

C-11

**Project Analysis and
Evaluation**

G.Kholjigitov

FIN-311 - Corporate Finance

EVALUATING ESTIMATES

- NPV > 0
 - PBP - as short as possible
 - IRR - as high as possible
- However**, we have to look at:
- Projected vs. actual cash flows
 - Discounted CF
 - Forecasting risks
 - Source of value

SCENARIO AND OTHER WHAT-IF ANALYSES

- **Scenario analysis** is the determination of what happens to NPV estimates when we ask what if questions.
 - ❖ Pessimistic, most likely, optimistic
- **Sensitivity analysis** is investigation of what happens to NPV when one variable is changed
- **Simulation analysis** is a combination of scenario and sensitivity analysis

SCENARIO ANALYSIS

Wilson's Woods is considering a project which involves producing inexpensive golf clubs for teenagers. The company expects to sell these clubs for \$100 a set, plus or minus 2%. The sales manager estimates that 20,000 sets can be sold, plus or minus 5%.

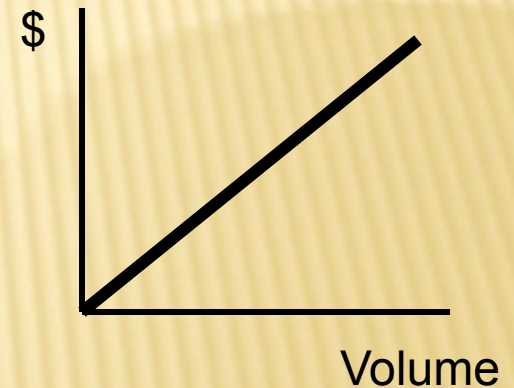
What is the expected amount of sales under the worst case scenario?

$$\begin{aligned} \text{Sales for worst case scenario} &= 20,000 \times (1 - .05) \times \$100 \times (1 - .02) \\ &= 19,000 \times \$98 \\ &= \$1,862,000 \end{aligned}$$

VARIABLE AND FIXED COSTS

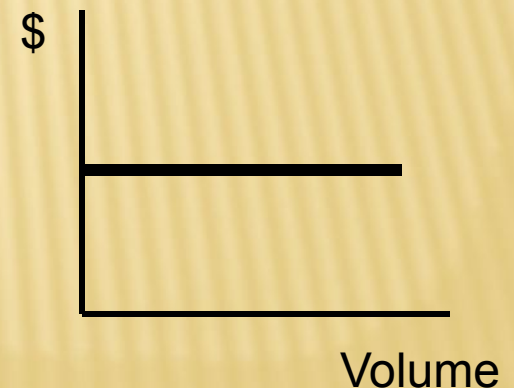
Variable Cost

- a cost which is constant per unit but changes in total in proportion to changes in the cost driver
- materials (parts), fuel costs for a trucking company



Fixed Cost

- a cost which **does not** change in total as volume changes but changes on a per-unit basis as the cost driver increases and decreases
- amortization, insurance



SCENARIO ANALYSIS

Bob's Custom Wheels is considering designing and selling customized steering wheels for hot rods. The projected fixed costs of this project are \$18,000. Variable costs are estimated at \$54.90 per wheel. The cost estimates are considered accurate within a plus or minus range of 5%. The depreciation expense is \$8,000 per year. Bob's expects to sell 1,500 wheels, plus or minus 3%. The sales price is estimated at \$139.00, plus or minus 5%.

What is the projected earnings before interest and taxes under the best case scenario?

$$\text{Sales} = 1,500 \times (1 + .03) \times \$139.00 \times (1 + .05) = \$225,493$$

$$\text{Var.cost} = 1,500 \times (1 + .03) \times \$54.90 \times (1 - .05) = \$ 80,579$$

$$\text{Fixed cost} = \$18,000 \times (1 - .05) = \$ 17,100$$

$$\text{Depreciation} = \$8,000 = \underline{\$ 8,000}$$

$$\text{EBIT} = \$119,814$$

SENSITIVITY ANALYSIS

- Sensitivity analysis is a “**what-if**” technique that examines how a result will change if the original predicted data are not achieved or if an underlying assumption changes
- What will happen to operating income if volume declines by 5%?
- What will happen to operating income if variable costs increase by 10% per unit?
- Sensitivity analysis broadens management’s perspectives about **possible outcomes**

SENSITIVITY ANALYSIS

Kettle Corn and Chips is considering selling snack foods at sporting events. The company has developed the following estimates:

Sales	25,000 units	± 10%
Variable cost	\$0.59 per unit	± 5%
Fixed cost	\$7,500	± 2%
Selling price	\$1.25 per unit	± 5%
Depreciation	\$1,000	

What is the earnings before interest and taxes for a sensitivity analysis using a variable cost of \$.60 per unit?

