Question 5: Volatility and GARCH estimates

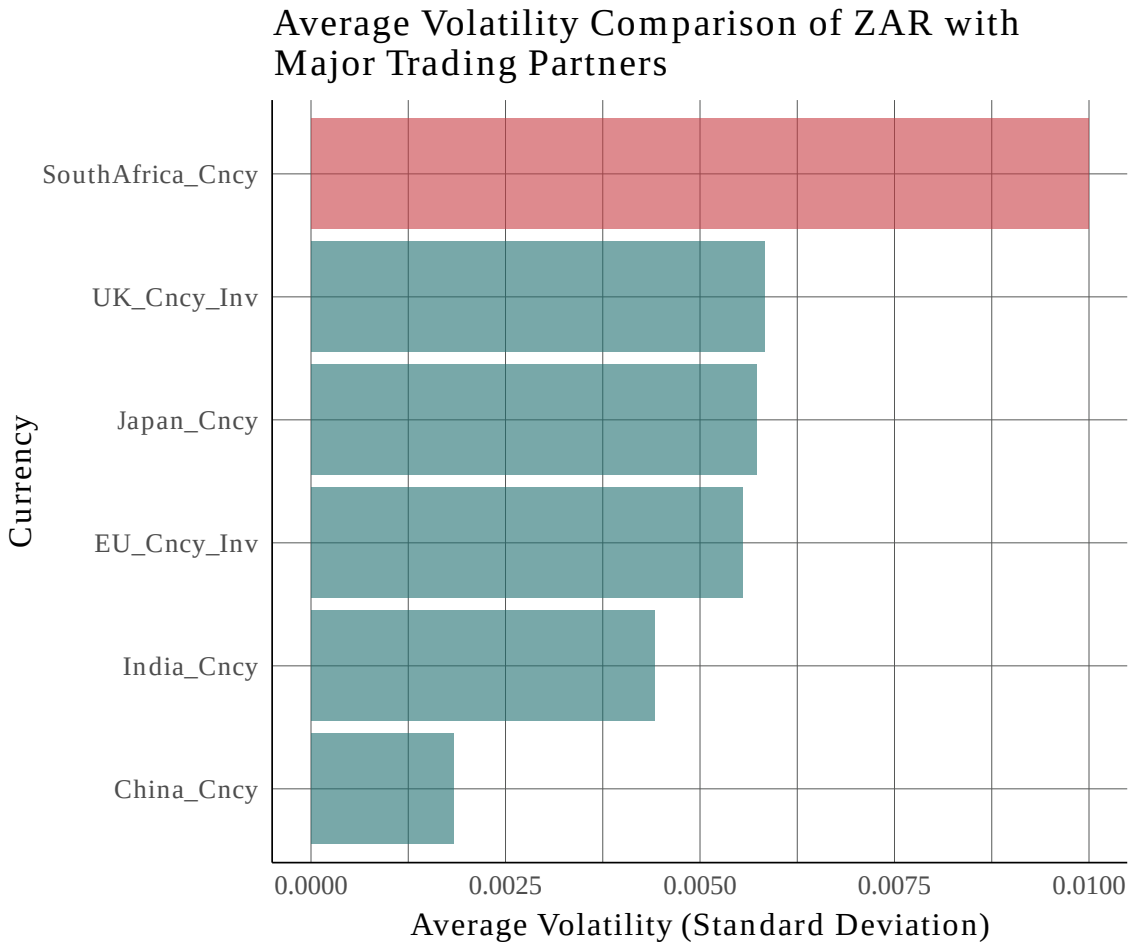
Jan-Hendrik Pretorius[a]

