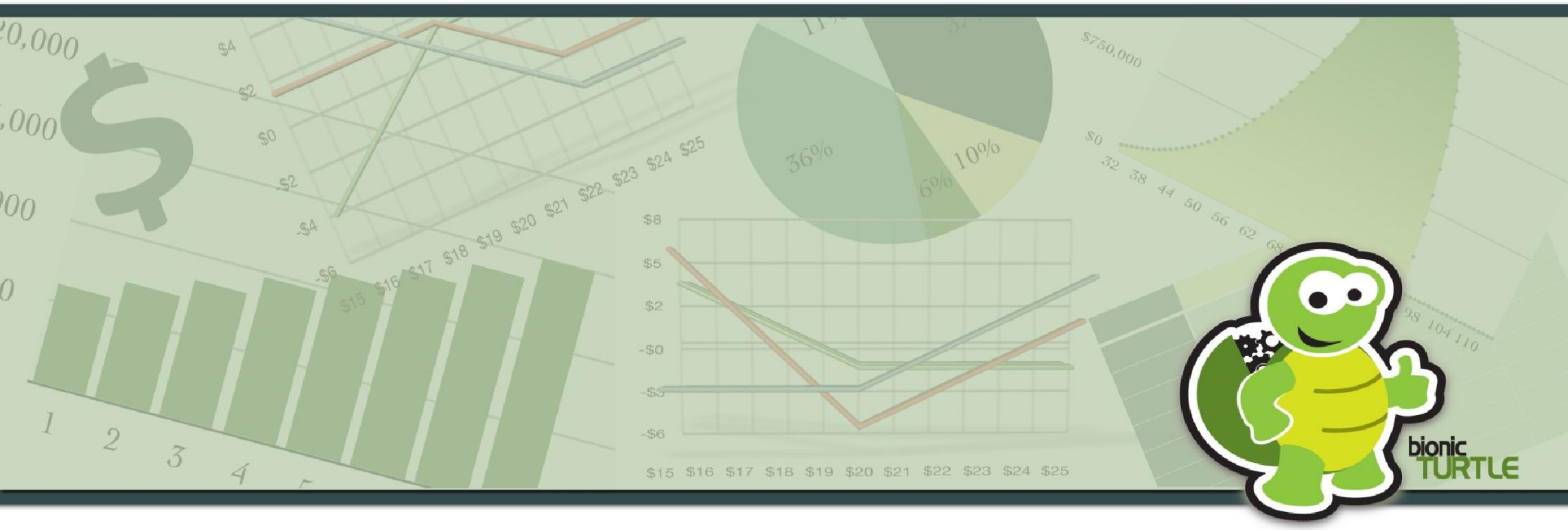


P2.T5. Market Risk Measurement & Management

Bionic Turtle FRM Practice Questions

Kevin Dowd, Measuring Market Risk

By David Harper, CFA FRM CIPM
www.bionicturtle.com

Dowd, Chapter 3: Estimating Market Risk Measures

Dowd, Chapter 4: Non-parametric Approaches

Dowd, Chapter 7: Parametric Approaches (II): Extreme Value

Dowd, Chapter 5: Appendix-Modeling Dependence: Correlations and Copulas (NOTE: No Longer in curriculum)

Dowd, Chapter 3: Estimating Market Risk Measures

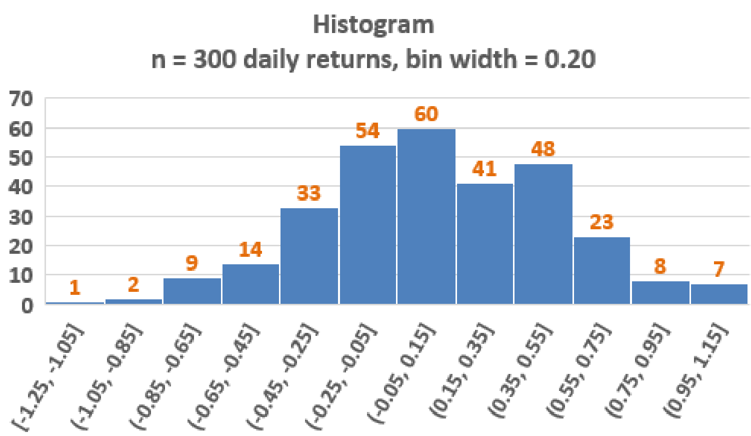
P2.T5.707. Historical simulation and lognormal value at risk

Learning objectives: Estimate VaR using a historical simulation approach. Estimate VaR using a parametric approach for both normal and lognormal return distributions.

