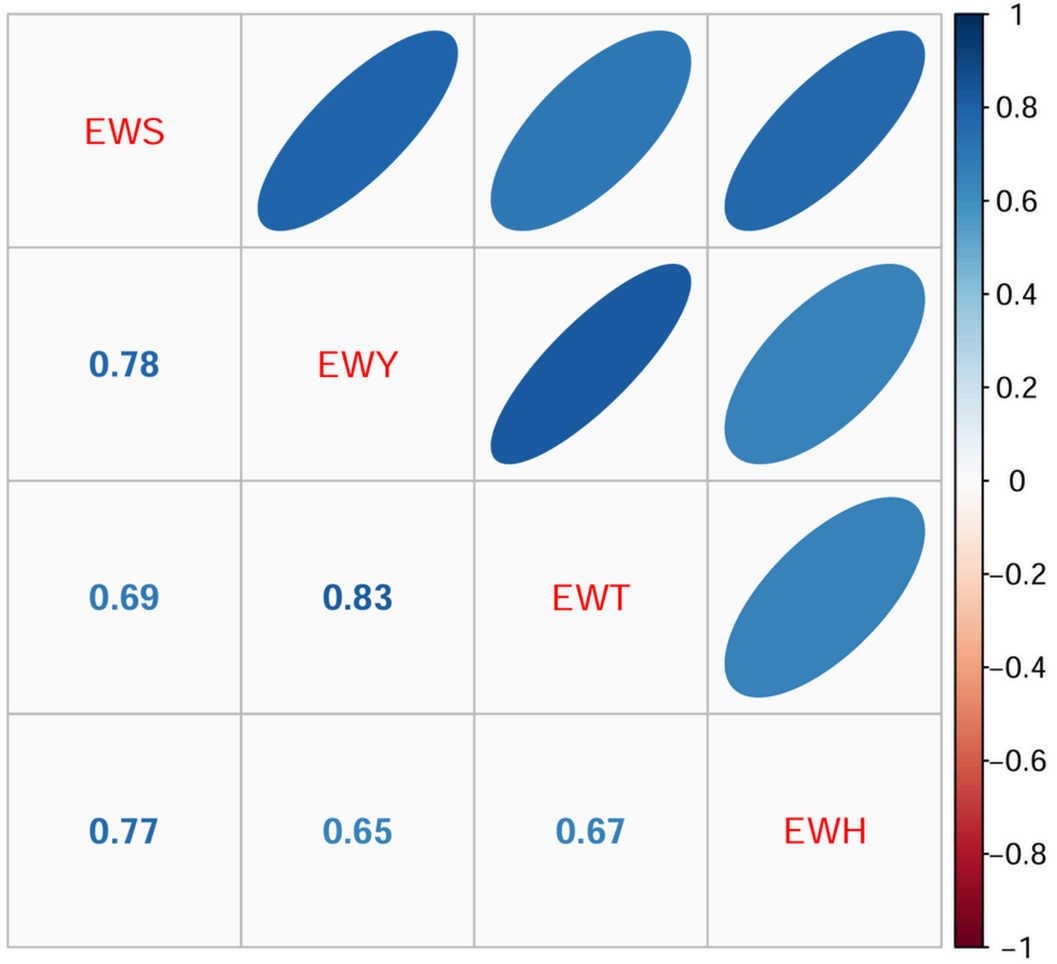
- **Growth Patterns**
- **Volatility and Risk**
- **Fat-Tails and Extreme Events (previous findings reinforced):**
- **Market Efficiency and Return Predictability:**
- **Random fluctuations and lack of clear persistent trends (especially for EWS, EWY, EWH) align with autocorrelation analysis findings, suggesting limited predictability and market efficiency.**

