Question 5

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1. Volatility and GARCH

The way that I interpreted the question is three fold:

1. I need to rank, by some metric, the average volatility of countries over my selected time period of the last ten years (after 2010/01/01). From this, I need to see where South Africa ranks.
2. Then, I should build a GARCH model (I have chosen univariate), select the best specification, and show the "cleaned" volatility of the ZAR, perhaps to be used in later explanations.
3. I should isolate low volatility time periods in the US dollar, and plot the ZAR volatility against some sort of global average volatility, perhaps only of selected countries, or all, and indicate on the same set of axes the low USD volatility periods.

In terms of the first point, see the table ranking the top ten countries by average volatility over the last ten years, below.

Country	Vol
Ghana	0.0001859
Russia	0.0001070
Brazil	0.0000988
SouthAfrica	0.0000969
Argentina	0.0000957
Nigeria	0.0000933
Zambia	0.0000912
Egypt	0.0000834
Turkey	0.0000826
Mexico	0.0000624

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As you can see, South Africa ranks in at number 4. This is an incredibly high position. The average volatility is substantially lower than Ghana at number one, but this is an outlier as it is higher than all others in the table by quite a distance. My comment on this is that the ZAR is indeed one of the most volatile currencies over the decade spanning 2010 - 2021.

I would now like to build a univariate GARCH model and estimate a noise reduced volatility estimate for the ZAR. For this I created three functions, which are all variations of the practical offered by Nico. Selection_foo() selects the best model, GARCH_Maker_foo creates a GARCH model, and then I created VolPlotter() to plot the cleaned volatility, in case I wanted to repeat this process for other countries. I did not end up doing this, though.

My chosen specification is a gjr-GARCH, because it had the lowest AIC. The AIC of this model is -6.483637. Figure 5.1 is the cleaned volatility of the ZAR plotted on the same set of axes as the raw volatility. You can clearly see that the GARCH estimate is noise reduced.

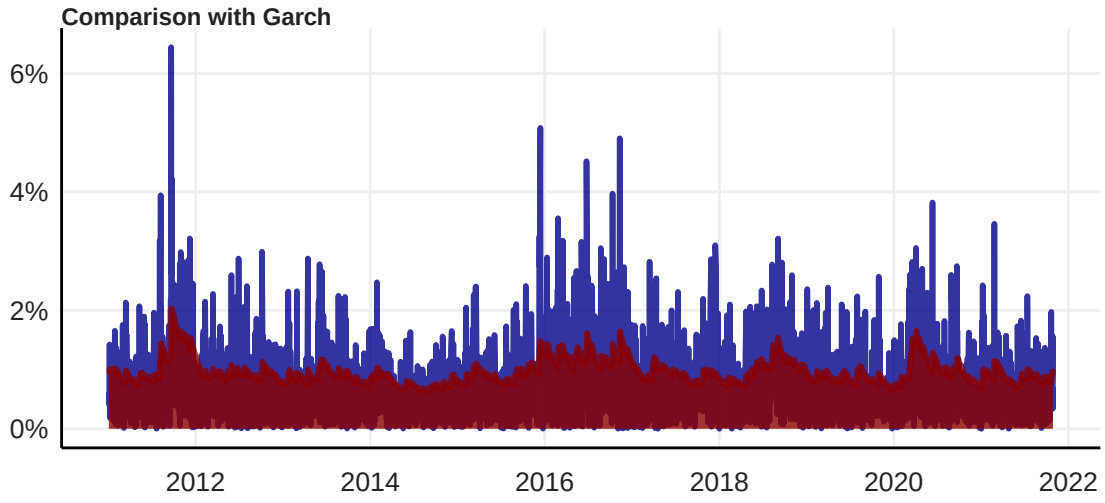

Figure 1.1

Finally, for step three, I calculated the low volatility periods for the USD and selected the top 3 years. Selecting only the years allows for a broader discussion and a simpler plot for the reader to interpret. I then plotted the ZAR volatility against the global average volatility over the time period. Selecting the global average is relatively simple, and perhaps not always the most informative, but given the question I interpreted that this would be the best decision.

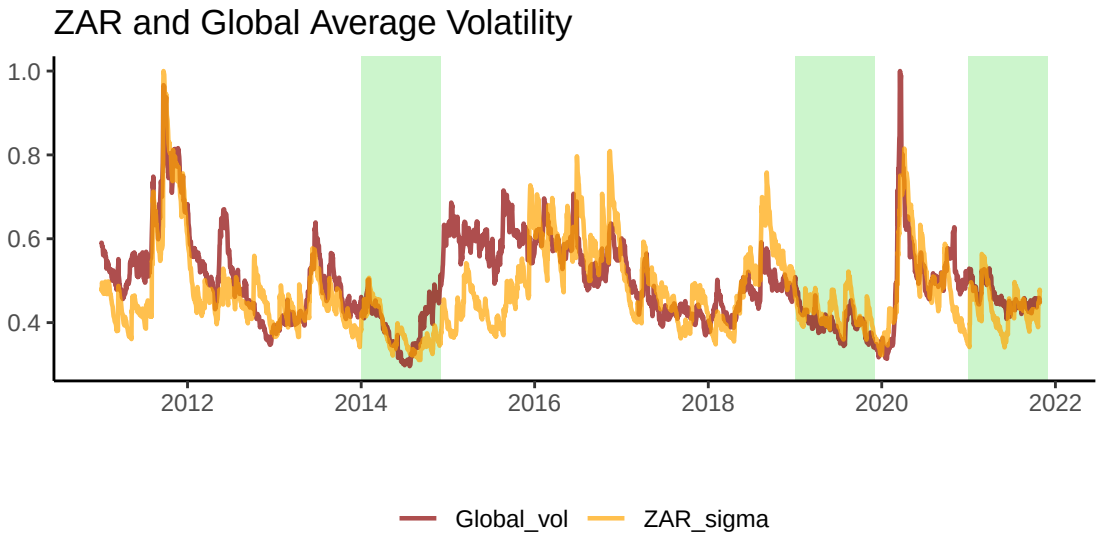

Figure 1.2

In figure 5.2 you can see that 2014, 2019, and 2021 were selected as the top 3 least volatile years for the USD in the past decade. My comment on this consists of two parts. Firstly, it is interesting that the ZAR has become so correlated over time to the global average volatility. You could argue that in the first half of the decade, this correlation did not necessarily exist. Though (I have no source for this but I think we learned it in Time Series Econometrics) I believe that co-movement is understood to increase during periods of economic struggle, which would explain the similar volatility during COVID-19.

Secondly, we see that all currencies seem to become less volatile when the USD is less volatile. In 2014, we see a rapid decline in the global average volatility, as well as the Rand. We see a similar decrease in volatility in 2019, and after the pandemic in 2021. I would say that there does seem to be a good relationship between the ZAR and the USD in terms of volatility, but this is also true for the global average volatility, so I might not necessarily argue that the Rand specifically has a special relationship.