Sales	= 25,000 × \$1.25	= \$31,250
Variable cost	= 25,000 × \$.60	= \$15,000
Fixed cost	= \$7,500	= \$ 7,500
Depreciation	= \$1,000	= <u>\$ 1,000</u>
EBIT		= \$ 7,750

SENSITIVITY ANALYSIS

The Sweet Shoppe is considering opening a kiosk and selling homemade cookies on the waterfront during tourist season. The company has developed these estimates:

Sales	6,000 cookies	$\pm 20\%$
Var.costs	\$.69 per cookie	$\pm 4\%$
Fixed costs	\$500	$\pm 3\%$
Sales price	\$1.10	$\pm 5\%$
Depreciation	\$800	
Tax rate	34%	

What is the operating cash flow for a sensitivity analysis using a sales quantity of 6,500 cookies?

SENSITIVITY ANALYSIS

$$\begin{aligned}\text{Sales} &= 6,500 \times \$1.10 &&= \$7,150 \\ \text{Variable cost} &= 6,500 \times \$0.69 &&= \$4,485 \\ \text{Fixed cost} &= \$500 &&= \$ 500 \\ \text{Depreciation} &= \$800 &&= \underline{\$ 800} \\ \text{EBIT} &&&= \$1,365 \\ \text{Tax} &= .34 \times \$1,365 &&= \underline{\$ 464} \\ \text{Net income} &&&= \$ 901\end{aligned}$$

$$\begin{aligned}\text{OCF} &= \text{EBIT} + \text{Depreciation} - \text{Taxes} \\ &= \$1,365 + \$800 - \$464 = \$1,701\end{aligned}$$

$$\begin{aligned}\text{OCF} &= [(\text{Sales} - \text{Costs}) \times (1 - \text{Tax rate})] + [\text{Depreciation} \times \text{tax rate}] \\ &= \{[6,500 \times (\$1.10 - \$0.69)] - \$500\} \times \{1 - .34\} + \{\$800 \times .34\} \\ &= \$1,428.90 + \$272.00 = \$1,700.90 \\ &= \$1,701 \text{ (rounded to whole dollars)}\end{aligned}$$

TOTAL COST

Sandwiches To Go sells 500 sandwiches per day. The company pays \$1,200 a month for rent. Other fixed costs are \$500 monthly.

The variable cost per sandwich is \$2.89. Assume a month has 30 days.

What are the monthly total costs incurred by Sandwiches To Go?

$$\begin{aligned} \text{Total monthly cost} &= (500 \times 30 \times \$2.89) + \$1,200 \\ &+ \$500 = \$43,350 + \$1,700 = \$45,050 \end{aligned}$$

AVERAGE VS. MARGINAL COST

Daisy's Flowers raises and sells 36,000 bouquets of fresh cut flowers each year. Total labor cost for the year are \$68,000. Total material costs for the year are \$28,470. Daisy's computed that at the current level of production the labor cost per additional unit is \$1.40 and the material costs are \$2.09.

Fixed costs for the year are \$50,000. Annual depreciation is \$55,000 on the greenhouses and equipment. Ignore taxes.

What is the average total cost per bouquet?

What is the minimum price Daisy's should charge if they can obtain a one-time special order for an additional 250 bouquets?

$$\begin{aligned} \text{Average total cost} &= \frac{\$68,000 + \$28,470 + \$50,000 + \$55,000}{36,000} \\ &= \$5.60 \text{ (rounded)} \end{aligned}$$

$$\text{Minimum price for one-time order} = \$1.40 + \$2.09 = \$3.49$$

CONTRIBUTION MARGIN

- **Contribution margin** is equal to the difference between total revenue and total variable costs

Contribution margin **per unit**
= Selling price - Variable cost per unit

Contribution margin **percentage**
= Contribution margin per unit / selling price per unit

Total for

Per Unit 2 units %

Revenue \$200 \$400 100%

Variable costs 120 240 60%

Contribution margin \$80 \$160 40%

CONTRIBUTION MARGIN

Jack's Custom Kars manufactures motorized toy cars for children aged 3 to 6. Jack's sells these cars for \$320 each. The company has fixed monthly expenses of \$1,500. The variable cost per car is \$212. During an average month, Jack's sells 20 of these toy cars.

