Ejercicios propuestos C. Alexander IV.1 – Risk Measures

1. [EIV.1.1] A historical sample of 36 active returns on a portfolio is presented in de spreadsheet for this exercise. Calculate a) the semi-standard deviation and b) the second order lower partial moment (LPM) relative to a threshold active return of 2% per annum.

2. [EIV.1.2] Calculate the k-th order LPMs for k = 1, 2, 3, 4, 5, 10 and 20 based on the sample of active returns in the previous example and using a) a threshold active return of 0%, and b) a threshold active return of 2% per annum.

3. [EIV.1.3] Consider a fund whose active returns are normally distributed with an expected active return over the next year of 1% and standard deviation about this expected active return (i.e. tracking error) of 3%. What is the probability of underperforming the benchmark by 2% or more over the next year? R: 15,87%.

4. [EIV.1.4] (Sin Excel) Compute the 10% VaR over a one-year horizon of $2 million invested in a fund whose annual returns in excess of the risk free rate are assumed to be normally distributed with mean 5% and volatility12%. R: $207.572. [*Nótese que estamos suponiendo conocida la distribución de rentabilidades en exceso de la ofrecida por el activo sin riesgo, pero no conocemos el nivel de la rentabilidad de éste*]

5. [EIV.1.5] A portfolio has daily returns, discounted to today, that are normally and identically distributed with expectation 0% and standard deviation 1.5%. Find the 1% 1-day VaR. Then find the 1% 10-day VaR under the assumption that the daly excess returns (a) are independent, and b) follow a first order autoregression process with autocorrelation 0.25. Does positive autocorrelation increase or decrease VaR? R: 11.0348% and 13.8608%

6. [EIV.1.6] Suppose that a portfolio's return is normally distributed with mean 10% and standard deviation 20%, both expressed in annual terms. The risk-free rate is 5% per annum. Calculate the 1% VaR as a percentage of the portfolio value when the risk horizon is 1-week, 2 weeks, 1 month, 6 months and 1 year.

7. [EIV.1.7] A portfolio contains cash positions on two stocks: $1 million is invested in a stock with a beta of 1.2, and $2 million is invested in a stock with a beta of 0.8 with respect to a broad market index. If the excess returns on the index are i., i.d., and normally distributed with expectation 5% and volatility 20% per annum, what is the 1% 10-day VaR of the portfolio?

8. [EIV.1.8] Find the 10-day VaR of a cash flow that is mapped to a 1-year and 2-year vertex with PV01 of $50 and $75, respectively. Assume the absolute changes in 1-year and 2-year interest rates over the next 10 days have a multivariate Normal distribution with expectation 0, correlation 0.9 and with annual volatilities of 100 basis points for the change in the 1.-year rate and 80 basis points for the change in the 2-year rate.

9. [EIV.1.9] Calcular el benchmark VaR a 1 año for $10 million invested in a fund with an expected return equal to the risk free interest rate and a tracking error of 3%. [El *tracking error* es la volatilidad de la rentabilidad activa]. R: 6.98%, $697.904. *Sugerencia: La hoja de cálculo extiende el ejercicio para distintos valores de la rentabilidad en exceso.*

10. [EIV.1.10] Disponemos de una serie temporal del DJIA, y de una cartera hipotética que trata de replicar al índice, entre el 5 de enero de 1998 y el 31 de diciembre de 2001. Al final del periodo, el valor de la cartera era $1.007.580, que es aproximadamente igual a $100 por cada punto de DJIA. Estimar el VaR 1% y el ETL (Expected Tail Loss) al 1% de la cartera a 31 de diciembre de 2001. Utilizando el DJIA como benchmark, calcular el benchmark VaR al 1% y la expected shortfall, a 31 de diciembre de 2001.

11. [EIV.1.11] Considere dos opciones binarias: la opción A paga $10.000 si la rentabilidad mensual del SP500 es al menos 20%. La opción B paga $10.000 si la rentabilidad mensual del oro es al menos 20%. Ambas opciones se venden por $1000. Suponemos que las rentabilidades del SP500 y del oro son independientes y que cada una tiene una probabilidad de 0.02532 de tener una rentabilidad mensual superior al 20%. Mostrar que la suma de los VaR al 5% de cada posición es menor que el VaR al 5% cuando formamos una cartera con una unidad de cada una de ellas