Risk-Return Tradeoff



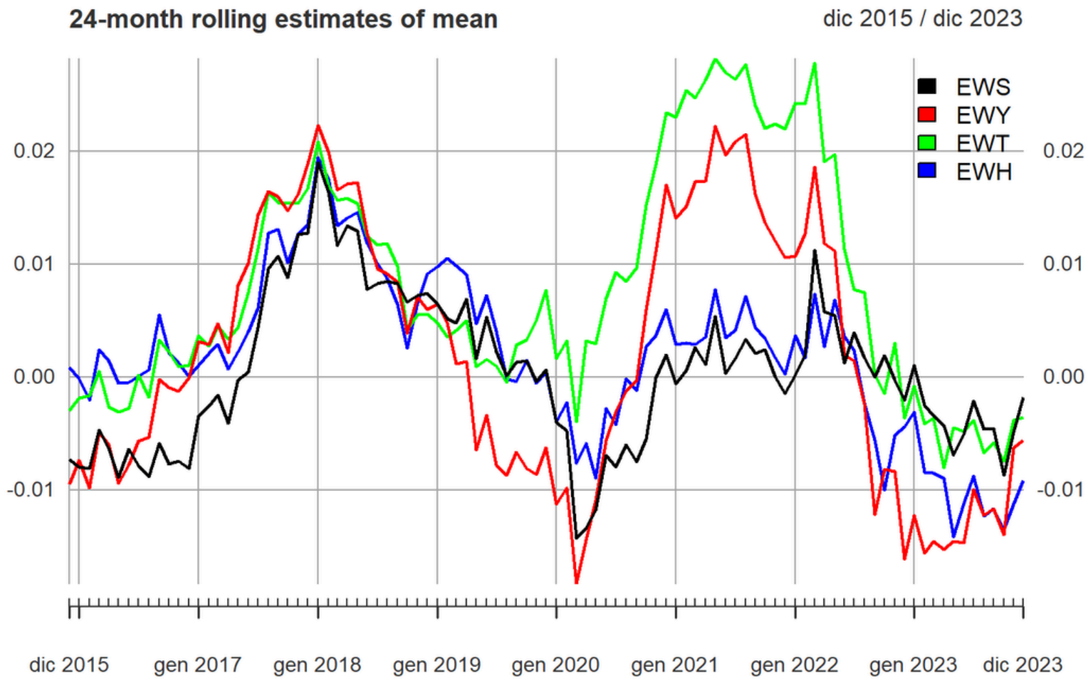
EWT has the highest expected return while maintaining relatively low risk. Meanwhile EWY has very low returns while having much more risk than the other assets.

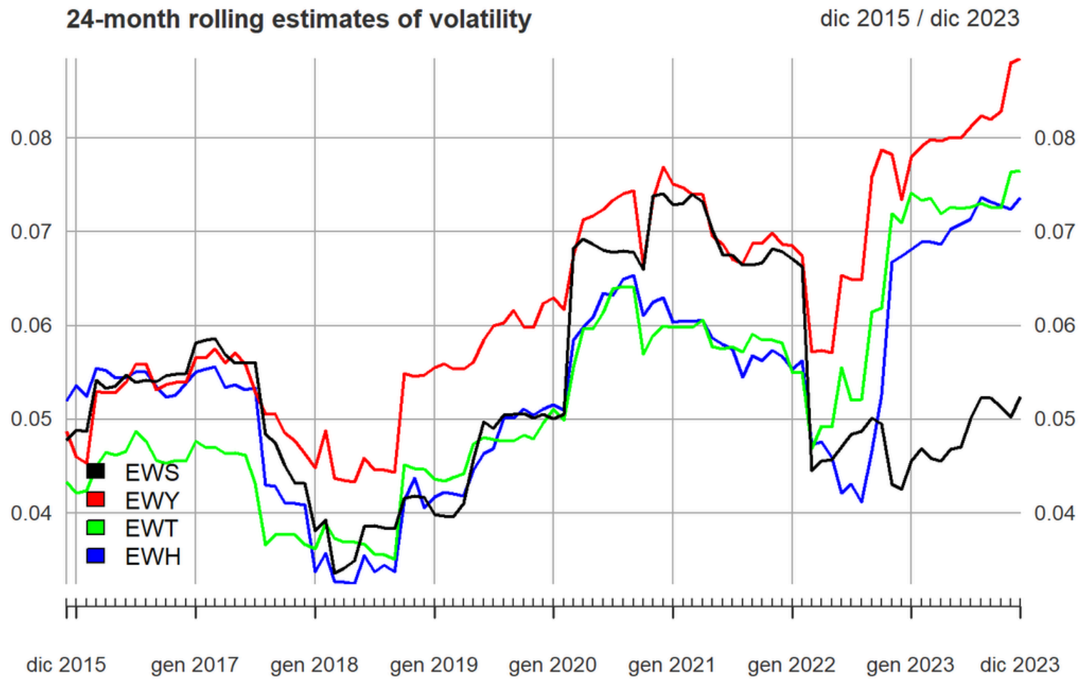
Correlation of Assets



All of the assets show high levels of correlation with each other. EWT (Taiwan) and EWY (Korea) have the highest correlation while EWY and EWH (Hong Kong) have the lowest correlation.

24-month rolling estimates of the mean and volatilities





It is unlikely that the data satisfies the assumption of covariance stationarity, because of the substantial time variation, especially during the COVID-19 period.

