# QUESTION 5 - VOLATILITY AND GARCH ESTIMATES

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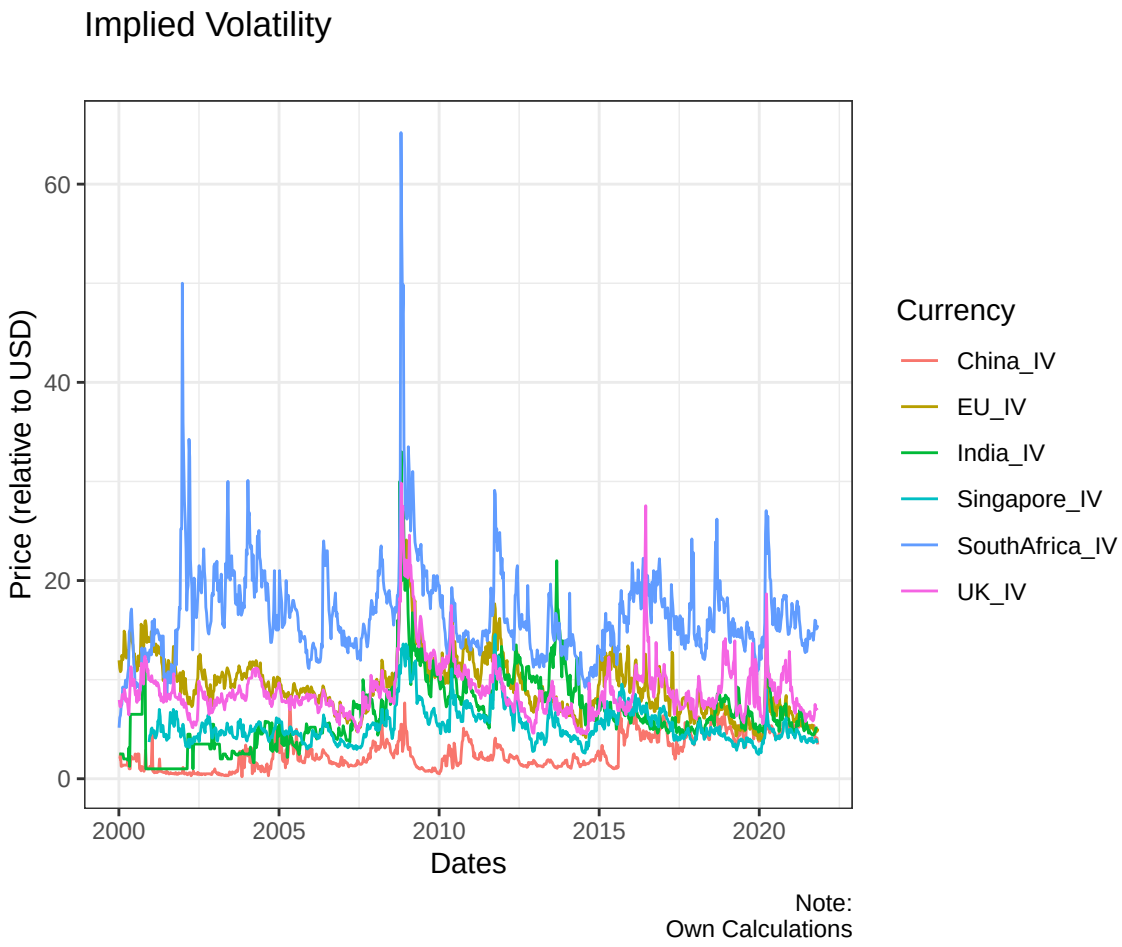
## 1. Short Introduction

The study of volatility is particularly important in financial modelling. Thus, in this question I will look at the South African ZAR since it has been quite volatile over the past couple of years. More specifically, I will conduct a simple univariate-GARCH estimation to analyse the volatility of the Rand.

