Which of the G10 Currencies is the Riskiest to Hold for An American Resident?

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1. Database Setting
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Database Setting

The G10 currencies list is as follows:

1. United States dollar (USD)
2. Euro (EUR)
3. Pound sterling (GBP)
4. Japanese yen (JPY)
5. Australian dollar (AUD)
6. New Zealand dollar (NZD)
7. Canadian dollar (CAD)
8. Swiss franc (CHF)
9. Norwegian krone (NOK)
10. Swedish krona (SEK)

All exchange rates (the remaining 9 of G10 currencies) are converted to one dollar, The data source is published by the Board of Governors of the Federal Reserve System (US)

Database Setting

We fetch all the data for the 10 currencies published on the Ferd website from last year today until today when accessed through the API. The database and csv file can be updated by running the code(posted on our app). Here we get the data from 2021.11.06 to 2022.11.06

	currencyal	currencyuk	currencyeu	currencysz	currencyno	currencyjp	currencyca	currencynz	currencysd
0	1.3461	0.7373	0.8628	1.159	8.5073	113.15	1.2441	1.3941	8.5724
1	1.357	0.738	0.8629	1.1589	8.5238	112.87	1.2457	1.4039	8.5724
2	1.3587	0.7424	0.8683	1.1517	8.5984	113.89	1.2447	1.411	8.6679
3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4	1.3657	0.7456	0.8739	1.1443	8.6867	113.9	1.2558	1.4205	8.7501
5	1.3585	0.7438	0.8756	1.1421	8.6947	113.96	1.2515	1.4166	8.7707
6	1.3682	0.7447	0.8824	1.1333	8.7223	114.62	1.2562	1.43	8.8675
7	1.3749	0.7414	0.8832	1.1322	8.7439	114.33	1.2594	1.4284	8.8595
8	1.3755	0.7413	0.8804	1.1358	8.8231	114.22	1.2629	1.4223	8.8889
9	1.378	0.7422	0.8835	1.1318	8.8702	113.81	1.2631	1.4251	8.9138

