FINC2012
CORPORATE FINANCE 2
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Lecture

Sources of Value: How to Ensure that Projects Truly Have Positive NPVs

BMAE Ch.11

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Topics Covered

- Behavioural Biases in Investment Decisions.
- Avoiding Forecasting Errors.
- How Competitive Advantage Translates Into Positive NPVs.
- Marvin Enterprises Decides to Exploit a New Technology- An Example.

Behavioural Biases in Investment Decisions

- Investment decisions often involve large outlays and may determine the shape of the company many years into the future. Therefore, senior managers rarely delegate decisions about major investments.
- Investment proposals often presented as sales documents with little discussion of potential risks or alternatives $\Rightarrow$ impedes managers' ability to distinguish between proposals.
- Most cash flow forecasts prone to error & bias $\Rightarrow$ financial manager must distinguish between genuinely good projects and those that look good because of errors or bias in forecasts.
- Financial managers need to be mindful that sponsors of investment project proposals liable to behavioural biases.

Behavioural Biases in Investment Decisions

- **Overconfidence Bias**
  - Most people tend to be overconfident when they forecast. Events viewed as almost certain to occur may actually happen only 80% of the time, while events that are believed to be impossible may happen 20% of the time $\Rightarrow$ understatement of risks of project proposals.
- **Optimism Bias**
  - Sponsors keen to have their investment project proposal accepted are likely to have mistaken overoptimistic assessment of the project's cash flows.

Avoiding Forecast errors

- Even if forecasts underpinning strategic investment proposals are *unbiased,* they may be liable to large errors, some positive and others negative.
  - The average error will be zero, but that is little consolation because you want to accept only projects with truly superior profitability.
- How to prevent these forecast errors from swamping genuine information?

Look first to asset’s market values.

- Many capital assets are traded in a competitive market.
- To ensure that project proposals truly add value, managers should start with looking at asset’s market value and then ask why the company can earn more from those assets than its rivals.

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Market Values

- *Smart investment* decisions make **more** money than smart financing decisions.
- Smart investments are worth more than they cost $\Rightarrow$ have positive NPVs.
- Firms calculate project NPVs by discounting forecasted cash flows, but …
- Projects may ***appear*** to have positive NPVs because of forecasting errors. Some acquisitions result from errors in DCF analysis.
- Don’t make investment decisions on the basis of errors in your DCF analysis.
- Start with the market price of the asset and ask whether it is worth more to you than to others.

Market Values

- How to distinguish projects with truly positive NPVs from those that appear worthwhile merely because of forecasting errors?
- Positive NPVs stem from a *competitive advantage*.
  - In a fully competitive environment, companies can expect to earn no more than the cost of capital.
  - Positive NPVs arise only when the company has a competitive advantage that allows it to earn more than the cost of capital.
- With strategic investment decisions, managers need to focus on competitive advantage and how long it will prevail.

Market Values

- One should *not* assume that other firms will watch passively to your strategic investment decisions.

Ask questions such as:

- *How long a lead do I have over my rivals?*
- *What will happen to prices when that lead disappears?*
- *In the meantime, how will rivals react to my move?*
- *Will they cut prices or imitate my product?*

Example: Investing in a New Department Store

- Department store chain estimated PV of the expected cash flows from each proposed store, including price at which it could eventually sell the store.
- Investment decisions were heavily influenced by the forecasted selling price of each store - even though management claims no particular real estate expertise.
  - Investment decision unintentionally dominated by its assumptions about future real estate prices.
- Decision to open a new store checked by asking the following question:
  "Let us assume that the property is fairly priced. What is the evidence that it is best suited to one of our stores rather than to some other use?"

Example: Investing in a New Department Store

- The new store costs $100 million.
- It will generate after-tax cash flow of $8 million a year for 10 years.
- Real estate prices are estimated to grow by 3% a year, the expected value of the real estate at the end of 10 years is 100 x $(1.03)^{10}$ = $134 million.
- Base case NPV at a discount rate of 10% is,

$$\text{NPV} = -\$100 + \frac{\$8}{1.10} + \frac{8}{1.10^2} \ldots + \frac{8+134}{1.10^{10}}$$

$$= \$1 \text{ million}$$

Notice how sensitive the decision is to the ending value of the real estate. For example, an ending selling price of $120 million implies an NPV of −$5 million.