## 2. Implied Volatility

I will start by looking at implied volatility. The market's estimate of how much a currency pair will fluctuate over a certain period in the future is known as implied volatility. Option traders can use a currency volatility index to price options on currency pairs. Implied volatility is generally considered a measure of sentiment.




This suggests that the market foresees the highest future volatility for the Rand, for this sub-sample.

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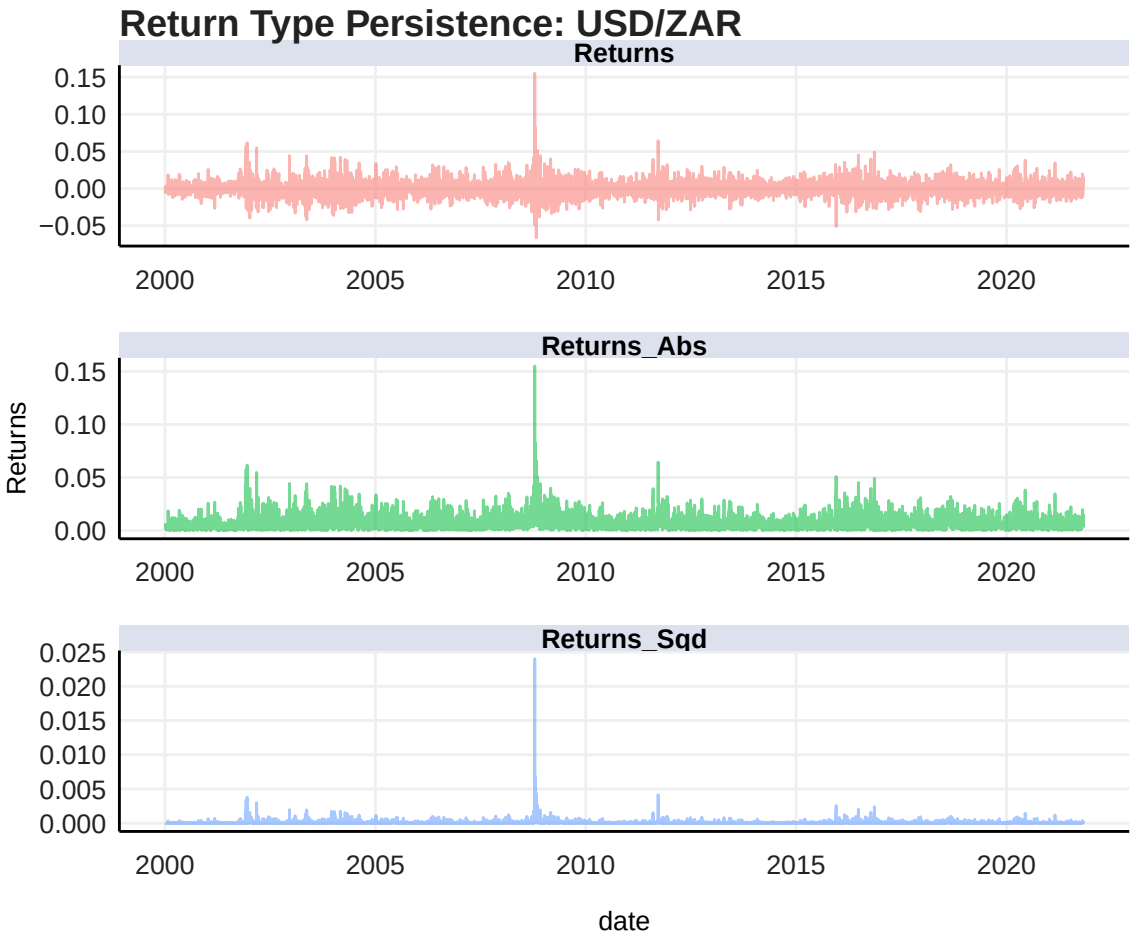
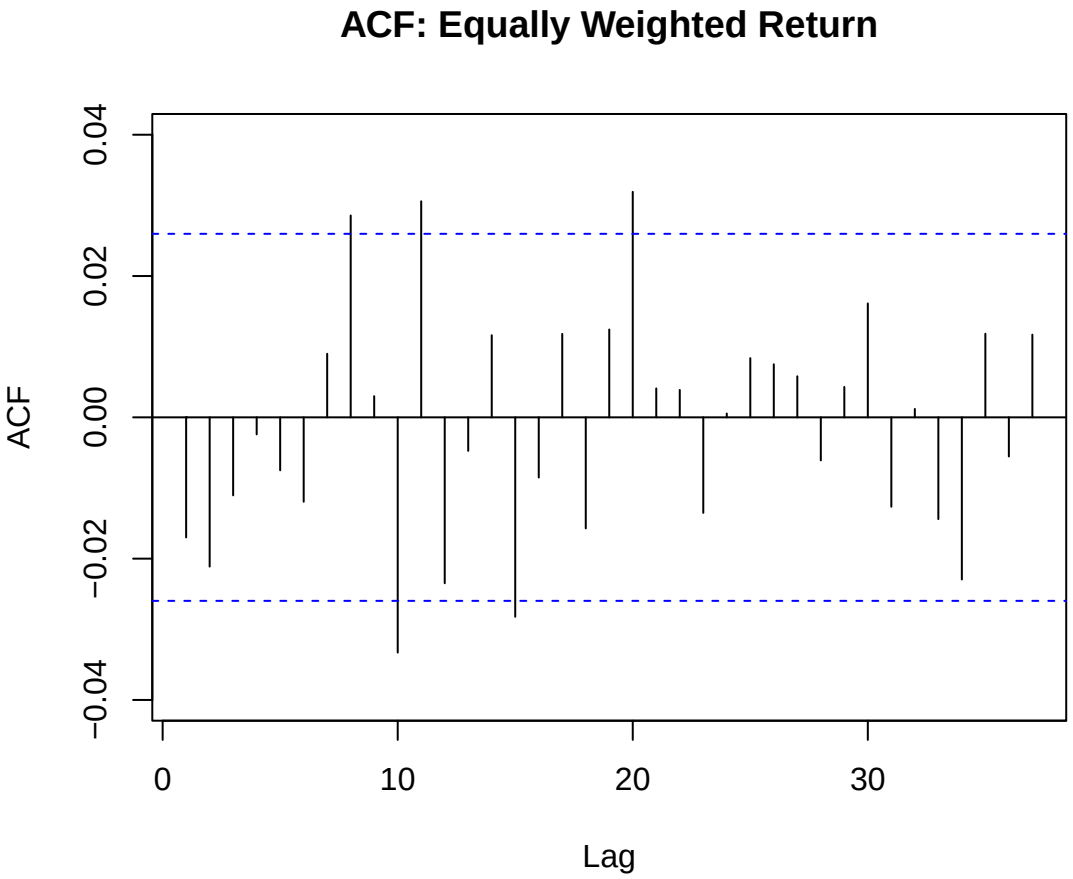
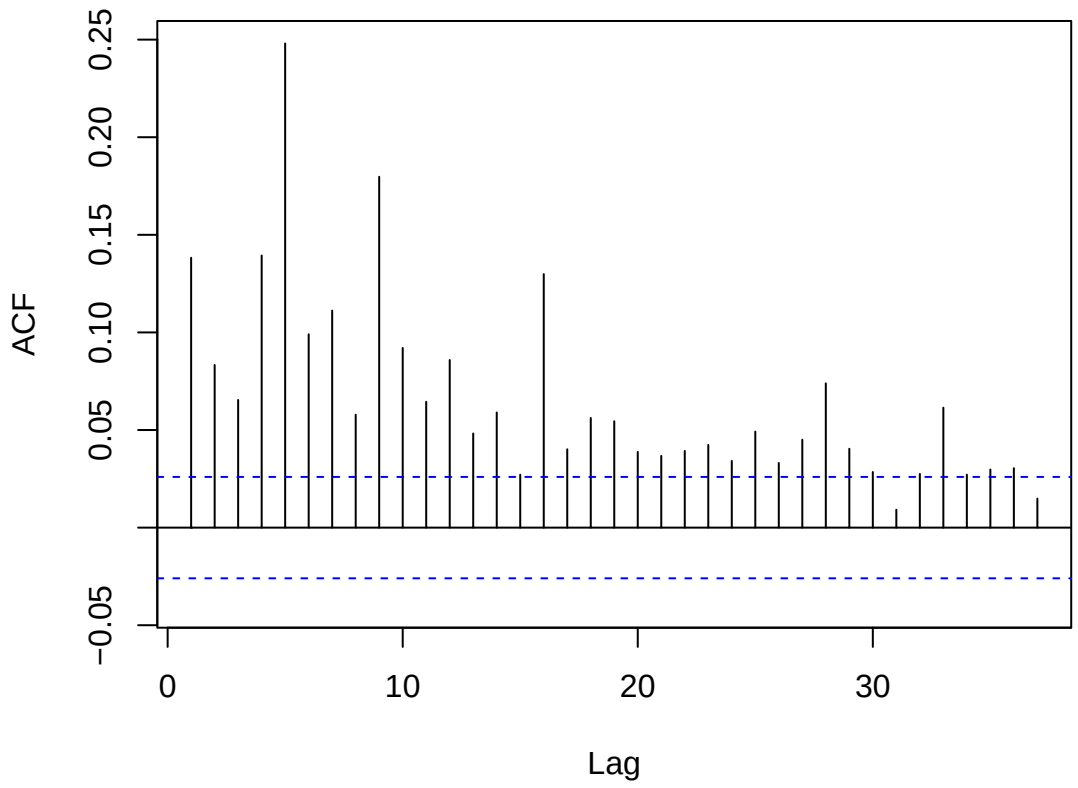
Now I'll calculate the returns to analyse the Auto-Persistence in Returns