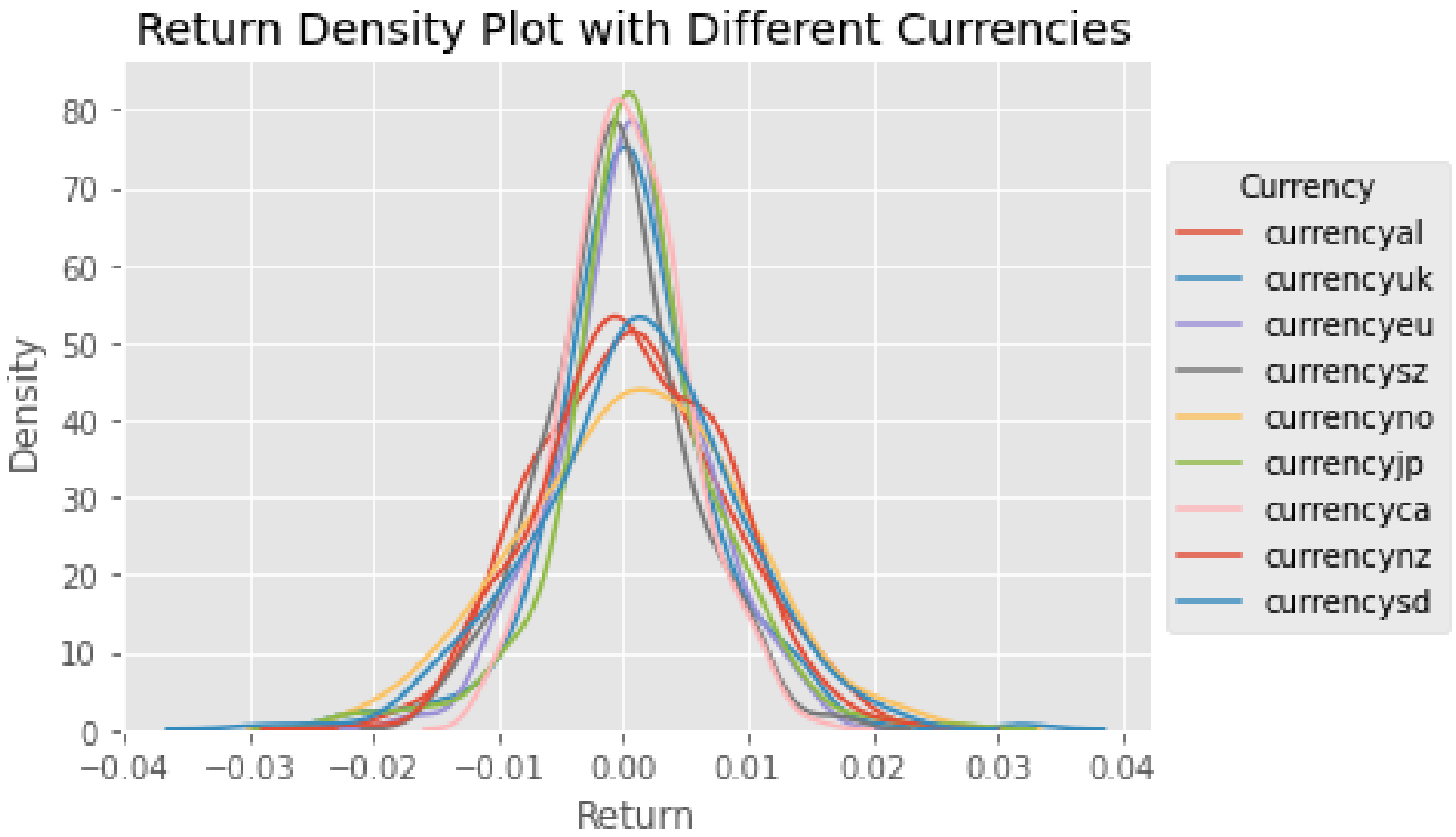
VaR Calculation

Here we use three method to calculate VaR, they're given as follows:

1. Historical VaR
2. Normal distribution Assumption
3. Monte Carlo Simulation

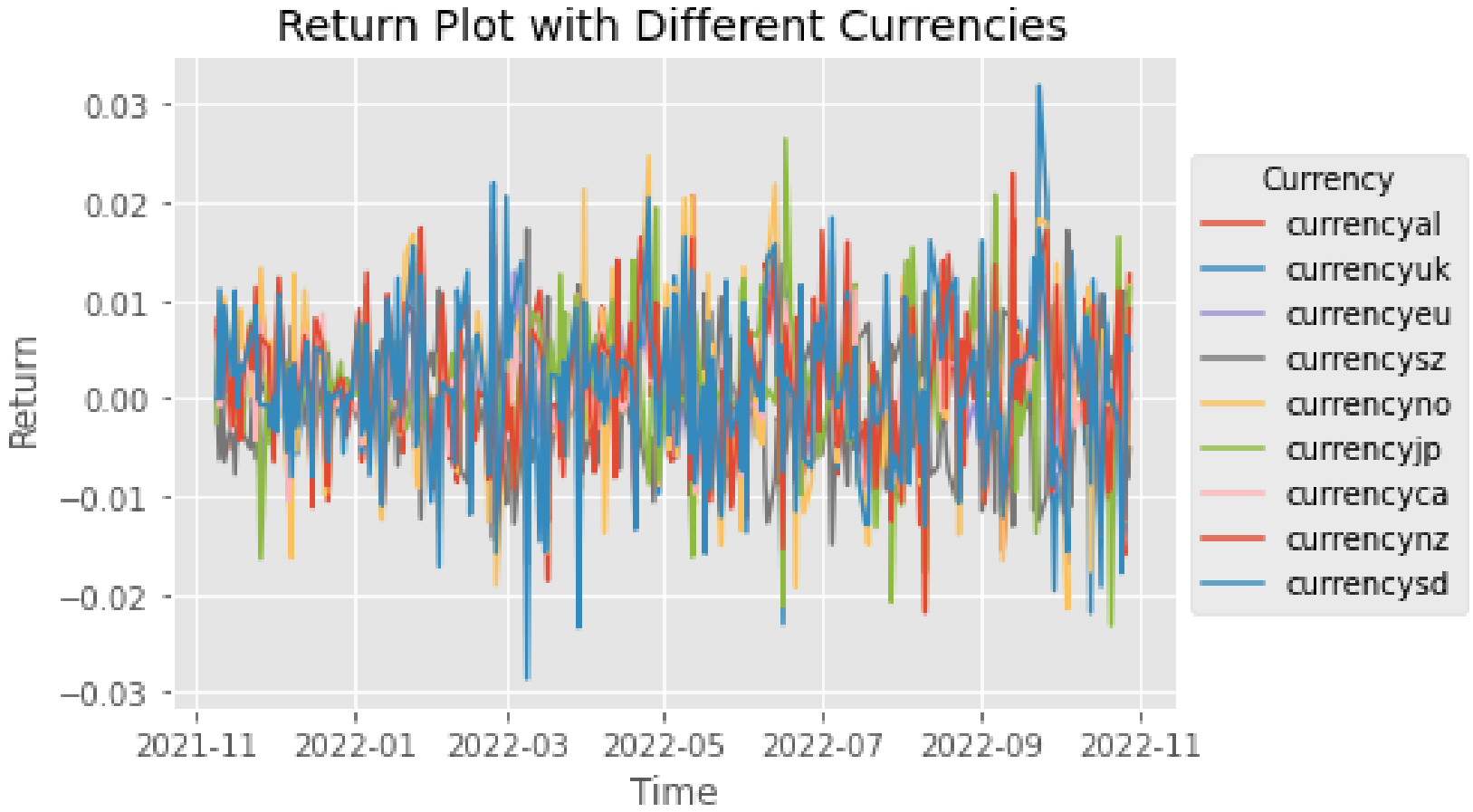
VaR Calculation-Historical VaR

First we plot the historical return distribution.