[a]*Stellenbosch University*

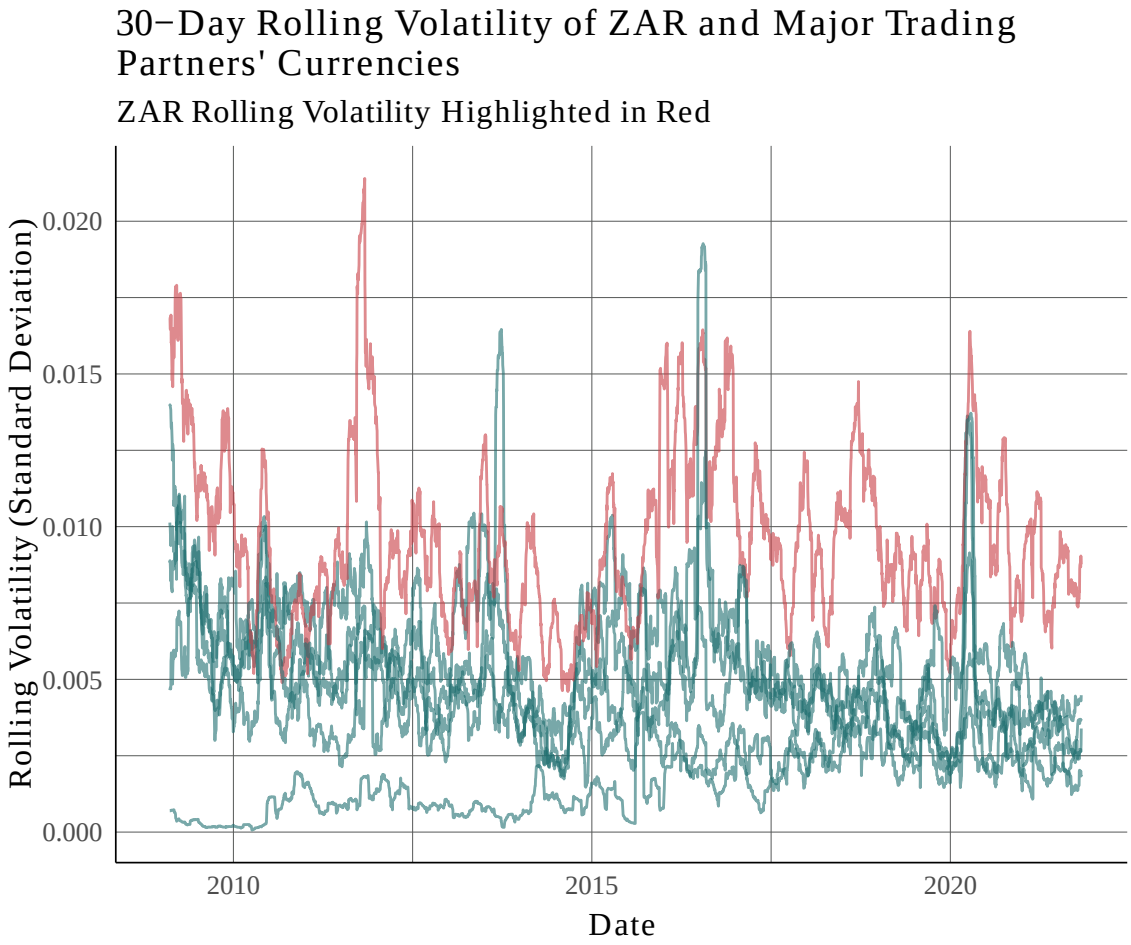
Abstract

This report analyzes currency market volatility and correlations, emphasizing the South African Rand (ZAR) and its major trading partners. Key insights include ZAR's volatility patterns, time-varying volatilities, and correlations with G10 currencies, offering valuable insights for risk management. I study the log returns of the ZAR for the period after the Global Financial Crisis, where ZAR saw increased volatility.