Example: Investing in a New Department Store

- Imagine the business as divided into two parts:

    1. Real estate subsidiary that buys the building

    2. Retailing subsidiary that rents and operates it.

- Then, figure out how much rent real estate subsidiary would have to charge and ask whether retailing subsidiary could afford to pay the rent.

- ***Case A***: Observe that similar retail space recently rented for $10 million p.a.
  $\Rightarrow$ department store is not the best use for the site.

    - *Once site acquired, better to rent it out at $10 million p.a. than to use it for a store generating only $8 million!*

Case B: Observe that similar property could be rented for only $7 million p.a.

Retailing subsidiary could pay this amount to real estate subsidiary and still earn net operating cash flow of $8 million - $7 million = $1 million

$\Rightarrow$ best ***current*** use for the real estate.

Example: Investing in a New Department Store

- Will this also be the best ***future*** use? Depends on whether retail profits keep pace with any rent increases.

- c) Suppose real estate prices and rents expected to increase by 3% per year.
- Real estate subsidiary must charge 7 x 1.03 = \$7.21 million in year 2, 7.21 x 1.03 = \$7.43 million in year 3 ...
- Graph shows that store's income fails to cover rental after year 5.
- If these forecasts are right, store has only a five-year economic life; from that point on real estate is more valuable in some other use.

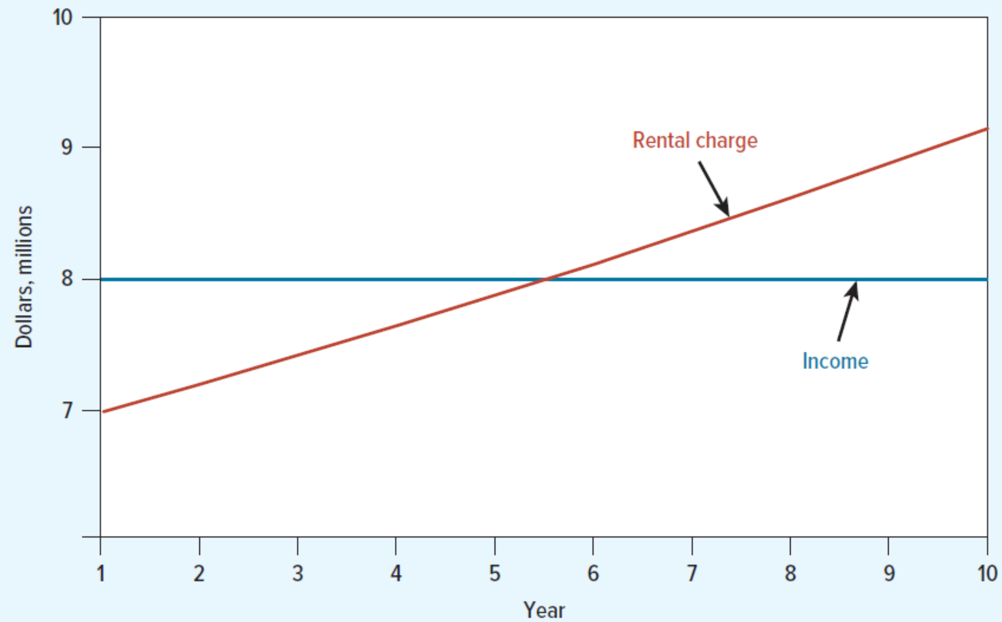


FIGURE 11.1

Beginning in year 6, the department store's income fails to cover the rental charge.

Example: Investing in a New Department Store

- Department store example involved two bets:

  i. Bet on real estate prices

  ii. Bet on the firm's ability to run a successful store.

- Don't make poor store investment just because you are optimistic about real estate prices. Better to buy real estate and rent it out to the highest bidders..

- Shouldn't be deterred from going ahead with a profitable store because of pessimistic outlook on real estate prices. Better to sell the real estate and rent it back for the store.

- Separate the two bets by first asking, "*Should we open a clothing store on this site, assuming that the real estate is fairly priced?*" and then deciding whether you also want to go into the real estate business.

Example: Opening a Gold Mine

- Another example of how market prices can help you make better investment decisions.
- Proposal to open a new gold mine.
- Initial investment to develop mine is $500 million.
- Mine will produce 100,000 ounces of gold in each of the next 10 years at a cost of $1,150 an ounce.
- Uncertainty about future gold prices.
- Gold price will assumed to rise by 5% per year from its current level of $1,500 an ounce.
- At a discount rate of 10%, this gives the mine an NPV of −$$35 million $\Rightarrow$ Reject the gold mine!