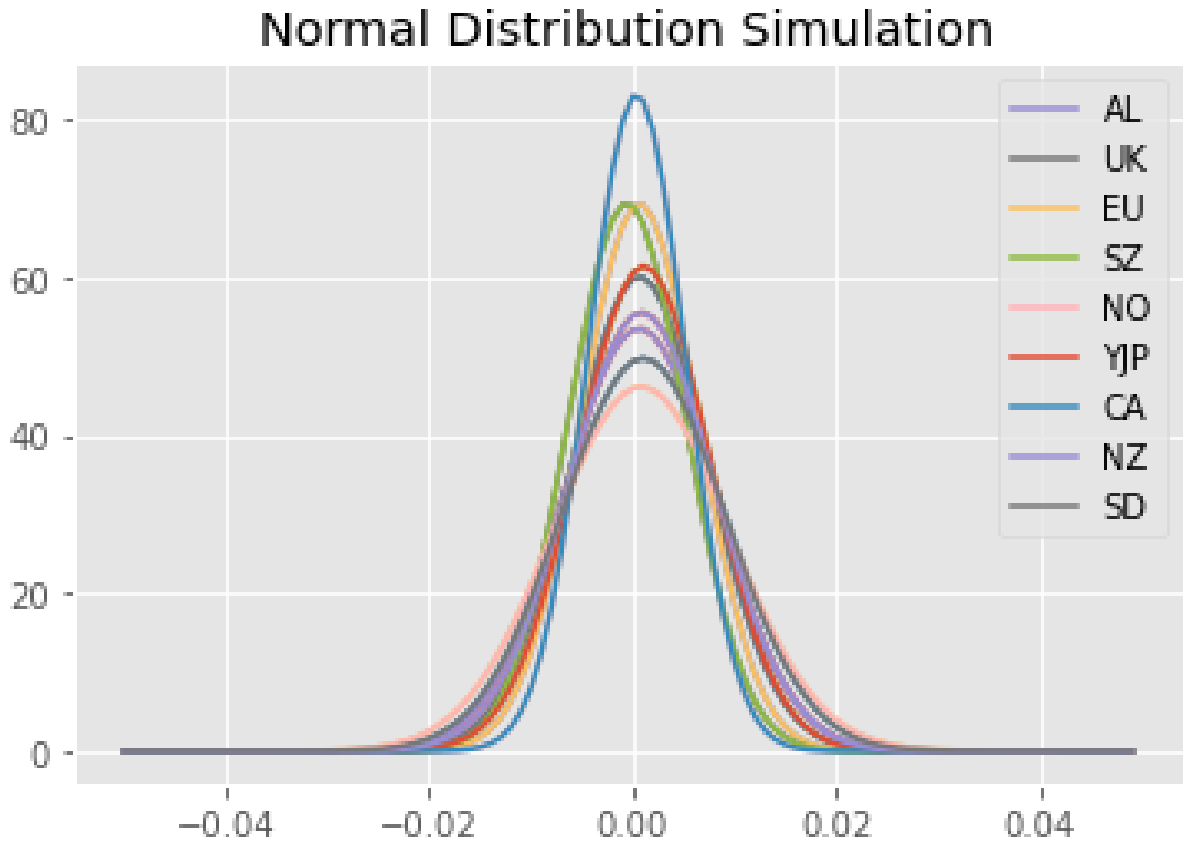
VaR Calculation-Historical VaR

Then we plot historical return.



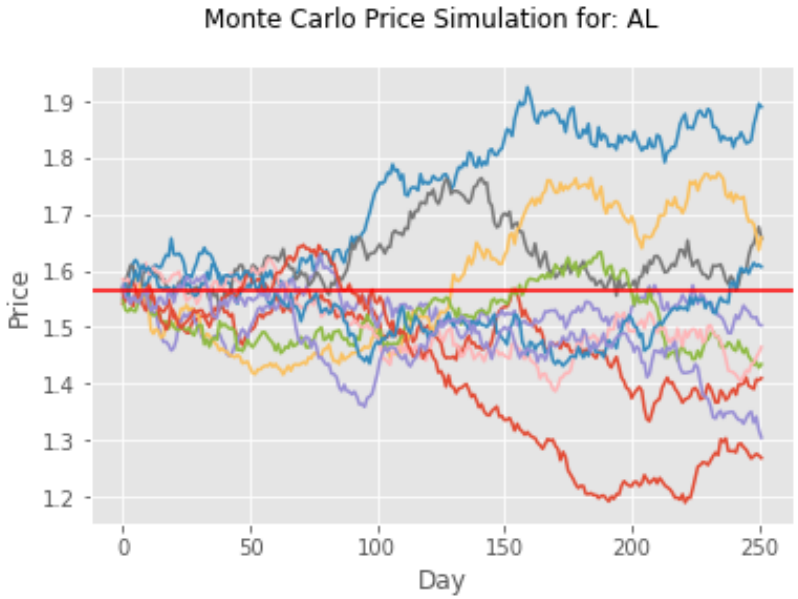
VaR Calculation-Normal distribution Assumption