Email address: 20713479@sun.ac.za (Jan-Hendrik Pretorius)

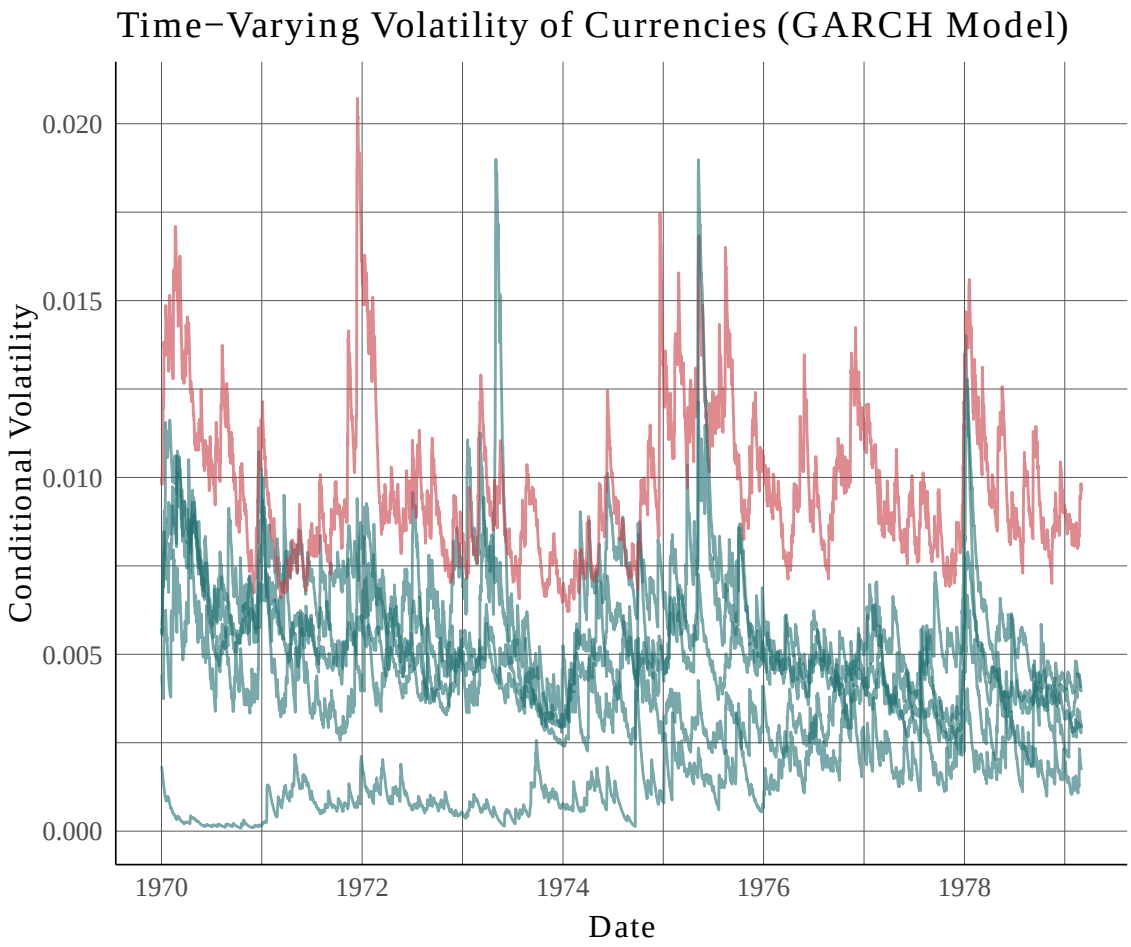


Compared to major trading partners, the Rand on average has seen much higher volatility over the past decade after the Global Financial Crisis (GFC) of 2008, exhibiting average volatility (standard deviation) of 0.01 - almost double the volatility faced by trading partner currencies.