Value at Risk (1% & 5%)

	Normal VaR.05	Empirical VaR.05	Normal VaR.01	Empirical VaR.01
EWS	-8232	-7381	-11461	-11568
EWY	-9940	-8714	-13820	-14644
EWT	-7871	-7773	-11241	-12078
EWH	-8609	-9297	-11997	-12916

Overall, VaR values calculated using a normal distribution did not capture extreme losses to the same degree as VaR calculated empirically. At the same time the normal distribution seems to overestimate risk at 5% for most assets.

Risk Budgeting

Risk Analysis for Equal Weighted Portfolio

	Dollars	Vol	Weight	MCR	CR	PCR	Beta	Rho
EWS	25000	0.053	0.25	0.047	0.012	0.233	0.934	0.934
EWY	25000	0.065	0.25	0.060	0.015	0.293	1.170	1.170
EWT	25000	0.055	0.25	0.049	0.012	0.240	0.961	0.961
EWH	25000	0.055	0.25	0.048	0.012	0.234	0.935	0.935
PORT.EQW	100000	NA	1.00	NA	0.051	1.000	1.000	1.000

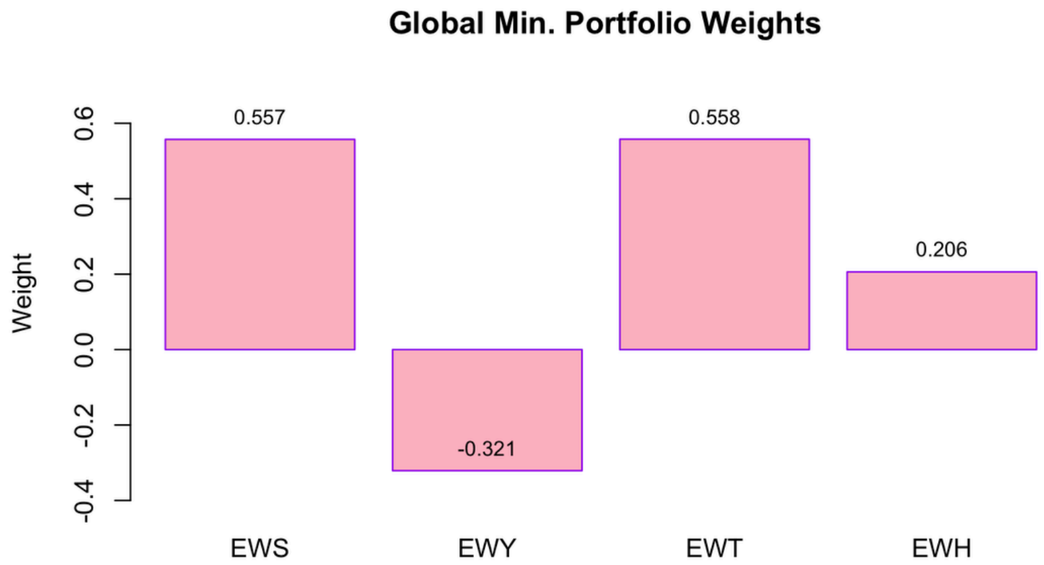
EWY (Korea) contributes the most risk, and more risk than it's standalone volatility, in this equally weighted portfolio. Both it's Beta and Rho are greater than 1. All of the assets have high rho values. This agrees with the high correlations between all of the assets and thus the portfolio.

Portfolio Theory

Global Minimum Variance Portfolio

```
gm_port = globalMin.portfolio(muhat.vals, cov.mat)
gm_port
```

```
  "Portfolio expected return":     0.00447
  "Portfolio standard deviation":  0.0475
```