What is the contribution margin per car sold?

$$\begin{aligned}\text{Contribution margin} &= \text{Selling price} - \text{Variable cost per unit} \\ &= \$320 - \$212 \\ &= \$108\end{aligned}$$

COST-VOLUME-PROFIT (BREAKEVEN) GRAPH

\$10,000

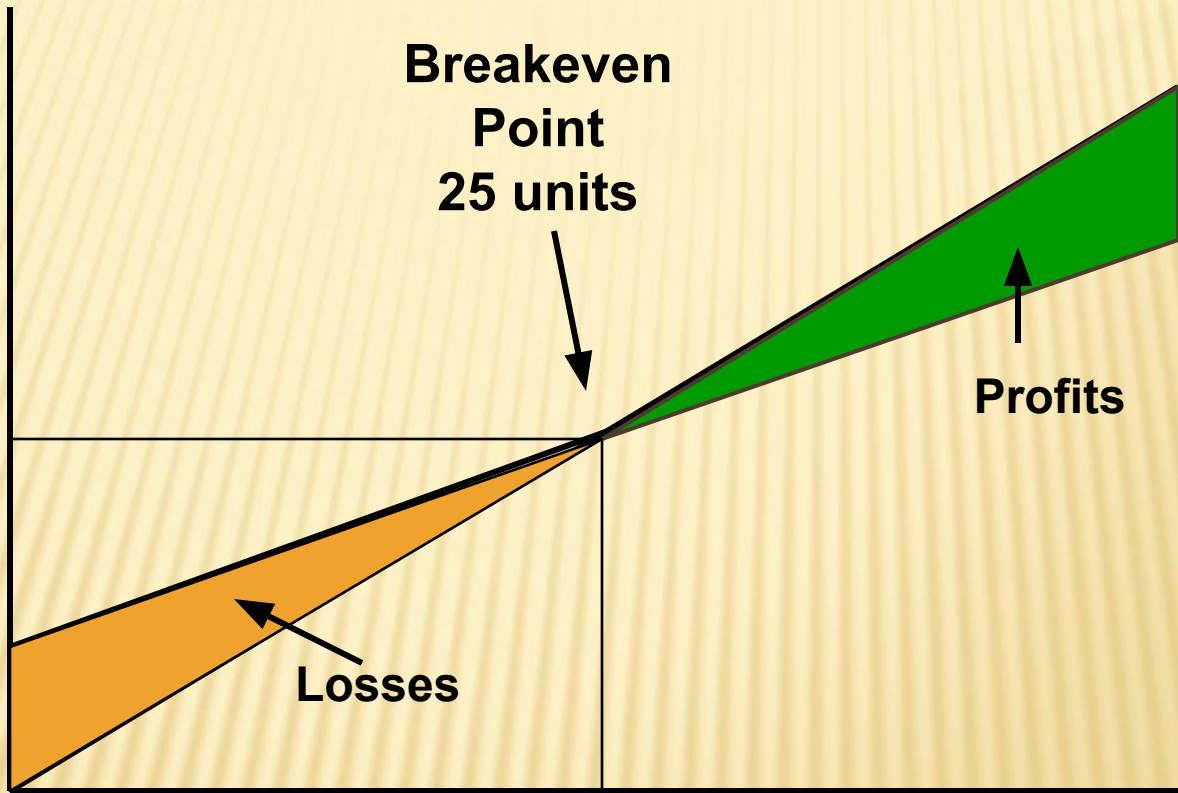
\$8,000

\$6,000

\$4,000

\$2,000

\$0



**Breakeven
Point
25 units**

**Total
Revenues**

Total Costs

Profits

Losses

0 10 20 30 40 50

Units Sold

BREAKEVEN POINT

- Quantity of output where total revenues equal total costs
- the point where operating income equals zero

