Semester : VIII Subject : AIFB Academic Year: 2024-25

VECTORIZED BACKTESTING:

Vectorized backtesting is a method of evaluating trading strategies by applying mathematical operations directly on vectors of historical data. Let us consider the below example and perform vectorized backtest.

Example:

Assume a 5-day example using daily price data. Perform vectorized backtesting.

Day	Price
1	100
2	102
3	101
4	103
5	104

Solution:

Calculate the Daily Returns: Step 1.

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

Day	Price	Return (r_t).
1.	100	NaN
2.	102	$\ln(102/100) = 0.0198$
3.	101	$\ln(101/102) = -0.0098$
4.	103	$\ln(103/101) = 0.0196$
5.	104	$\ln(104/103) = 0.0097$.

Signal Generation : Step 2

$$signal = \begin{cases} 1 & \text{if } r_{t-1} > 0 \\ 0 & \text{otherwise.} \end{cases}$$

Day	~~Signal~~ r_{t-1}	Signal
1.	–	–
2.	NaN	0
3.	0.0198	1
4.	−0.0098	0
5.	0.0196	1

Strategy Returns : Step 3

$$strategy_t = signal_t \times r_t.$$

Day	r_t	Signal	Strategy Return.
1.	NaN	–	–
2.	0.0198	0	0
3.	−0.0098	1	−0.0098
4.	0.0196	0	0
5.	0.0097	1	0.0097.

Cumulative Returns : Step 4

Total Market Returns = 0.0198 + (−0.0098) + 0.0196 + 0.0097.

= 0.0393.

= 3.93%.

Total strategy returns : $-0.0098 + 0.0097$.

$= 0.0001$

$= 0\ \%$

Interpretation:

→ The strategy missed the big day on Day 2 (because it didn't trade on Day 1's NaN.

→ It lost on Day 3 and gained on Day 5.

This is how vectorized backtesting is performed