707.1. A mutual fund's daily returns for the last 300 trading days is plotted on this histogram. Additionally, the worst 20 daily returns are sorted explicitly below the histogram:

Under the basic historical simulation approach, which of the following is the **BEST** one-day 99.0% value at risk (VaR)?

a) 0.710
b) 0.840
c) 0.800
d) 0.900



Worst 20 Losses (sorted)			
1	-$1.250	11	-$0.680
2	-$0.900	12	-$0.670
3	-$0.870	13	-$0.630
4	-$0.840	14	-$0.630
5	-$0.820	15	-$0.610
6	-$0.800	16	-$0.600
7	-$0.770	17	-$0.590
8	-$0.730	18	-$0.590
9	-$0.710	19	-$0.520
10	-$0.700	20	-$0.520

707.2. Consider the following asset over three periods that starts with an initial price of $20.00 and pays a $2.00 dividend each period. In addition to the asset's price and dividends over three periods, we also show its per-period arithmetic (aka, simple) return:

	Period			
	Initial	1	2	3
Price	$20.00	$23.00	$19.00	$25.00
Dividend		$2.00	$2.00	$2.00
Arithmetic returns		25.00%	-8.70%	42.11%

About this asset's performance, each of the following statements is true **EXCEPT** which is not accurate?

a) Geometric returns cannot be greater than arithmetic returns
b) The geometric returns in each period are approximately +22.31%, -9.10% and 35.14%
c) If the asset instead paid zero dividends, then the geometric return would equal the arithmetic return
d) The three-period geometric return is conveniently the sum of per-period geometric returns which, in this case, is about +22.31% -9.10% +35.14% = 48.36%

707.3. A risk manager is estimating the market risk of a portfolio using both the normal distribution and the lognormal distribution assumptions. The manager gathers the following data on the portfolio:

- Annual mean: 12.0%
- Annual volatility: 37.0%
- Current portfolio value: USD $1.0 million due to 12,500 shares at a current price of $80.00 per share
- Trading days in a year: 250

Which of the following statements is **correct**? (This question inspired by GARP's 2017 Practice Exam Part 2, Question #2 despite its tedious nature)

a) Lognormal 95% VaR is greater than normal 95% VaR at the one-day holding period by about 2.43%
b) Lognormal 95% VaR is less than normal 95% VaR at the one-year (250 days) holding period by about 3.90%
c) Lognormal 99% VaR is greater than normal 99% VaR at the one-day holding period by about 4.04%
d) Lognormal 99% VaR is less than normal 99% VaR at the one-year (252 days) holding period by about 21.75%

Answers:

707.1. B. 0.840. Per Dowd, the 99.0% VaR is the 4th worst loss per 1%*300 + 1 = 4.0; in the way, the VaR is the loss immediately adjacent to the 1.0% tail (i.e., 3 worst losses). Under Jorion's approach, the 3rd worst loss would quality as correct, in this case 0.870, however it is not given as a choice. (This histogram is not required).

707.2. C. False. Without dividends, the geometric returns would still be less than the arithmetic returns.

In regard to (A), (B) and (D), each is TRUE. Below is the scenario with returns added.

The spreadsheet is here https://www.dropbox.com/s/hz8r1ntnpbxjfrm/t5-702-2.xlsx

		Period			
	Initial	1	2	3	
Price	$20.00	$23.00	$19.00	$25.00	
Dividend		$2.00	$2.00	$2.00	
Arithmetic returns		25.00%	-8.70%	42.11%	*3-period*
Geometric returns		22.31%	-9.10%	35.14%	48.36%
Without dividends					
Arithmetic returns		15.00%	-17.39%	31.58%	*3-period*
Geometric returns		13.98%	-19.11%	27.44%	22.31%

707.3. D. True: Lognormal 99% VaR is less than normal 99% VaR at the one-year (252 days) holding period by about 21.75%.

Please note (A) and (C) can be instantly eliminated due to the "greater than" impossibility.

Here is a spreadsheet (see below): https://www.dropbox.com/s/ynfvo0vsupeod8v/t5-707-3-lognormal.xlsx

			Trading days:	250
Liquidity-adjusted VaR		**Inputs in yellow**	**Annual**	**Daily**
Price per share, P	$80.00	Volatility, σ(daily)	37.00000%	2.34009%
Number of shares, N	12,500	Exp return, μ	12.00000%	0.04800%
Wealth, W = P*N	$1,000,000			
Confidence levels	95.0%	→ deviate, α =	1.645	
	99.0%	→ deviate, α =	2.326	

One-year @ 95%		***One-year @ 99%***	
Absolute Value at Risk (%), normal	48.860%	**Absolute Value at Risk (%), normal**	74.075%
Absolute Value at Risk ($), normal	$488,596	**Absolute Value at Risk ($), normal**	$740,749
Absolute Value at Risk (%), log	38.651%	**Absolute Value at Risk (%), log**	52.324%
Absolute Value at Risk ($), log	$386,513	**Absolute Value at Risk ($), log**	$523,243
One-day @ 95%		***One-day @ 99%***	
Absolute Value at Risk (%), normal	3.801%	**Absolute Value at Risk (%), normal**	5.396%
Absolute Value at Risk ($), normal	$38,011	**Absolute Value at Risk ($), normal**	$53,959
Absolute Value at Risk (%), log	3.730%	**Absolute Value at Risk (%), log**	5.253%
Absolute Value at Risk ($), log	$37,298	**Absolute Value at Risk ($), log**	$52,529

		95.0%		99.0%
Differences	**One-year**	10.208%	**One-year**	21.751%
	One-day	0.071%	**One-day**	0.143%

Discuss here in forum: https://www.bionicturtle.com/forum/threads/p2-t5-707-historical-simulation-and-lognormal-value-at-risk-var-dowd.10815/