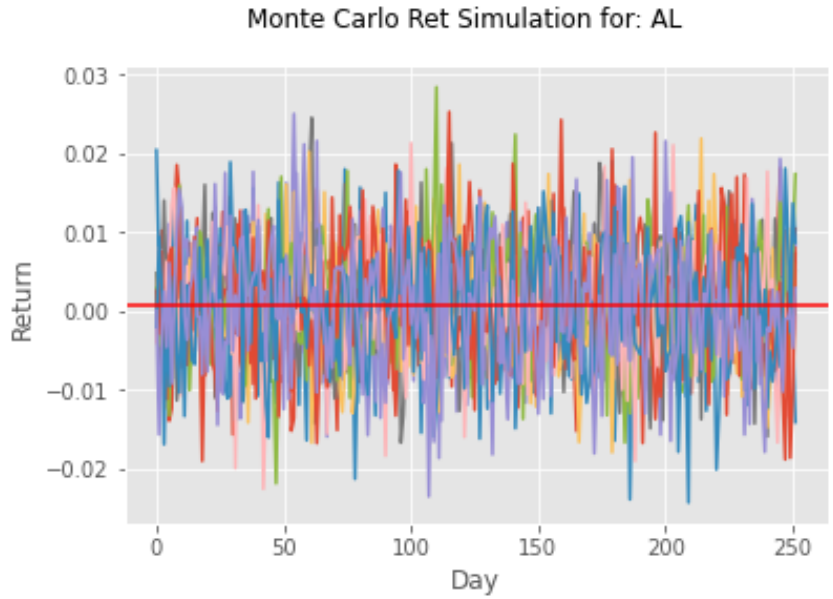
Assume the currency return is normally distributed, we plot the normal distribution of the return for each currency.



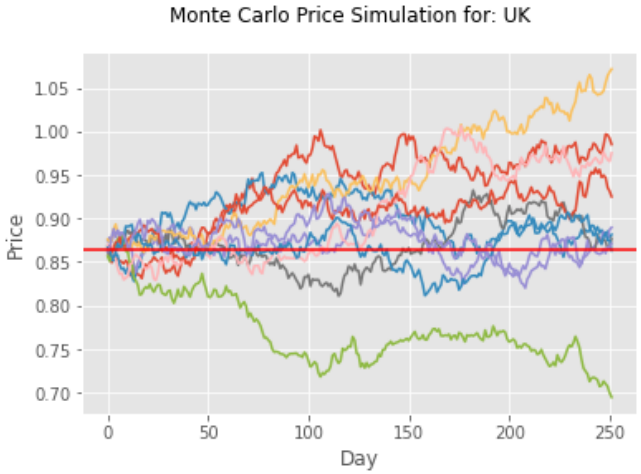
VaR Calculation-Monte Carlo Simulation

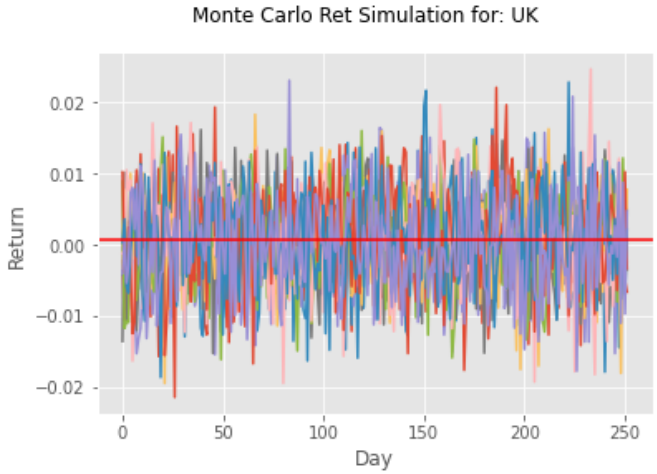
We simulate n path of the exchange rate and return, and then calculate the VaR of Monte Carlo Simulation Method.