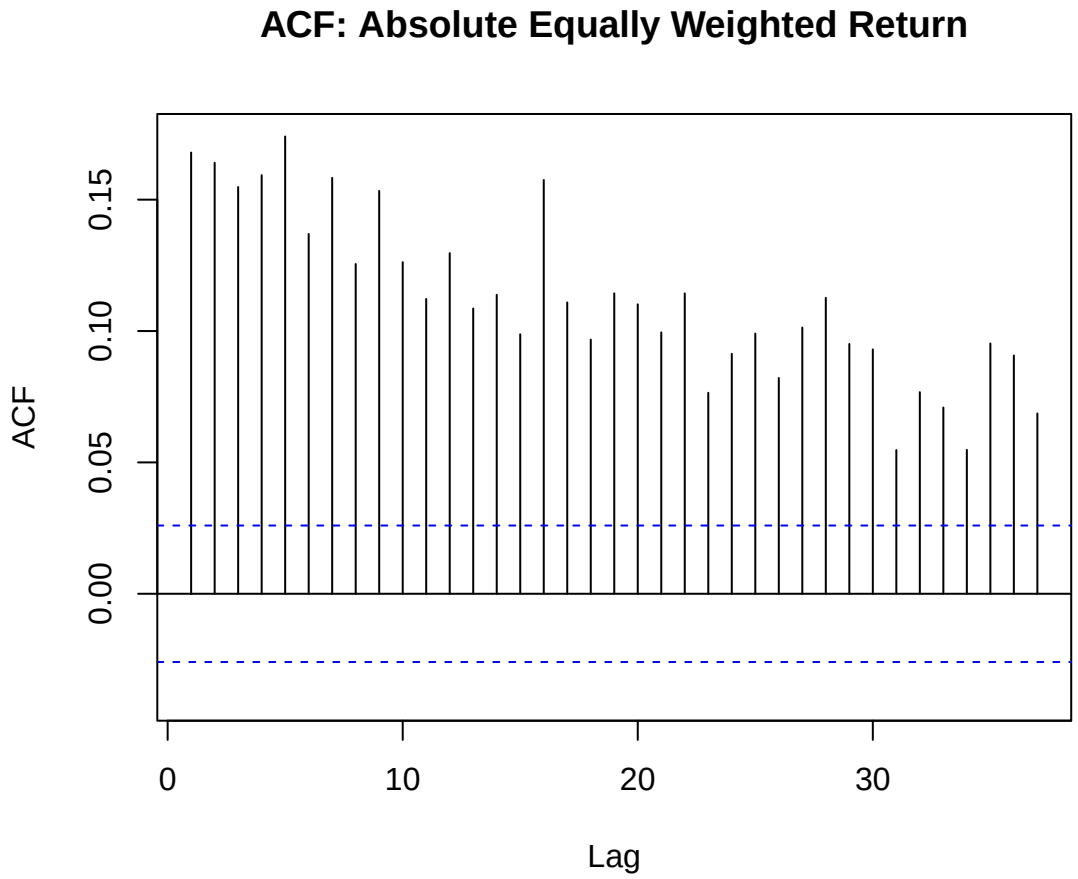



From the graph above it is clear that there is persistence in certain periods of USDZAR returns. Moreover, we have first and second order persistence as well as clear evidence of long-term memory in the second order process.

Let's investigate further...


ACF: Equally Weighted Return
ACF
0.04
0.02
0.00
−0.02
−0.04
0
10
20
30
Lag


ACF: Squared Equally Weighted Return
ACF
0.25
0.20
0.15
0.10
0.05
−0.05
0
10
20
30
Lag