Example: Opening a Gold Mine

Example:

King Solomon's Mine

Investment	=	\$500 million
Life	=	10 years
Production	=	1 million oz a year
Production cost	=	\$1,150 per oz
Current gold price	=	\$1,500 per oz
Discount rate	=	10%

- ***King Solomon's Mine.***
- If the gold price is forecasted to rise by 5% per year:

$$\begin{aligned} NPV &= -\$500 + \frac{0.1\times(\$1{,}575 - 1{,}150)}{1.10} + \frac{0.1\times(1{,}654 - 1{,}150)}{1.10^2} + \ldots + 0.1\times\frac{\$2{,}443 - 1{,}150}{(1.10)^{10}} \\ &= -\$35 \text{ million} \end{aligned}$$

Example: Opening a Gold Mine

- Information from the market that is being ignored.
- There is a market forecast for PV of an ounce of gold – current market price. Current market price of \$1,500 oz = discounted value of the expected future gold price.
- Mine is expected to produce a total of 1 million oz (0.1 million oz p.a. for 10 years), the present value of the revenue stream is 1 million × \$1,500 = \$1,500 million.

If gold is fairly-priced, you do not need to forecast future gold prices:

NPV = − investment + PV revenues − PV costs.

$$= -\$500 + 1{,}500 - \sum_{t=1}^{10} \frac{0.1 \times \$1{,}150}{1.10^t} = \$293 \text{ million}$$

Gold mine is not such a bad bet after all!

Current market price = discounted value of the expected future gold price

- Investing in an ounce of gold is like investing in a stock that pays no dividends: the investor's return comes entirely as capital gains.
- The price of the stock today, P_0, depends on the expected dividend, DIV_1 , price for next year, P_1 and the opportunity cost of capital *r:* $$P_0 = \frac{DIV_1 + P_1}{(1+r)}$$
- But for gold $DIV_1 = 0$, so we have: $$P_0 = \frac{P_1}{(1+r)}$$

$\Rightarrow$ *today's price is the present value of next year's price.*

- Also, since $DIV_2 = 0$, we have $\rightarrow$ $P_1 = \frac{P_2}{(1+r)}$ and we can express P_0 as:

$$P_0 = \frac{P_1}{(1+r)} = \frac{1}{(1+r)}\left(\frac{P_2}{(1+r)}\right) = \frac{P_2}{(1+r)^2} = \frac{P_3}{(1+r)^3} = \ldots\ldots = \frac{P_t}{(1+r)^t}$$

- In general, $$P_0 = \frac{P_t}{(1+r)^t}$$
- Holds for any asset that pays no dividends, is traded in a competitive market, and costs nothing to store.

How Competitive Advantage Translates into Positive NPVs

- Financial Managers should ask whether an asset is more valuable to them than to someone else.
- In long-run competitive equilibrium, assets are expected to earn their opportunity cost of capital.
  If assets earned more, firms would expand or firms outside industry would enter.
- A project's *economic income* in any year is equal to the cash flow plus the change in the asset's present value

$$\textbf{\textit{Economic income in year t}} = C_t + (PV_t - PV_{t-1})$$

- The difference between a project's economic income and the cost of capital is the project's *economic rent.* Projects that earn economic rents have positive NPVs.

How Competitive Advantage Translates into Positive NPVs

- When realized economic income > the income shareholders require, company earns an **economic rent**:

Economic rent = actual economic income − cost of shareholders' capital

- Companies add value whenever their economic income is greater than the cost of capital.
- Positive-NPV projects are those that earn economic rents.

NPV = PV(economic rents)

- Positive rents arise only when the company is able to identify and exploit some competitive advantage.

e.g. better product; lower costs; protected market; 'Barriers to Entry'; patents or proprietary technology; skills and experience of employees; durable customer/supplier relationships; reputation & respected brand name; strategic assets competitors can't easily duplicate.

How Competitive Advantage Translates into Positive NPVs

- Competition between companies erodes economic rents and drives them down to zero.
- A competitive advantage will protect a firm only if durable and can be sustained against competition from other businesses.
- Having a clear understanding of firm's competitive strengths
  $\Rightarrow$ Manager better placed to identify positive NPV projects.
- Calculations of apparent positive NPV should not be accepted at face value. Need to probe behind the cash-flow estimates, try to identify the source of economic rents and how long they will endure.
- A positive NPV for a new project is believable only if you believe that your company has some special advantage.

