Constant historical Volatility

1. It considers an asset whose annual volatility is 45%. It finds an estimate for volatility in one day, in a week and in a month. (Consider that there are 5 days in a week and 20 days in a month)

a. 1 dia : $\sigma_{1\,dia} = \frac{\sigma_{anual}}{\sqrt{252}} = \frac{0.45}{\sqrt{252}} = 0.02835$

b. 5 dias : $\sigma = \sigma_{diaria}\sqrt{n} = \frac{0.45\sqrt{5}}{\sqrt{252}} = 0.06339$

c. 20 dias : $\sigma = \sigma_{diaria}\sqrt{n} = \frac{0.45\sqrt{20}}{\sqrt{252}} = 0.1268$

2. The price of an asset today is \$65. Its annual volatility has been estimated to be 32%. What would be the variation in price in one day considering two daily deviations?

$\Delta S = S_0 \cdot n\,\sigma_{diarias}$

$S_0 = 65$

$\sigma_{diaria} = \frac{\sigma_{anual}}{\sqrt{252}} = \frac{0.32}{\sqrt{252}}$

$\Delta S = 65 \cdot \frac{2(0.32)}{\sqrt{252}} = 2.6206$

3. If you have a total of 1253 days of performance and are used to calculate the historical volatility of an asset. What weight in the variance estimate has the oldest performance? And the most current one? What do you think of this form of income weighting?

Este método asigna el mismo peso a todos los rendimientos históricos, implicado que los eventos pasados tienen el mismo impacto en la volatilidad actual que los eventos recientes. Este presenta un problema porque, por lo general, los eventos más recientes son aquellos que tienen un mayor impacto al estimar la volatilidad futura.

Promedio Móvil

1. What weight does the estimating of the variance has in each of the yields when m=40?

$$w = \frac{1}{m} = \frac{1}{40} = 0.025$$

2. Copy the following data table into Excel and using the mobile average definition completes the missing data. Shaded areas do not require information. Note: yields were obtained using the percentage yield equation

3. The above table shows that the estimated volatility with m=10 for tomorrow is 2.5%. Determine an estimate for the volatility of tomorrow with m= 5.

Time	Price	Yield	Volatility with m=5	Volatility with m=10
	74.78			
	73.91	-0.01163		
	74.72	0.01096		
	75.19	0.00629		
	74.06	-0.01503		
	74.15	0.00122		
	75.06	0.01227	1.02%	
	75.23	0.00226	1.04%	
	77.56	0.03097	0.92%	
	77.72	0.00206	1.64%	
	74.87	-0.03667	1.50%	
	77.44	0.03433	2.22%	1.73%
	74.39	-0.03939	2.64%	2.01%
	74.52	0.00175	3.17%	2.34%
	73.34	-0.01583	2.86%	2.33%
	74.36	0.01391	2.94%	2.33%
4 days ago	74.28	-0.00108	2.52%	2.38%
3 days ago	76.99	0.03648	2.00%	2.34%
2 days ago	75.77	-0.01585	1.89%	2.61%
Today	76.62	0.01122	2.01%	2.47%
Tomorrow			1.95%	2.50%

4. If for certain time series, models of variance have been estimated using moving averages with m=5,10,20,40 And the following table of RMSE was obtained: What value of m is the most suitable to use? Why?

	RSME
5	0.001137481
10	0.001105943
20	0.001103769
40	0.001123667

Se debería de emplear un m = 20 porque es este el que disminuye el RMSE lo mayor posible en comparación a los demás valores.

EWMA

1. Consider the example above and answer: What if the new volatility estimate is calculated considering that there has been a major change in performance? That is, how is the new estimate if the observed yield was 3%?, and if the observed yield was .3%?

a. $R_{t-1} = 0.03$: $\hat{\sigma} = \sqrt{(0.06)(0.03)^2 + (0.94)(0.01)^2} = \underline{1.2166\ \%}$

b. $R_{t-1} = 0.003$: $\hat{\sigma} = \sqrt{(0.06)(0.003)^2 + (0.94)(0.01)^2} = \underline{0.9723\ \%}$

2. Explain the exponentially weighted moving average (EWMA) model for estimating volatility from historical data.

El modelo EWMA tiene la premisa de poner más peso a la observación más reciente de rendimiento en comparación a las observaciones más antiguas al hacer una estimación de varianza, es decir, pesos exponenciales. Dichos pesos se establecen por una lambda, que suele rondar entre 0.94 y 0.97, que maximice la verosimilitud del modelo.

3. The most recent estimate of the daily volatility of an asset is 1.5% and the price of the asset at the close of trading yesterday was \$30.00. The parameter λ in the EWMA model is 0.94. Suppose that the price of the asset at the close of trading today is \$30.50. How will this cause the volatility to be updated by the EWMA model?

$$R = \left(\frac{R_t}{R_{t-1}}\right) - 1 = \left(\frac{30.5}{30}\right) - 1 = 0.01\overline{6}$$

$$\hat{\sigma} = \sqrt{(0.06)(0.01\overline{6})^2 + (0.94)(0.015)^2} \approx \underline{1.51\ \%}$$

4. A company uses an EWMA model for forecasting volatility. It decides to change the parameter λ from 0.95 to 0.85. Explain the likely impact on the forecasts.

Reducir el parámetro de lambda hace que el modelo le ponga incluso más peso a la observación más reciente de rendimiento para la predicción de varianza.

5. The most recent estimate of the daily volatility of the US dollar/sterling exchange rate is 0.6% and the exchange rate at 4 p.m. yesterday was 1.5000. The parameter λ in the EWMA model is 0.9. Suppose that the exchange rate at 4 p.m. today proves to be 1.4950. How would the estimate of the daily volatility be updated?

$$R = \left(\frac{R_t}{R_{t-1}}\right) - 1 = \left(\frac{1.495}{1.5}\right) - 1 = -0.00\overline{3}$$

$$\hat{\sigma} = \sqrt{(0.1)(-0.00\bar{3})^2 + (0.9)(0.006)^2} = \underline{0.5789\ \%}$$