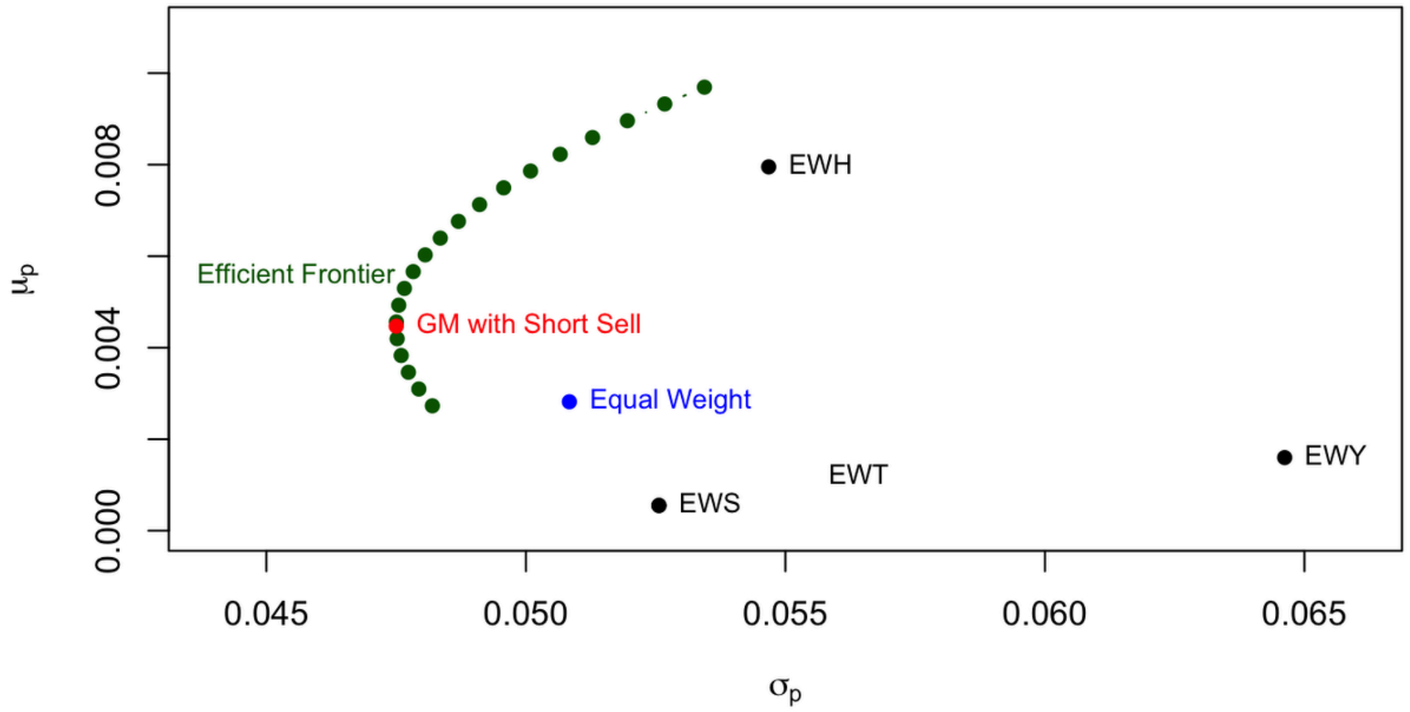


Application of Global Min Portfolio 1% & 5% VaR with investment of $10,000

```
W = 100000
var_one_gm = W * qnorm(p = 0.01, mean = gm_port[2]$er, sd = gm_port[3]$sd)
var_five_gm = W * qnorm(p = 0.05, mean = gm_port[2]$er, sd = gm_port[3]$sd)
```

There is a 1% chance that we lose $10604 or more over the next month.
There is a 5% chance that we lose $7366 or more over the next month.

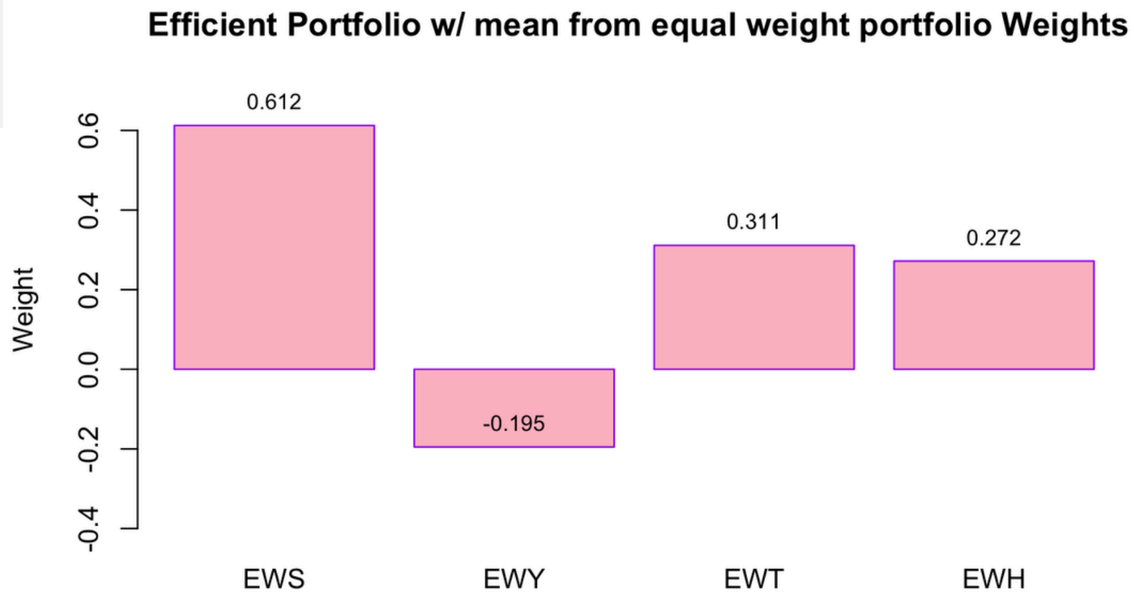
Plot of efficient frontier with global min, equal weight portfolios and assets