Marvin Enterprises Example

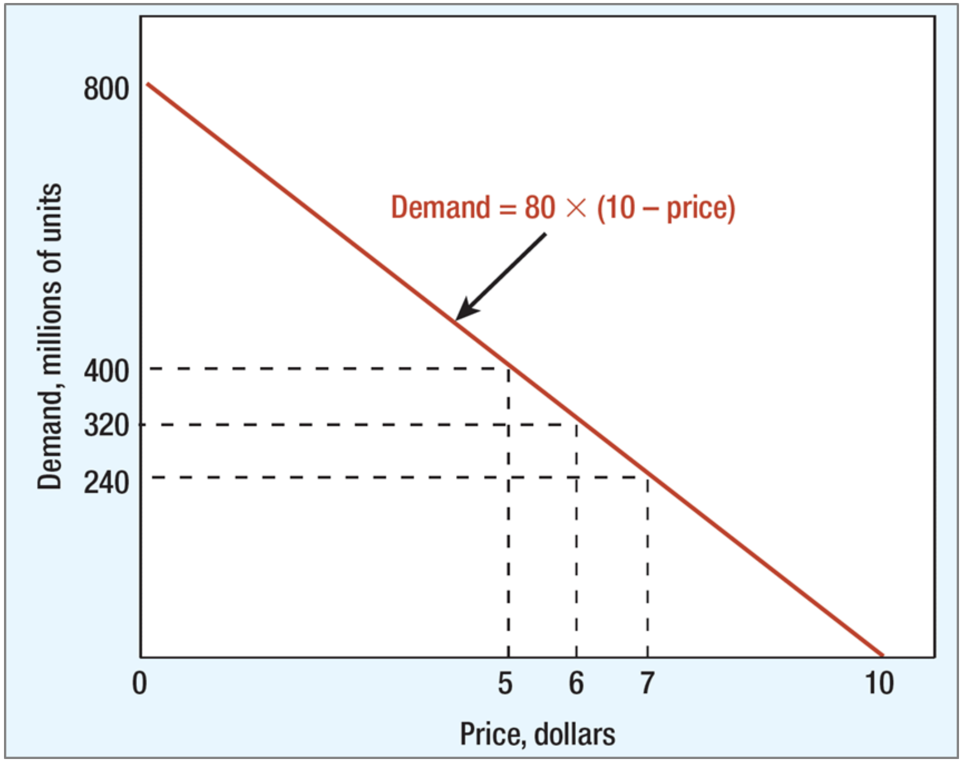
- Example illustrates some of the problems involved in predicting economic rents.

Scenario:

- Remarkable growth of completely new industry – "*Gargle Blasters*" – witnessed in early part of 21^{st} century.
- By 2044, annual sales of gargle blasters totalled $1.68 billion, or 240 million units.
- Marvin Enterprises had entered late into the business, but it had pioneered the use of implanted microcircuits to control the genetic engineering processes used to manufacture gargle blasters.
- Development enabled producers to cut price of gargle blasters from $9 to $7 $\Rightarrow$ contributed to dramatic growth in the size of the market.

Marvin Enterprises Example Figure 11.2

- The estimated demand curve in Figure 11.2 shows just how responsive demand is to such price reductions.



The demand "curve" for gargle blasters shows that for each $1 cut in price there is an increase in demand of 80 million units.

Demand (quantity) = 80(10 − price)
Price = 10 × quantity/80

Marvin Enterprises Example Table 11.4

- Table 11.4 summarizes cost structure of old and new technologies. Companies with the new technology were earning 20% on their initial investment, those with first-generation equipment had been hit by the successive price cuts.

TABLE 11.4

Size and cost structure of the gargle blaster industry before Marvin announced its expansion plans.

	Capacity (Millions of Units)				
Technology	Industry	Marvin	Capital Cost per Unit ($)	Manufacturing Cost per Unit ($)	Salvage Value per Unit ($)
First generation (2032)	120	—	17.50	5.50	2.50
Second generation (2040)	120	24	17.50	3.50	2.50

Note: Selling price is $7 per unit. One unit means one gargle blaster.

Marvin Enterprises Example

CURRENTLY:

Industry capacity = 120m + 120m = 240m,

P =10 - Q/80m = 10 - 240m/80m = $7

NEW EXPANSION PLAN:

- Marvin decides to spend $1b to add 100m units to capacity
- New units will have capital cost of $10 & manufacturing costs of $3 each.
- After 5 years competitors will have access to the new technology.