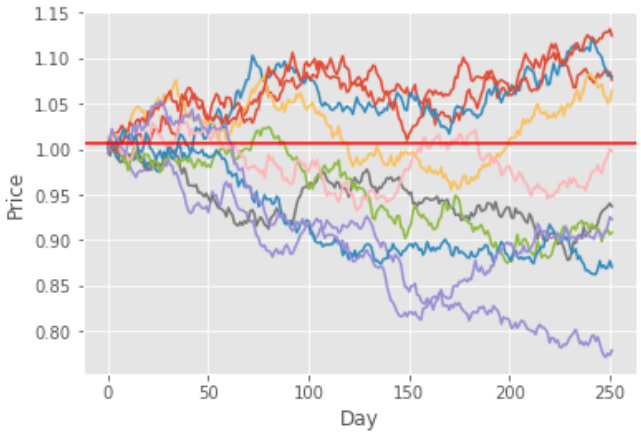


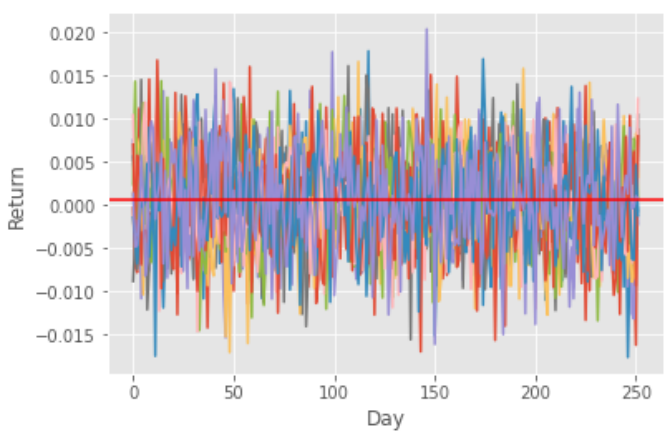


VaR Calculation-Monte Carlo Simulation

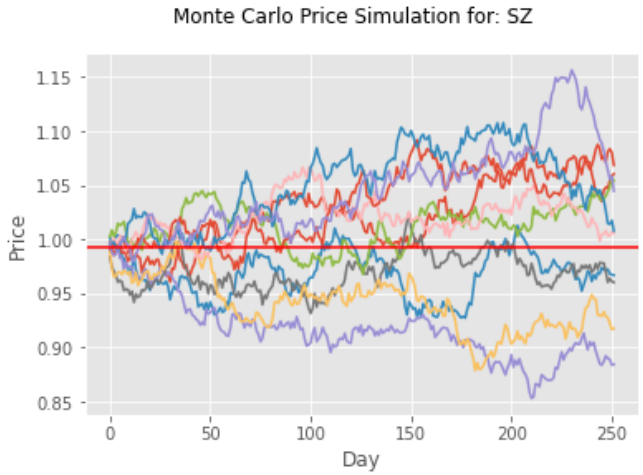


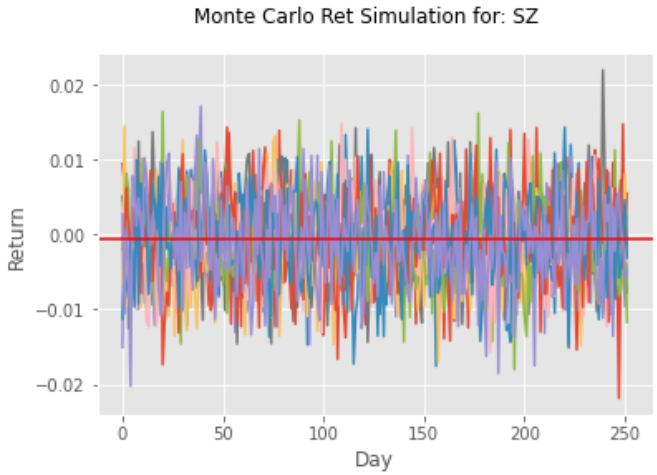


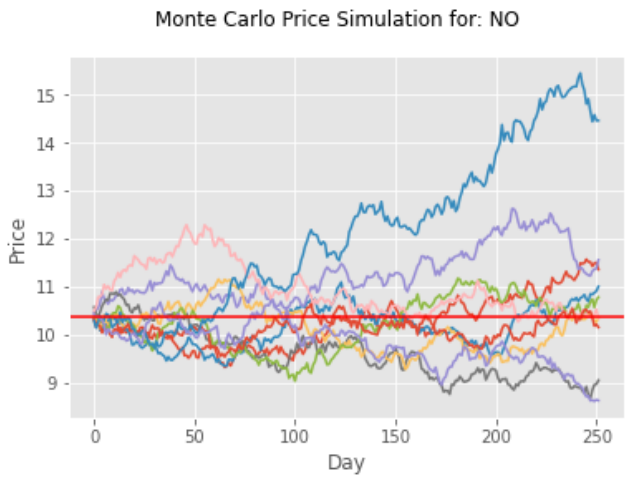


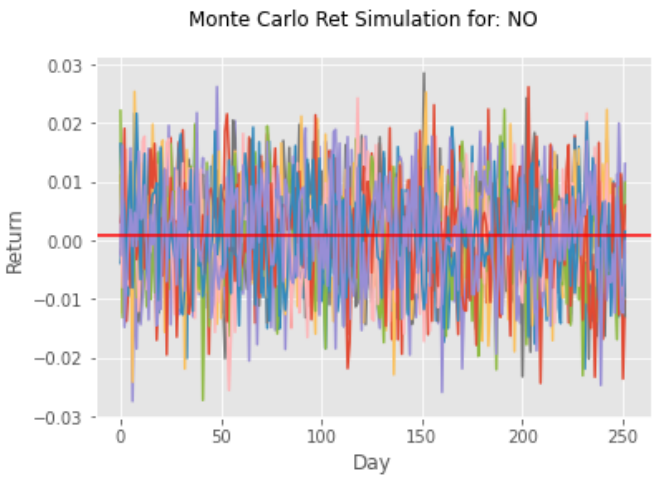


VaR Calculation-Monte Carlo Simulation