Efficient Portfolio with mean from equal weight portfolio

```
eff_eqwmu = efficient.portfolio(muhat.vals, cov.mat, eqw_port[2]$er)
eff_eqwmu
```

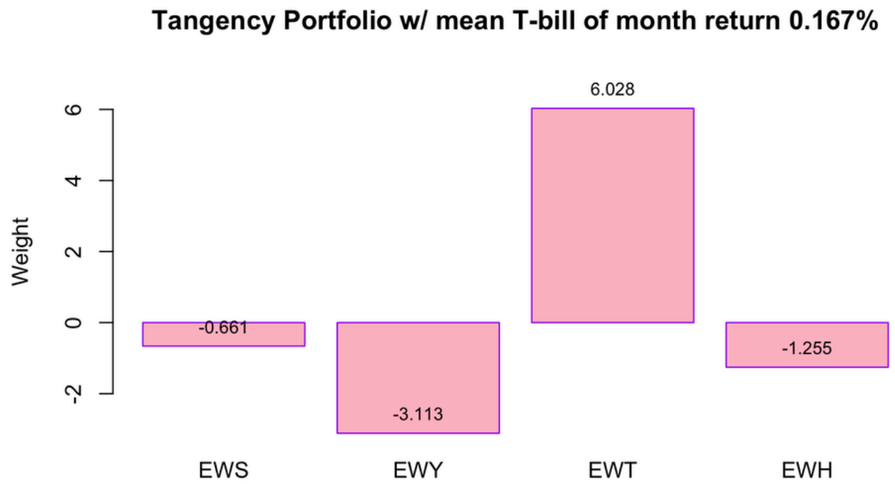
```
"Portfolio expected return: "     0.00282
"Portfolio standard deviation:"   0.0481
```



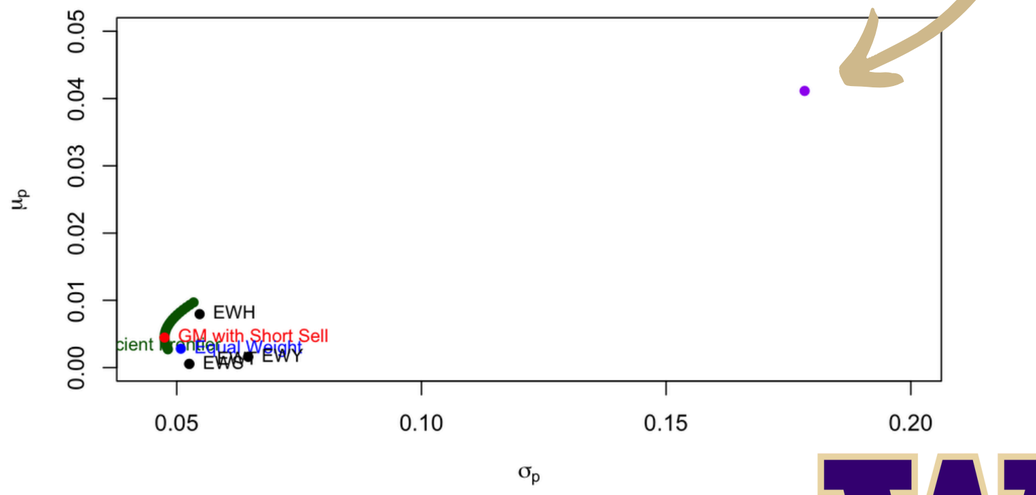
Tangency Portfolio with T-bill of month return 0.167%

```
tan_port = tangency.portfolio(muhat.vals, cov.mat, 0.00167)
tan_port
```

```
"Portfolio expected return:"    0.0411
"Portfolio standard deviation:"  0.178
```



