Estimating the risk of a stock II (‘Total Risk’)

Recap: Estimating Total Risk (I)

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A generally accepted measure of total risk is the Standard Deviation.

$$\sigma_j = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(r_j - E\left[r_j\right]\right)^2} \equiv \sqrt{\sigma_j^2}$$

Application (Manual: Deviations)

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Date	Price	r_{FB}	$r_{FB} - E[r_{FB}]$
Jan 02, 2018	181.42	#N/a	#N/a
Jan 03, 2018	184.67	0.017914232	0.010870265
Jan 04, 2018	184.33	-0.001841122	-0.008885089
Jan 05, 2018	186.85	0.013671133	0.006627167
Jan 08, 2018	188.28	0.007653198	0.000609231
Jan 09, 2018	187.87	-0.002177608	-0.009221574

$$\boxed{E[r_{FB}] = \frac{1}{n}\sum_{t=1}^{n} r_{FB}}$$

Application (Manual: SSD)

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Date	r_{FB}	$r_{FB} - E[r_{FB}]$	$(r_{FB} - E[r_{FB}])^2$
Jan 03, 2018	0.017914232	0.010870265	0.000118163
Jan 04, 2018	-0.001841122	-0.008885089	7.89448E-05
Jan 05, 2018	0.013671133	0.006627167	4.39193E-05
Jan 08, 2018	0.007653198	0.000609231	3.71163E-07
Jan 09, 2018	-0.002177608	-0.009221574	8.50374E-05
SUM →	Not needed	0	0.000326435

Application (Manual, FB)

$$\sigma_{FB}^2 = \frac{1}{n-1}\sum_{i=1}^{n}(r_{FB} - E[r_{FB}])^2$$

$$\sigma_{FB}^2 = \frac{1}{5-1} \times 0.00032644$$

$$\sigma_{FB}^2 = \frac{0.00032644}{4} = 0.0000816089$$

Application (Manual, FB)

$$\sigma_{FB} = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(r_{FB} - E[r_{FB}])^2} \equiv \sqrt{\sigma_{FB}^2}$$

$$\sigma_{FB} = \sqrt{0.0000816089}$$

$$\sigma_{FB} \approx 0.0090 = 0.90\%$$

Risk close to 0?

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Recall that we're dealing with daily data.

While 0.90% doesn't appear very risky, annualising it might tell a different story.

Annualised Standard Deviation

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$$\sigma_{FB[Annual]} = \sigma_{FB[Daily]} \times \sqrt{250}$$

$$\sigma_{FB[Annual]} = 0.90\% \times \sqrt{250}$$

$$\sigma_{FB[Annual]} = 14.28\%$$

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Calculating the Standard Deviation on Python is easy.

Python Walkthrough

Summary

The standard deviation of a stock represents its total risk, and is calculated as:

$$\sigma_j = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(r_j - E\left[r_j\right]\right)^2} \equiv \sqrt{\sigma_j^2}$$

On Python, it can be calculated using NumPy as:
var_j = np.var(df['returns'], ddof=1) and then taking the square root of the variance using np.sqrt(var_j). Or using np.std(df['returns'], ddof=1)

Now have a go at the quiz!