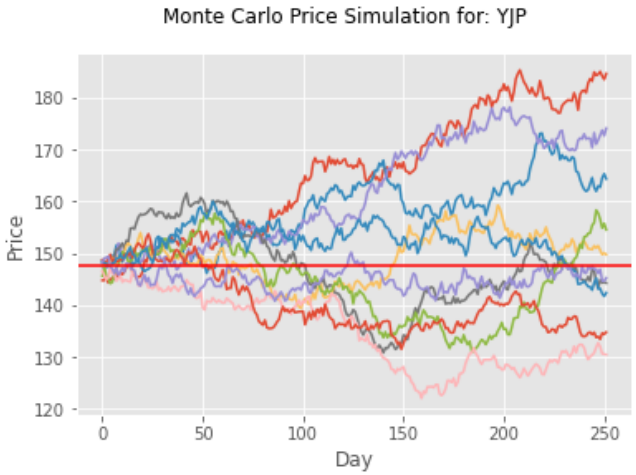


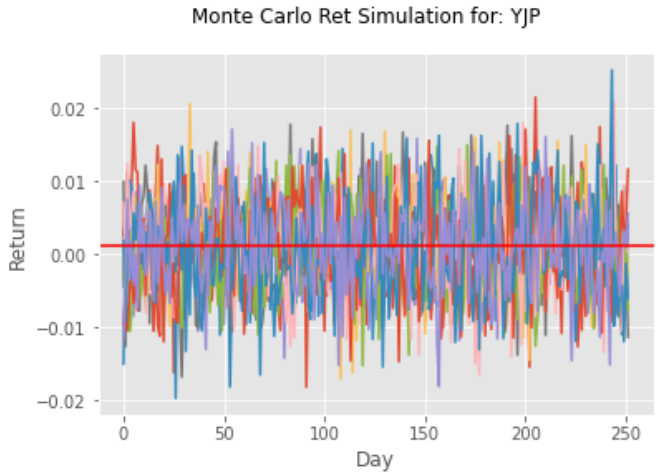


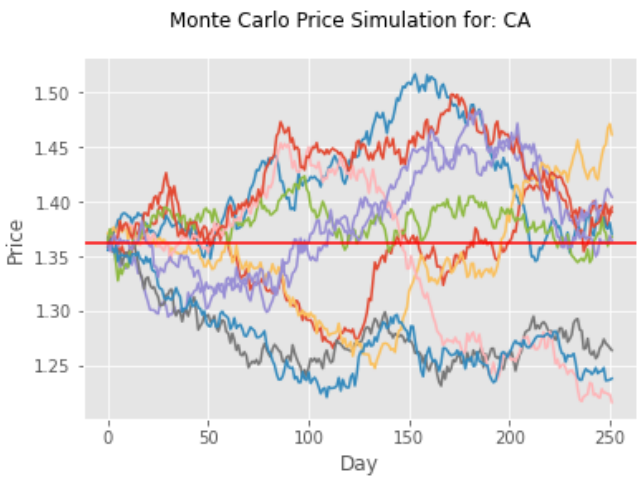


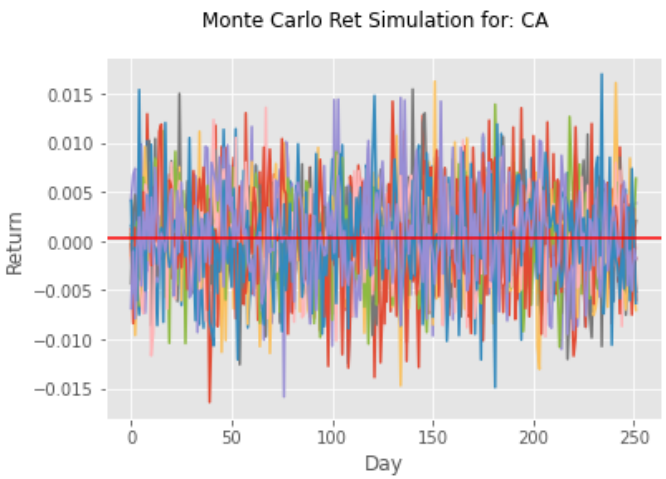


VaR Calculation-Monte Carlo Simulation

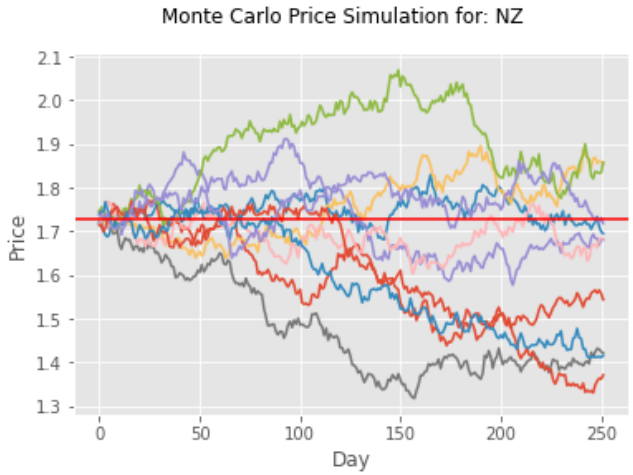


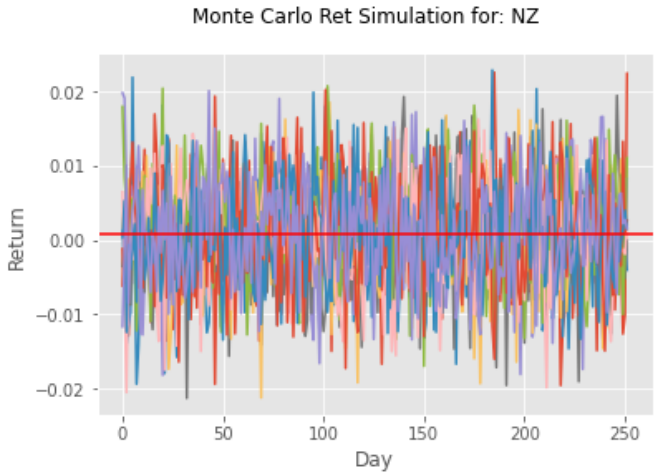


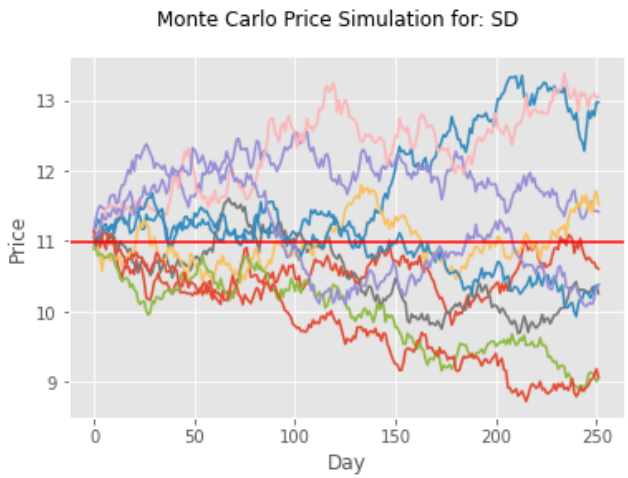