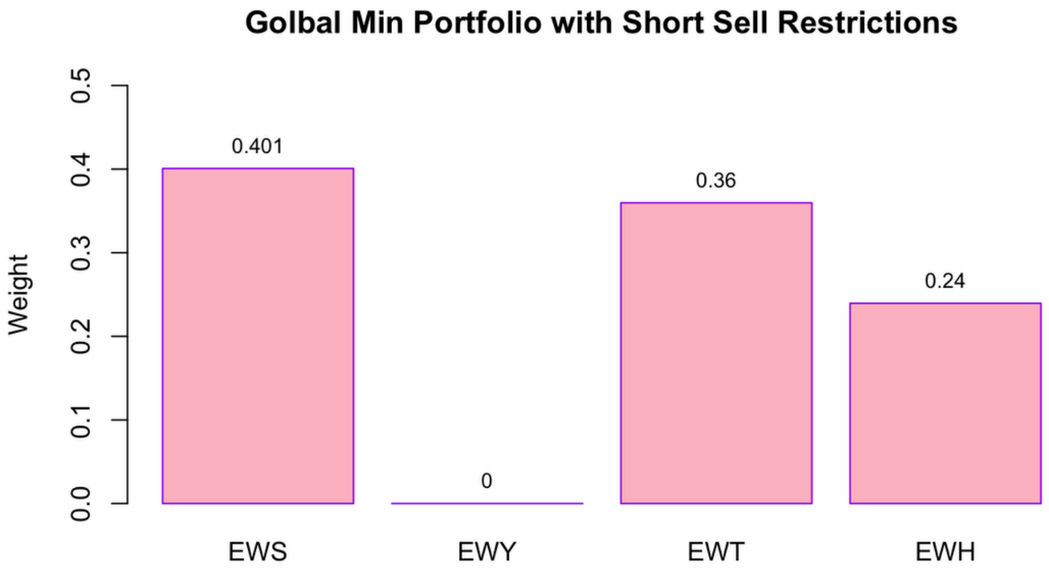
Note: The portfolio won't fit the efficient portfolio frontier. Way too much volatility!



Global Min Portfolio with short selling restrictions

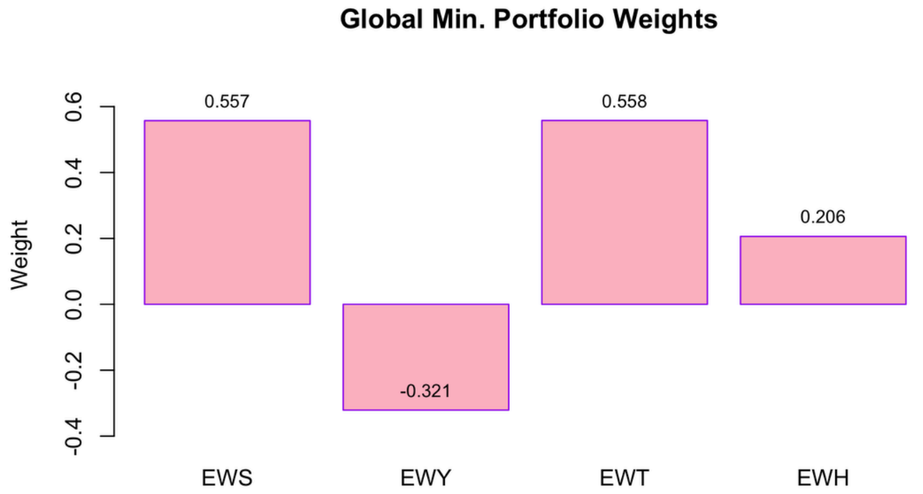
```
gm_port_ns = globalMin.portfolio(muhat.vals, cov.mat, shorts = FALSE)
gm_port_ns
```

```
"Portfolio expected return:"      0.00336
"Portfolio standard deviation:"   0.0486
```



Where Previously without short selling restrictions ...

```
"Portfolio expected return":      0.00447
"Portfolio standard deviation":   0.0475
```