Breakeven point in units

= Fixed costs / Contribution margin per unit

= \$2,000 / \$80 = 25 units

Breakeven point in dollars

= Fixed costs / Contribution margin %

= \$2,000 / 40% = \$5,000

BREAKEVEN POINTS

- **General BE expression** – relation between OCF (ignoring taxes) and quantity of output or sales volume (Q)

$$Q = (FC + OCF) / (P - v)$$

where FC- Fixed costs

P- price per unit

V- variable cost per unit

- **Accounting BE** – the sales level results in zero project **net income**

$$Q = (FC + D) / (P - v)$$

where D – depreciation

- **Cash BE** – the sales level that results in a zero **OCF**

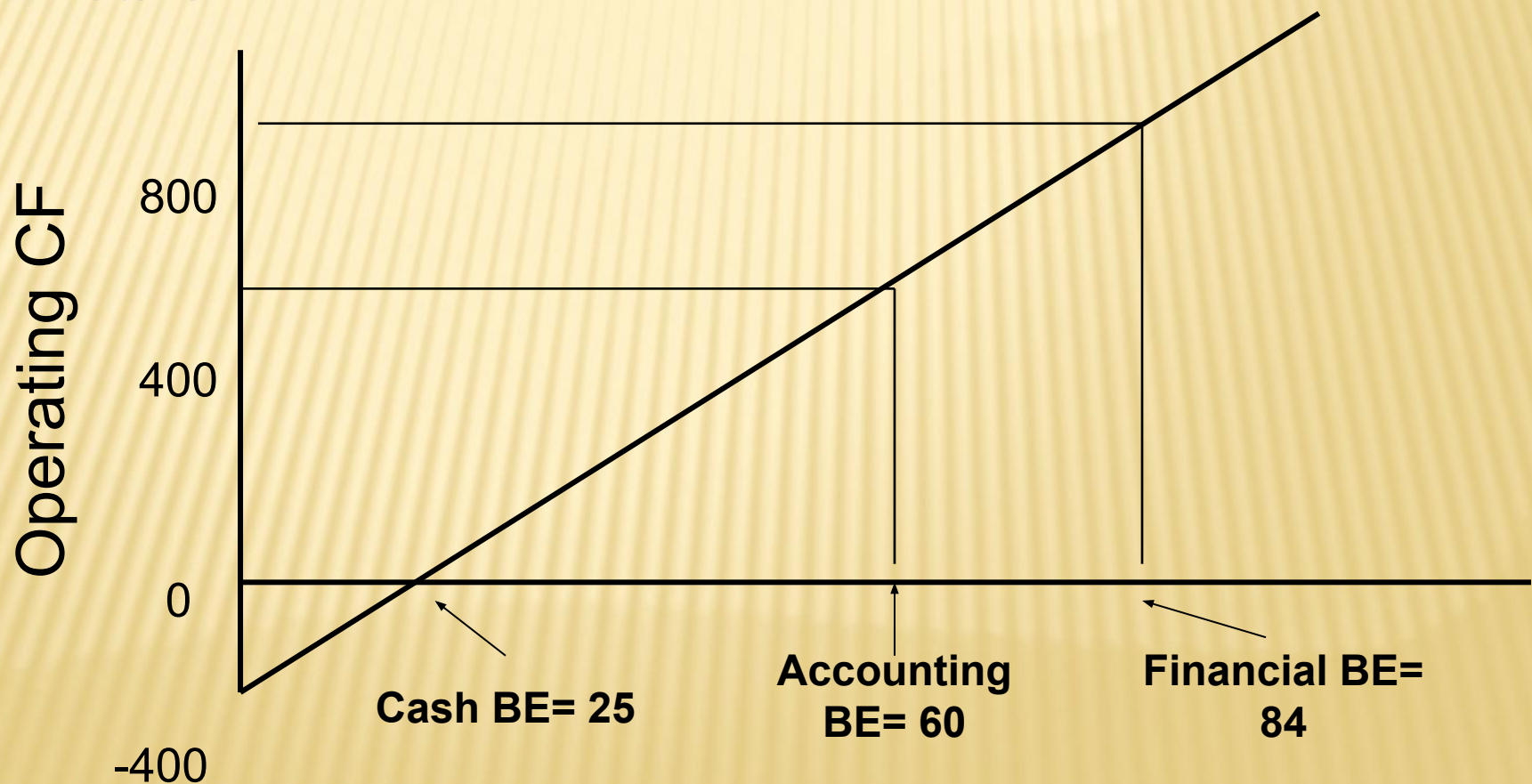
$$Q = FC / (P - v)$$

BREAKEVEN POINTS

- Financial BE – the sales level that results in a zero NPV

$$Q = (FC + OCF^*) / (P - v)$$

where OCF* is the level of OCF that results zero NPV



ACCOUNTING BREAK-EVEN

You are considering a new project. The projections include a sales price of \$11.99, fixed costs of \$7,500, depreciation of \$2,400 and variable costs per unit of \$6.20. Ignore taxes.