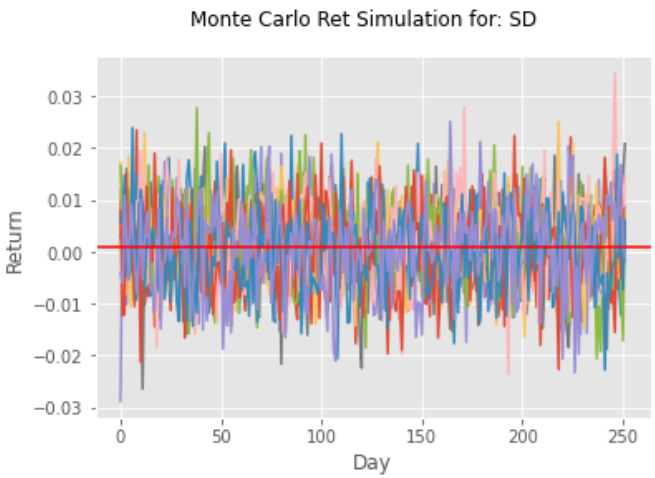


VaR Calculation-Monte Carlo Simulation









VaR Calculation-Summary

We set alpha value to 5, so we want to look at how much we lose at a 5 percent of chance in one day. In all of the three method, we see NO(Norwegian Krone)has the lowest VaR, thus is relatively risky than other currencies.