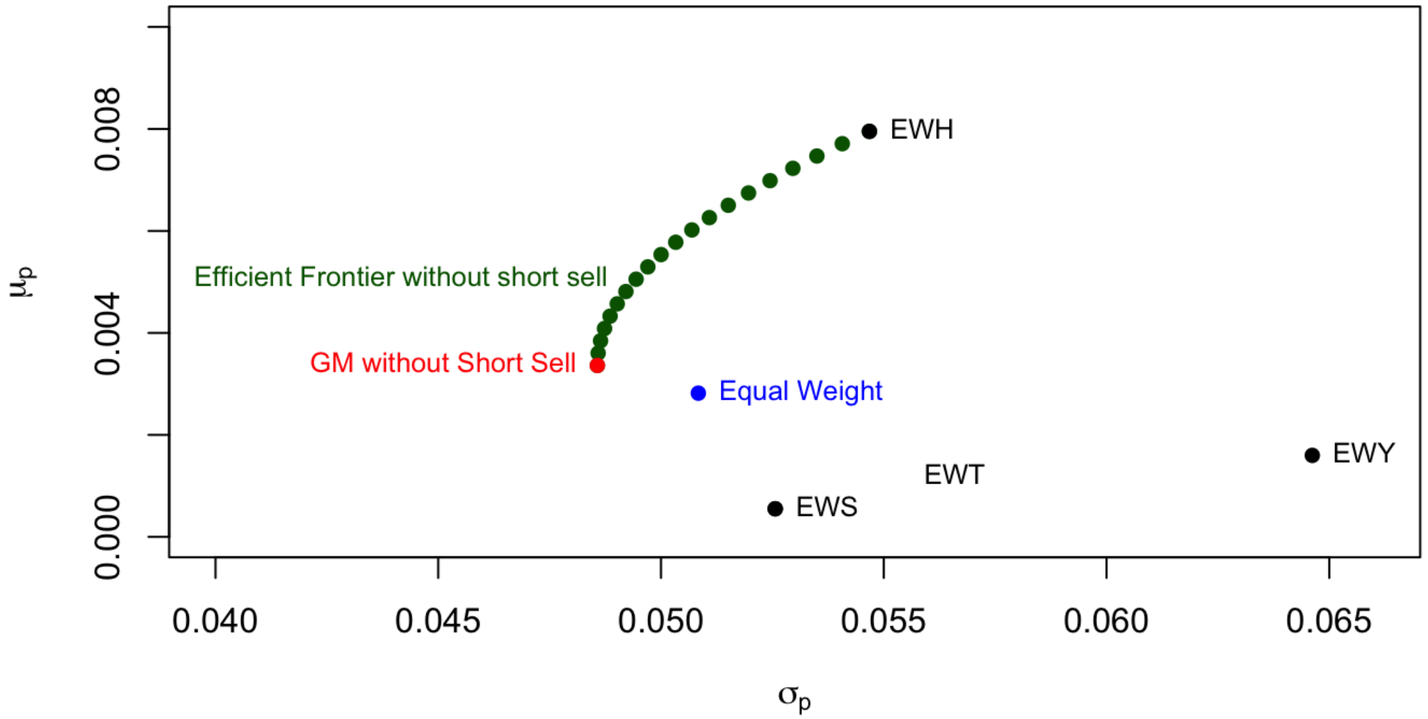


Application of Restricted Global Min Portfolio 1% & 5% VaR with investment of $10,000

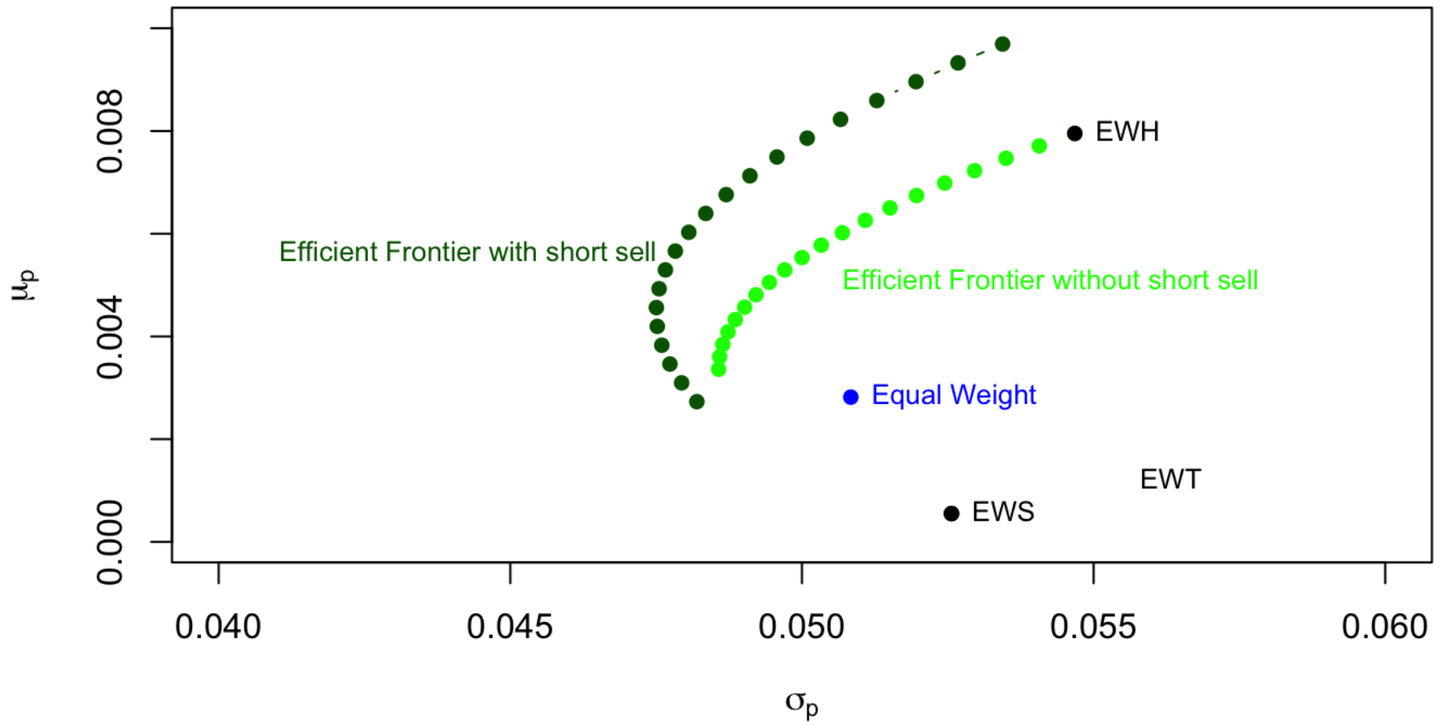
```
W = 100000
var_one_gm_ns = W * qnorm(p = 0.01, mean = gm_port_ns[2]$er,
                          sd = gm_port_ns[3]$sd)
var_five_gm_ns = W * qnorm(p = 0.05, mean = gm_port_ns[2]$er,
                           sd = gm_port_ns[3]$sd)
```

