

Python Assignment for Market Data

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The following tasks should be completed using python in the form of a Jupyter notebook. Importing functions/libraries, apart from the final pricers themselves, is allowed and encouraged.

1. Create functions which can calculate the Black-Scholes-Merton present value of European call and put options. The functions should take the following arguments: strike, time to maturity, spot, interest rate, dividend yield, volatility.
2. Create a function which can calculate the present value of an equity [forward contract](https://fincyclopedia.net/derivatives/tutorials/forward-contract-payoff). It should use a subset of the arguments of the option function. ~~Again, assume there are no dividends.~~
3. Using the functions created above, calculate the present value of the following contracts:
   1. A call option on the S&P 500
   2. A put option on the S&P 500
   3. A forward contract on the S&P 500

using the parameters and market data from Table 1.

|  |  |
| --- | --- |
| Strike | $4700 |
| Time to Maturity (years) | 0.25 |
| Spot | $4450 |
| Interest rate | 5.5% |
| Dividend Yield | 1.5% |
| Volatility | 15% |

Table 1: Parameters and market data for examples

* 1. Show that [put-call parity](https://en.wikipedia.org/wiki/Put%E2%80%93call_parity) is satisfied by your functions with these inputs.
  2. Calculate the delta and gamma of the put option above using a numerical method.

1. (Non-coding) If the strike of the option was $5000, would you expect the volatility to be higher or lower? Why?
2. (Non-coding) Does the gamma of a forward contract depend on the current stock price? Does it depend on the strike price? Why?
3. (Non-coding) Consider a cash-settled call option where the underlying is a bespoke basket of 2 indexes: the United States’ S&P500 and the UK’s FTSE 100. The value of the basket is defined as the sum of the 2 indexes in exactly 6 months. What market data would be required to price this instrument?

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