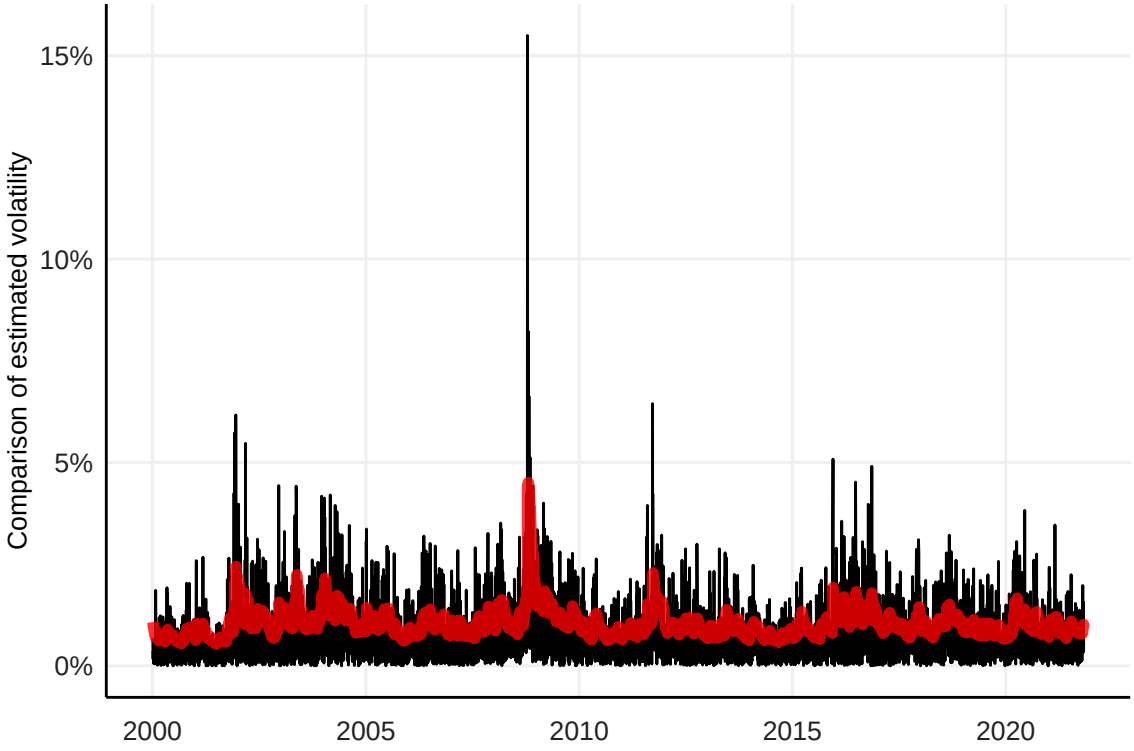



**3. Fit Model**

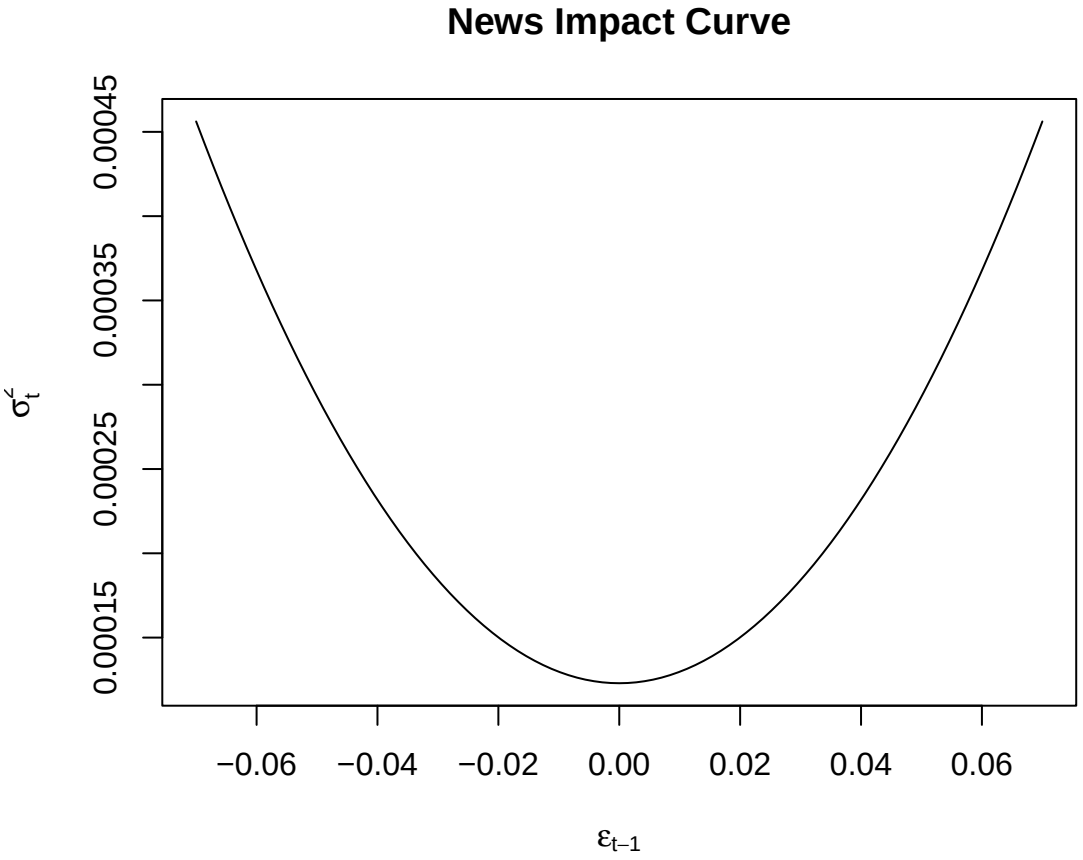
| | Estimate | Std. Error | t value | Pr(>\|t\|) |
|---|---|---|---|---|
| mu | 0.00029 | 0.00012 | 2.3906 | 0.0168 |
| ar1 | -0.00039 | 0.01383 | -0.0282 | 0.9775 |
| omega | 0.00000 | 0.00000 | 2.7404 | 0.0061 |
| alpha1 | 0.07925 | 0.00543 | 14.5894 | 0.0000 |
| beta1 | 0.92896 | 0.00748 | 124.1921 | 0.0000 |
| gamma1 | -0.03796 | 0.00803 | -4.7290 | 0.0000 |

## Comparison: Returns Sigma vs Sigma from Garch

Note the smoothing effect of garch, as noise is controlled for.