There is a 1% chance that we lose $10963 (compared to $10604 without restrictions) or more over the next month.
There is a 5% chance that we lose $7653 (compared to $7366 without restrictions) or more over the next month.

Plot of efficient frontier with global min, equal weight portfolios and assets (with short selling restrictions)



Comparison of plots of efficient portfolio with and without short selling restrictions



Comparison of approximate cost in expected return of investing in $10,000

```
#Eff Port without ss
eff_eqwmu_ns = efficient.portfolio(muhat.vals, cov.mat, eqw_port[2]$er, shorts = FALSE)

#Cost for without short sell
cost_ns_x = 0.02 / eff_eqwmu_ns[3]$sd
cost_ns = cost_ns_x * eff_eqwmu_ns[2]$er
#Cost for with short sell
cost_x = 0.02 / eff_eqwmu[3]$sd
cost = cost_x * eff_eqwmu[2]$er
```

The expected return of investing with the short sell restrictions is $116, while without the restriction is $117. Thus, the approximate cost is $1.

Asset Allocation

Efficient Portfolio without Risk Free Asset

Target Expected Return: 6% per year and 0.5% per month
Risk-free rate: 2.004% per year and 0.167% per month

Asset <chr>	Weight <dbl>
EWS	0.244
EWY	0.000
EWT	0.587
EWH	0.169

Efficient Portfolio with Risk Free Asset

Target Expected Return: 6% per year and 0.5% per month
Risk-free rate: 2.004% per year and 0.167% per month

Asset <chr>	Weight <dbl>
EWS	0.163
EWY	0.000
EWT	0.391
EWH	0.112
Risk-Free	0.334

Longer-horizon Investment

Assuming a Risk-free rate: 2.004% per year and 0.167% per month

Asset <chr>	Annual_Return <dbl>	Annual_SD <dbl>	Annual_Sharpe <dbl>
EWS	0.0066	0.182	-0.0737
EWY	0.0192	0.224	-0.0038
EWT	0.0954	0.189	0.3980
EWH	0.0141	0.192	-0.0311

Precision

```
     muhat.vals seMuhat
EWS    0.000551 0.00480
EWY    0.001598 0.00590
EWT    0.007952 0.00499
EWH    0.001172 0.00506
     sd.vals seSD.vals s
EWS   0.0526   0.00339
EWY   0.0646   0.00417
EWT   0.0547   0.00353
EWH   0.0554   0.00358
```

Conclusion

Conclusion

- **EWT** is the overall **best performing asset**
- The portfolio exhibits **low expected return** (Highest 9.54%) and **low sharpe ratio**
- **Little diversification benefits** since all assets have **high levels of positive correlation** with each other
- High **Standard Error for expected return** but stable **Standard Error for SD**

Thank you!