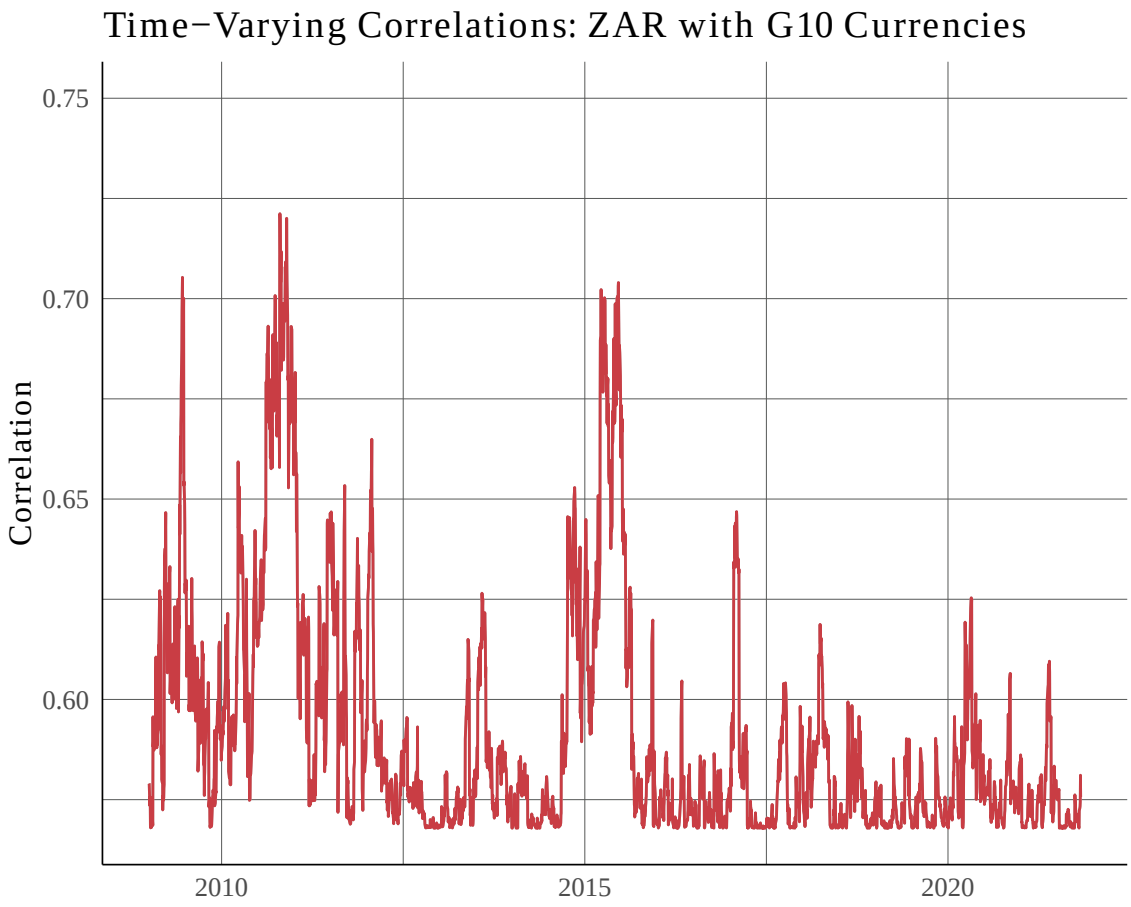


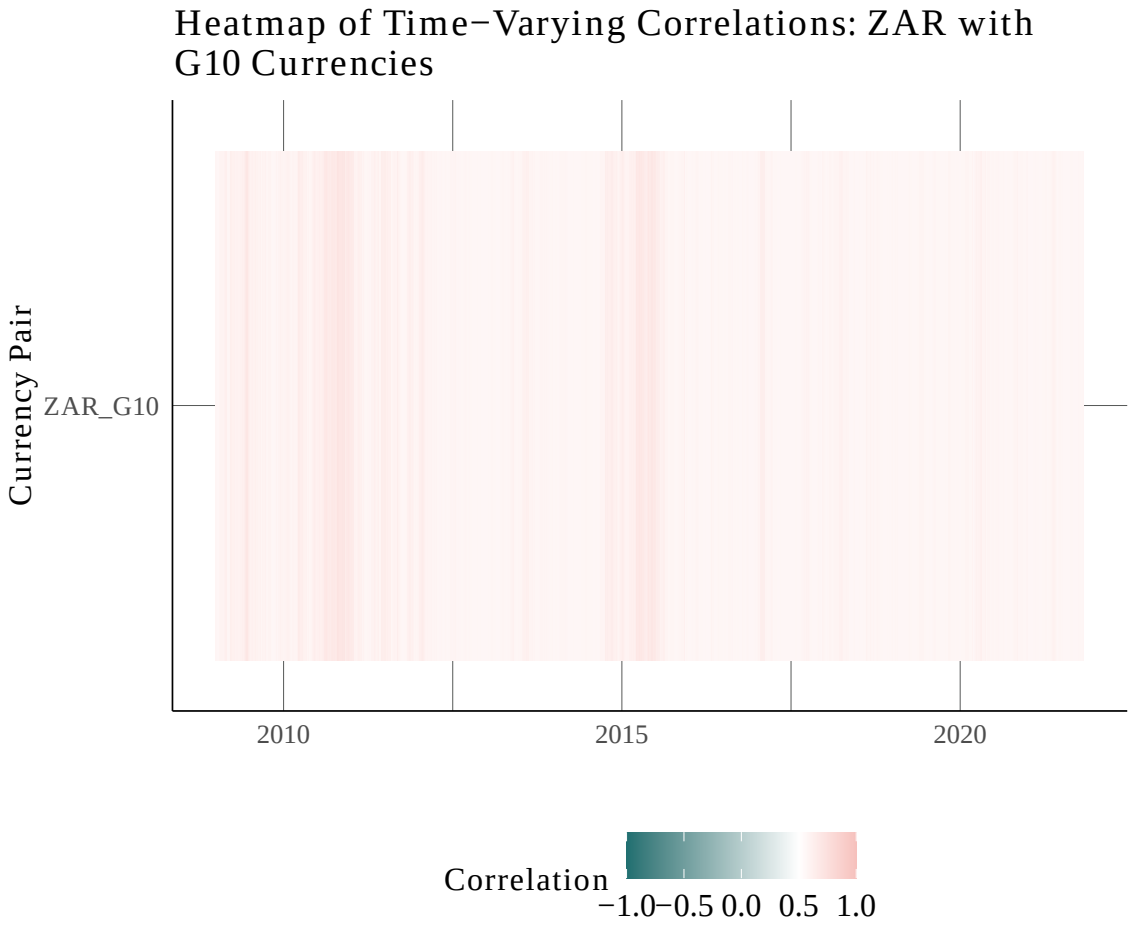
The ZAR consistently exhibited higher 30-day rolling volatility than trading partners over the period under study. In the figure above, the ZAR is highlighted in red.

Studying currency volatility involved fitting a GARCH(1,1) model to estimate time-varying volatilities of multiple currencies, including the South African Rand (ZAR). The model structure consisted of a GARCH(1,1) framework. This model is designed to capture volatility clustering and shocks in financial time series data. It works by modeling the conditional variance of returns as a function of past squared returns and past conditional variances. In simpler terms, it estimates how volatile each currency's returns are at any given time, taking into account its own historical volatility and squared returns, which helps identify periods of high or low volatility. The model was applied individually to each currency's returns, and the resulting conditional volatilities were used for comparative analysis.



Conditional volatility was also consistently higher.


Time−Varying Correlations: ZAR with G10 Currencies
Correlation
0.75
0.70
0.65
0.60
2010
2015
2020


Heatmap of Time−Varying Correlations: ZAR with G10 Currencies
Currency Pair
ZAR_G10
2010
2015
2020
Correlation
−1.0
−0.5
0.0
0.5
1.0