	Currency	ND VaR	Historical VaR	Monte Carlo Simulation VaR
0	AL	-0.011638	-0.010392	-0.006785
1	UK	-0.010273	-0.008992	-0.003335
2	EU	-0.008836	-0.009431	-0.004830
3	SZ	-0.010045	-0.010602	-0.003997
4	NO	-0.013398	-0.013790	-0.019593
5	YJP	-0.009611	-0.009258	-0.007089
6	CA	-0.007520	-0.007332	-0.006375
7	NZ	-0.010940	-0.011092	-0.008528
8	SD	-0.012176	-0.012922	-0.004612

Volatility Calculationa and Variance-Covariance Martix

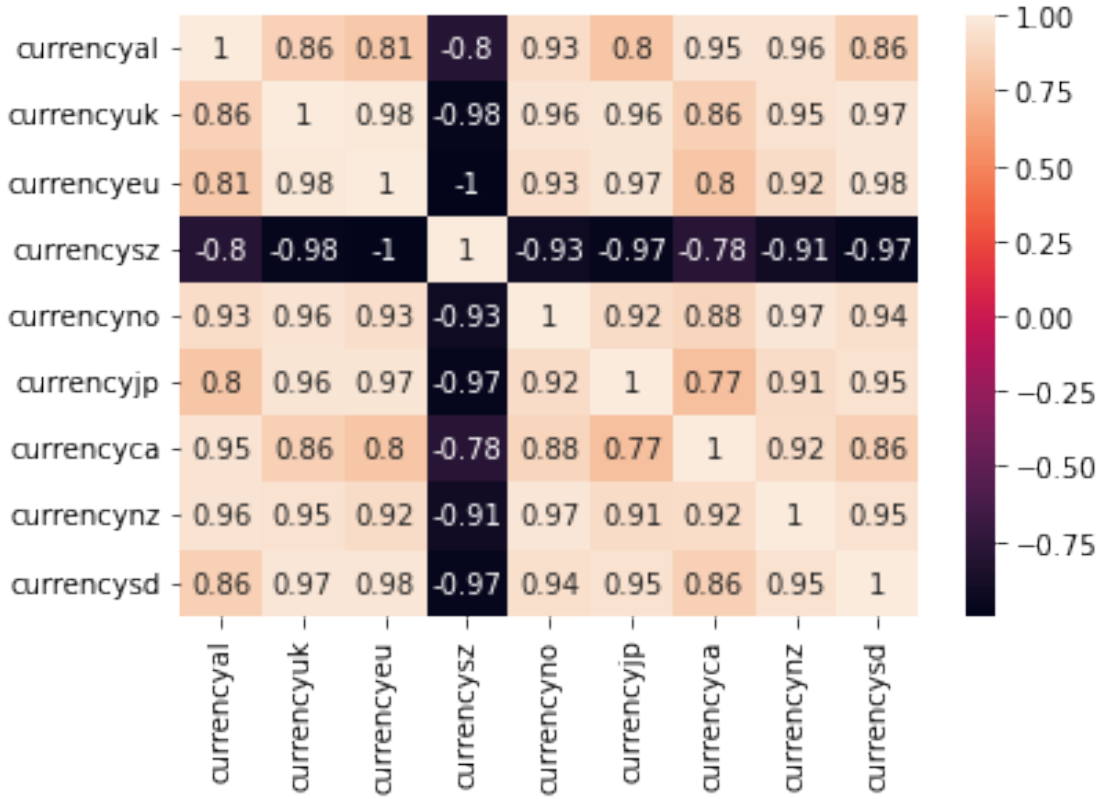
We can also calculate volatility of return to measure the riskness of the asset. From the result of the daily and annual volatility calculated, we see currency yjp has the highest volatility.

```
# daily price volatility
daily_vol = df_replace.std()
print(daily_vol)
# annual price volatility
annual_vol = df_replace.std() * np.sqrt(252)
print(annual_vol)
```

```
currencyal      0.061957
currencyuk      0.052058
currencyeu      0.049658
currencysz      0.055870
currencyno      0.625246
currencyjp     11.416770
currencyca      0.032930
currencynz      0.096866
currencysd      0.700157
dtype: float64
currencyal       0.983539
currencyuk       0.826387
currencyeu       0.788298
currencysz       0.886911
currencyno       9.925465
currencyjp     181.235613
currencyca       0.522746
currencynz       1.537700
currencysd      11.114646
dtype: float64
```

Volatility Calculationa and Variance-Covariance Martix

We can see all the G10 currencies' exchange to USD are highly correlated, and Swiss Franc has a negative correlation with all other currencies.



Conclusion

1.In all of the three VaR caculation method, we see NO (Norwegian Krone) has the lowest VaR, thus is relatively risky than other currencies.

2.From the result of the daily and annual volatility calculated, we see currency yjp has the highest volatility.

3.it's hard to do risk diversification using only G10 currencies since they are highly correlated, also the investor can use swiss franc to hedge against risk.