

# Capital Budgeting: Distribution Moments

(Welch, Chapter 13-1)

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# 1: Expected Cash Flows

## 2: Value of Graduate Degree

- ▶ Life is not fair. At age 25,
  - ▶ male life expectancy is about 52.5 years,
  - ▶ female life expectancy is about 57 years.
- ▶ If you expect to earn \$100,000 per year **extra** because of your degree, and
- ▶ if the applicable interest rate / (opportunity) cost of capital is 5%/year, then what is your degree really worth?

### 3: Expectation of Function

- ▶ Is  $E(f[x]) = f[E(x)]$  ?
- ▶ Where could this even matter?
- ▶ How would you figure out the answer for yourself?

## 4: Expectation Cooking

- ▶ **Cook up as simple an example as possible!**
  - ▶ Say, you can expect to live one of three lengths, with equal probabilities of 0, 1, and 2 years.
  - ▶ Say, the interest rate is 10%.
  - ▶ What is the correct expected value of \$1 as long as you live?

## 5: Simple Stew I

$$E(CF(t)) = 1/3 \times (\$1 + \$1/1.1 + \$1/1.1^2)$$

$$+ 1/3 \times (\$1 + \$1/1.1) + 1/3 \times (\$1)$$

$$= \$1.88 .$$

- ▶ However, if you lived the expected number of years, you would receive

## 6: Simple Stew II

- ▶ Non-linearities in  $E(\text{CF})$  matter greatly in insurance, annuities, etc.
- ▶ But non-linearities also matter when machines can wear out.
- ▶ Sometimes they are first-order important. Sometimes approximations are reasonable. Tough to know beforehand!

## 7: Drug-Dealing

- ▶ You expect to earn \$300,000/year. Holding money for a drug-dealer would earn you an extra \$100,000 per year. It is highly unlikely that you will get caught—maybe 1 in 1,000. 999 out of 1,000 times, you earn 25% more.
- ▶  $.999 \times \$400 + .001 \times \$0 \approx \$400$  .



## 8: Bad Example

- ▶ OK, drug-dealing was a bad example but it illustrated the possibility of a rare bad outcomes with terrible payoffs.
- ▶ More commonly, there is a small probability of disaster where you lose all. The manager dies. An explosion happens. etc.
- ▶ It is rare that rare events are positive surprises.