**Using Crystal Ball for NPV and IRR - 2019**

**Example**: You plan to open a new supermarket. Here is what we expect (in thousands of dollars). These are our expected values. We expect sales, variable costs, and fixed costs to stay level for 12 years and then grow at a constant terminal growth rate. We will depreciate the initial investment over the lifetime of the project.

**Fixed Costs** - Costs incurred regardless of the level of sales

**Variable Costs** - Costs that rise as sales rise

0 1-12\_\_\_\_\_\_\_\_\_\_\_\_

# Initial Investment $5,400

1. Sales 16,000

2. Var. Costs 81.25% of sales = $13,000

3. Fixed Costs 2,000

4. Depreciation 450

5. EBIT

(1-2-3-4= EBIT) 550

6. Taxes (21%) 193

7. Net Income 358

8. CF from Operations

(4+7) 808

Net Cash Flow -$5,400 +808

Opp. Cost of Capital = 12%

Terminal Growth Rate after year 12 = 3%

NPV = $2,399.55 and IRR = 18.28%, so you should go for it.

Let’s examine this more closely. To do a basic sensitivity analysis, we might construct the following chart and see how NPV (and/or IRR) changes when we change one (or more) of these input variables

### Variable Pessim. Expected Optim.

Investment $6,200 5,400 5,000

Sales 14,000 16,000 18,000

Variable Costs

(% of Sales) 83% 81.25% 80%

Fixed Costs 2,100 2,000 1,900

Term. Growth 1% 2% 3%

Excel will allow us to do a basic sensitivity analysis without any special tools.

**Monte Carlo Analysis** - Excel generates outcomes under many combinations of assumptions - creating a probability distribution of outcomes. This can be done through an add-on called Crystal Ball.

Assume the following about the variables in this example:

Investment – triangular distribution

Sales – normal distribution with mean of 16,000 and standard deviation of 1,000

Var. Costs – uniform distribution between 80% and 83%

Fixed Costs – 20% probability of pess. and optim. values. 60% prob. of expected value

Term. Growth – normal distribution with mean of 2% and standard dev. of 0.5%

There is a correlation of +0.5 between variable costs and fixed costs

Run Crystal Ball to see a probability distribution of the NPV and IRR

We are defining 5 assumptions (plus a correlation) and 2 forecasts.