Source: Fin metrics class | Calculations: Own

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##
## please wait...calculating quantiles...
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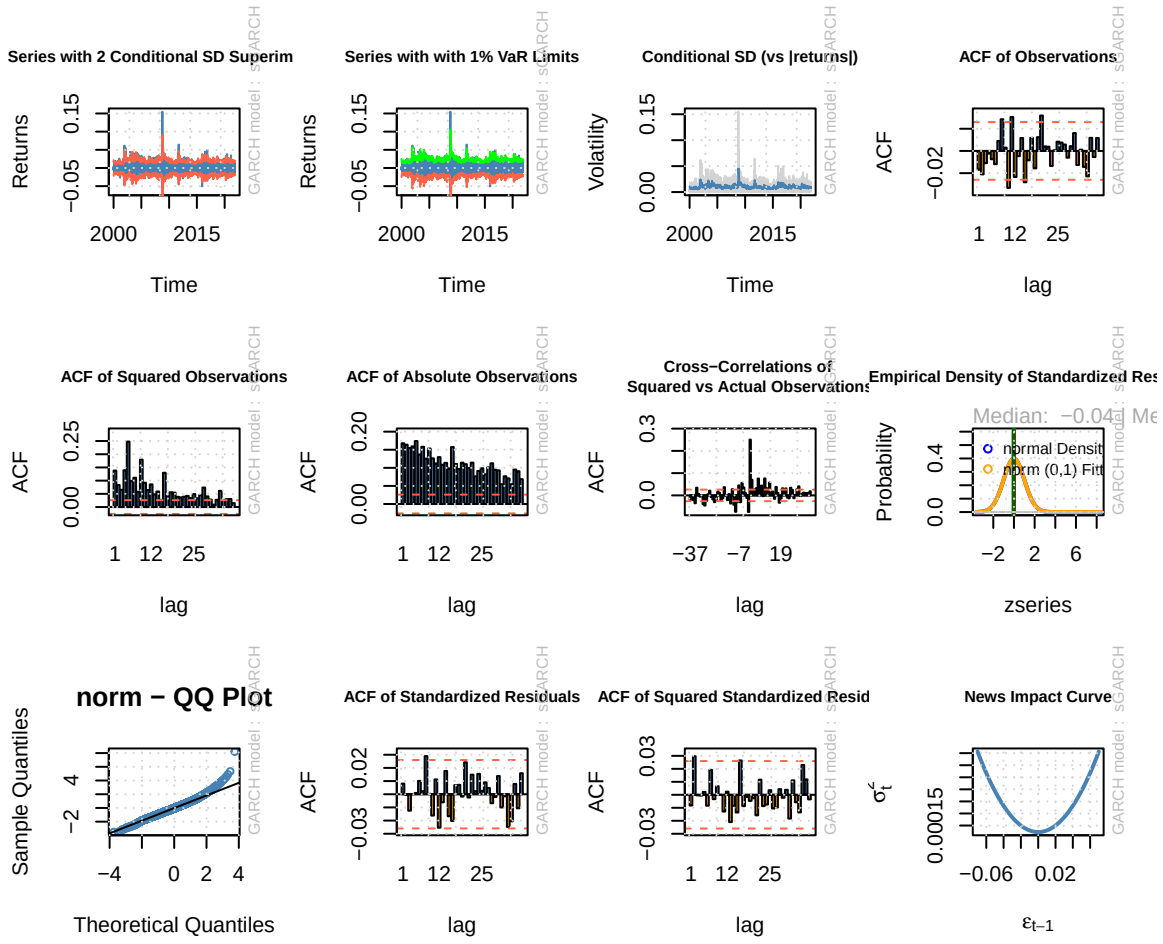
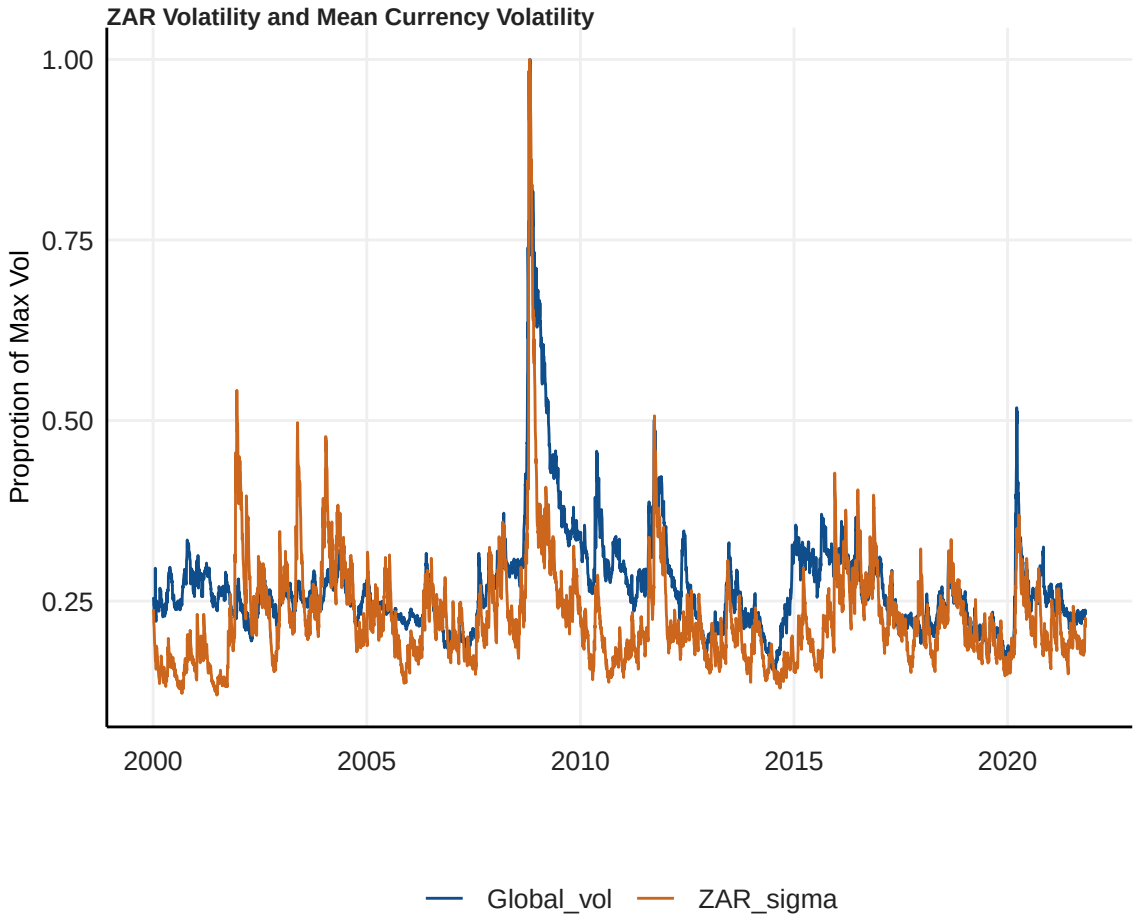



Lets investigate further by compare smoothed ZAR Volatility to mean Global volatility


ZAR Volatility and Mean Currency Volatility
1.00
0.75
0.50
0.25
Proprotion of Max Vol
2000
2005
2010
2015
2020
Global_vol
ZAR_sigma

## References

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## Appendix

*Appendix A*

Some appendix information here

*Appendix B*