What is the accounting break-even level of production?

$$\begin{aligned} Q &= \frac{FC + D}{P - v} \\ &= \frac{\$7,500 + \$2,400}{\$11.99 - \$6.20} \\ &= \frac{\$9,900}{\$5.79} = 1,709.84 \text{ units} \end{aligned}$$

ACCOUNTING BREAK-EVEN

Katie's Kites is considering a project with estimated fixed costs of \$2,100, depreciation expense of \$900 and a sales quantity of 2,500 units. Ignore taxes.

What is the contribution margin per unit if the projected level of sales is at the accounting break-even point?

$$Q = \frac{FC + D}{P - v}$$
$$2,500 = \frac{\$2,100 + \$900}{P - v}$$
$$P - v = \frac{\$2,100 + \$900}{2,500}$$
$$P - v = \$1.20$$

CASH BREAK-EVEN

Pretzels N' More is considering adding a new retail outlet. Fixed costs are estimated at \$160,000 per year. The forecasted sales price is \$1.59 per pretzel. Variable costs per pretzel are \$.79.

What is the cash break-even point for this new retail outlet?

$$\begin{aligned} Q &= \frac{FC}{P - v} \\ &= \frac{\$160,000}{\$1.59 - \$.79} \\ &= \frac{\$160,000}{\$.80} = 200,000 \text{ units} \end{aligned}$$

CASH BREAK-EVEN

Tight-Wad Willsen is reviewing a proposal that has fixed costs of \$12,500, depreciation expense of \$5,400 and a contribution margin of \$2.05.

Willsen wants to know how many units of this product will have to be sold so that his potential loss is limited to his initial investment. What should you tell him?

$$\begin{aligned} Q &= \frac{FC}{P - v} \\ &= \frac{\$12,500}{\$2.05} = 6,097.56 \text{ units} \end{aligned}$$

FINANCIAL BREAK-EVEN

You are considering a new project that has an operating cash flow of \$22,600 when the net present value is equal to zero. At that level of sales, the selling price per unit is \$14.95, the variable cost per unit is \$8.60 and the fixed costs are \$19,000.

What is the financial break-even sales quantity?

$$\begin{aligned} Q &= \frac{FC + OCF_{\text{where } NPV=0}}{P - v} \\ &= \frac{\$19,000 + \$22,600}{\$14.95 - \$8.60} \\ &= \frac{\$41,600}{\$6.35} = 6,551.18 \text{ units} \end{aligned}$$

OPERATING LEVERAGE

- **Operating leverage** – the degree to which a firm's or project relies on fixed costs
- **Degree of Operating leverage** is the percentage in operating CF relative to the percentage change in quantity sold
$$\% \text{ change in OCF} = \text{DOL} \times \% \text{ change in } Q$$

$$\text{DOL} = 1 + \text{FC}/\text{OCF}$$

DEGREE OF OPERATING LEVERAGE

Def: DOL is change in OCF relative to % change in quantity sold.

A project has fixed costs of \$2,500 and variable costs per unit of \$10.15. The depreciation expense is \$1,100. The operating cash flow is \$6,400.

What is the degree of operating leverage?

$$\begin{aligned} DOL &= 1 + \frac{FC}{OCF} \\ &= 1 + \frac{\$2,500}{\$6,400} \\ &= 1 + .39 = 1.39 \end{aligned}$$

DEGREE OF OPERATING LEVERAGE

Martha's Linens, Etc. has a 2.5 degree of operating leverage. Sales are expected to increase by 4% next year.

What is the expected percentage change in operating cash flow for next year?

$$\begin{aligned} \text{Percentage change in OCF} &= \text{DOL} \times \text{Percentage change in Q} \\ &= 2.5 \times 4\% = 10\% \end{aligned}$$

CAPITAL RATIONING

Capital rationing is the situation that exists if the firm has a positive NPV projects but cannot find the necessary financing

- ❖ **Soft**- the situation when units in a business are allocated a certain amount of financing fro capital budgeting
- ❖ **Hard** – when a business cannot raise financing for a project under any circumstances