Case Study: Foreign Exchange Rate Simulation and Hedging of FX Risk

Quantitative Analyst

The aim of this exercise is to expose you to the kind of problems you will be working on and for us to evaluate how you can independently bring your own knowledge up. You are allowed and encouraged to search for reference materials that will help you undergo your task and we would also be happy to discuss your findings. We ask that you complete the case study and send your results back to us along with the approximate amount of time you spent.

Please attempt this case study using Python and send us the codes by https://github.com/.

We hope you can gain a better insight of what you would be doing as a member of the Quant Team at Validus, learn about the Alternative Asset Management space and hopefully enjoy the time spent while working on this.

Good Luck!

Validus Fund V is a Private Equity Fund (USD Fund) investing in a GBP asset, and it is thus exposed to Foreign Exchange risk. You are being given cashflow data (please find excel file attached) and are asked to perform the following:

1. Using the Monte Carlo method, simulate 1000 paths across time for the GBPUSD FX spot rate, using the Geometric Brownian Motion (*GBM*) model. See below for model assumptions.
2. Using the simulated FX spot rate paths, convert the GBP cashflows into fund currency (USD) and calculate the corresponding IRR (internal rate of return) for each of the simulated paths. Plot the distribution of the IRR and evaluate the 95%, 50% and 5% percentiles.
3. Assume we would like to buy a GBPUSD European Put option to hedge our FX exposure. If the USD and GBP risk-free (interest) rates are 0% throughout the time horizon of the fund, how can we use the simulated FX spot rate paths to calculate the option’s fair market value (premium) on the trade date. See the option details below:
   * Trade Date: 31/03/2021
   * Expiry Date: 31/03/2026
   * Notional Amount: 100,000,000 GBP
   * Strike: 1.3925
4. Calculate the IRR of the hedged portfolio, including the option premium payment you calculated in (c) and the option payoff. Looking at the distribution of the hedged portfolio IRR, assess the impact of the Put option on the portfolio FX risk.

Assume we are on the 31st March 2021 (use this date for the start of your simulation), GBPUSD volatility to be used is 10%, zero drift (no drift) is required for the simulation and that the FX pair starts with an FX spot rate:

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| GBPUSD | 1.3925 |