

Variance, Volatility and Returns

Review

Standard error

- SE (of something), SD(of something)
Typically reserve SE for SD of a “statistic” computed from data
- “Magic formula” $SE(\text{avg of } n \text{ items}) = SD(1 \text{ item}) / \sqrt{n}$
- Less variation among averages than among individuals
- Estimating SE using \sqrt{n} adjustment from SD of data

Tests and confidence intervals

- Dual approaches to answering the same type of question.
- Emphasis on one type of error rather than costs.

Dice Experiment

Experiment

- Variance and volatility and how these affect returns on investments.
- 3 possible investments: “Green”, “Red” and “White”
- Value of each determined by outcome of die of matching color.

Description from coursepack

- Form teams for 3-4 students
- “Nature” rolls the dice
- “Market” finds the dice and reports outcome
- “Accountant” keeps track of what happens
- Others manage and keep rest making progress...
- Dice determine value of investments, returns.

Table of outcomes

Roll	Red	White	Green
1	0.06	0.9	0.8
2	0.2	1	0.9
3	1	1	1.05
4	3	1	1.1
5	3	1	1.2
6	3	1.1	1.4

Example

Suppose that on the first roll of all three dice, you obtain

(Red 5) (White 3) (Green 2)

Then the values of the investments after the first year are

Red: $\$1000 \cdot 3 = \3000

White: $\$1000 \cdot 1 = \1000

Green: $\$1000 \cdot 0.9 = \900

For the next roll, the values are compounded from these. If second roll gives

(Red 2) (White 6) (Green 4)

then the values of the three investments after two years are

Green: $\$900 \cdot 1.1 = \990

Red: $\$3000 \cdot 0.2 = \600

White: $\$1000 \cdot 1.1 = \1100

Preliminary Questions

Which investment do you like?

Color Die	Expected Annual Return	SD of Annual Return
Red	71%	132%
White	0%	6%
Green	7.5%	20%

Which investment of these wins in a simulation

– 25 years of returns...

A Hybrid

Make a third investment...

- Mixes the results for Red and White... so call it Pink.
- For the first round, using the same dice rolls as above (*Red*=5, for a value of 3 and *White*=3, for a value of 1), the value of the “Pink” investment is

$$\text{Pink: } \$1,000 \cdot \frac{3+1}{2} = \$2,000$$

- Compounded in the second round (which had values *Red*=2 for a value 0.2 and *White*=6 with value 1.1), the result is

$$\text{Pink: } \$2,000 \cdot \frac{0.2+1.1}{2} = \$1,300$$

Impression of the chances for this hybrid?

- How does Pink fare in your simulation?