Should Marvin undertake expansion plan?

First problem is to decide what is going to happen to the price of gargle blasters.

What happens to prices with introduction of an additional 100m units?

Existing industry capacity = 240m.

Adding 100m units will result in **capacity of 340m.**

At Q = 340m,   P = 10 - 340m/80m = 10 - 4.25 = $5.75

Figure 11.2: industry can sell 340m gargle blasters only if the price declines to $5.75**.**

Marvin Enterprises Example

- If price falls to \$5.75, what happens to those with old 2023 technology? Should they keep producing or sell their equipment for salvage value of \$2.50 per unit of capacity?

At P = \$5.75 & old costs of \$5.50, given 20% cost of capital, the NPV of staying in business is equal to:

NPV = - Investment + PV(Price – Manufacturing Cost)

$$\text{NPV} = -2.50 + (5.75-5.50)/0.20 = -1.25$$

Smart companies with 2032 equipment will be better to sell off capacity. More profitable to sell the equipment for \$2.50 per unit than to operate it and lose \$1.25 per unit

- As capacity is sold off, supply of gargle blasters ↓ & price ↑. An equilibrium is reached when the price gets to \$6. At this point 2032 equipment has a zero NPV:

$$0 = -2.50 + (P-5.50)/0.20 \quad \Leftrightarrow \quad 2.5 = (P-5.50)/0.20 \quad \Rightarrow \mathbf{P = 6}$$

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Marvin Enterprises Example

- At P = 6, total quantity demanded = 80(10 - 6) = 320m units
- Marvin's expansion will cause price to settle down at $6 a unit and will induce first-generation producers to withdraw (340m-320m) = 20m units of capacity.
- After 5 years, Marvin's competitors also in a position to build third-generation plants. As long as these plants have positive NPVs, companies will increase their capacity and force prices down once again.
- New equilibrium reached at **P = $5**. At this point, the NPV of new third-generation plants is zero, and no incentive for companies to expand further.
- Solving for the new breakeven price:

$$NPV = -10 + (P - 3)/0.20 = 0 \;\Rightarrow\; 10 = (P-3)/0.20 \Leftrightarrow 2 = P-3 \quad \therefore \mathbf{P = 5}$$

$$\mathit{NPV} = -10 + (5 - 3)/0.20 = 0$$

New 3rd generation technology reduces capital costs to $10 per unit and manufacturing costs to $3 per unit.

Marvin Enterprises Example

- At P = 5 total quantity demanded = 80 (10-5) = 400m units
- So, after 5 years, Marvin's competitors will enter with new capacity increasing total output to 400m units and price will settle at $5.
- The effect of third-generation technology is, therefore, to cause industry sales to expand from 240 million units in 2044 to 400 million five years later.
- By end of five years, any company that has only 1st generation technology will no longer be able to cover its manufacturing costs and will be forced out of business.
  - At new price of $5, any competitor with 1st generation technology (and cost per unit of $5.5) will have exited the market.
- Introduction of 3rd generation technology causes gargle blaster prices to decline to $6 for the next five years and to $5 thereafter.

The Value of Marvin's New Expansion

Expected cash flows from Marvin's new plant:

	Year 0 (Investment)	Years 1–5 (Revenue – Manufacturing Cost)	Year 6, 7, 8, . . . (Revenue – Manufacturing Cost)
Cash flow per unit ($)	–10	6 – 3 = 3	5 – 3 = 2
Cash flow (100 million units, $ millions)	–1,000	600 – 300 = 300	500 – 300 = 200

Value of Gargle Blaster Investment

$$\text{NPV} = -\$1000 + \sum_{t=1}^{5} \frac{\$300}{(1.20)^t} + \frac{1}{(1.20)^5}\left(\frac{\$200}{0.20}\right) = \$299 \text{ million}$$

The Value of Marvin's New Expansion

- Negative externality with Marvin's new expansion decision → reduces PV of existing 2040 plant.
  - Decision not to go ahead with the new technology ⇒ $7 price holds until Marvin's competitors start to cut prices in 5 years' time. Marvin's expansion decision → immediate $1 cut in price.
- PV of 2040 equipment reduced by $72 million:

$$\Delta \text{PV}_{\text{Existing Plant}} = 24 \text{ million} \times \sum_{t=1}^{5} \frac{\$1.00}{(1.20)^t} = \$72 \text{ million}$$

Actual NPV of Marvin's venture is: $299 million − $72 million = **$227 million**

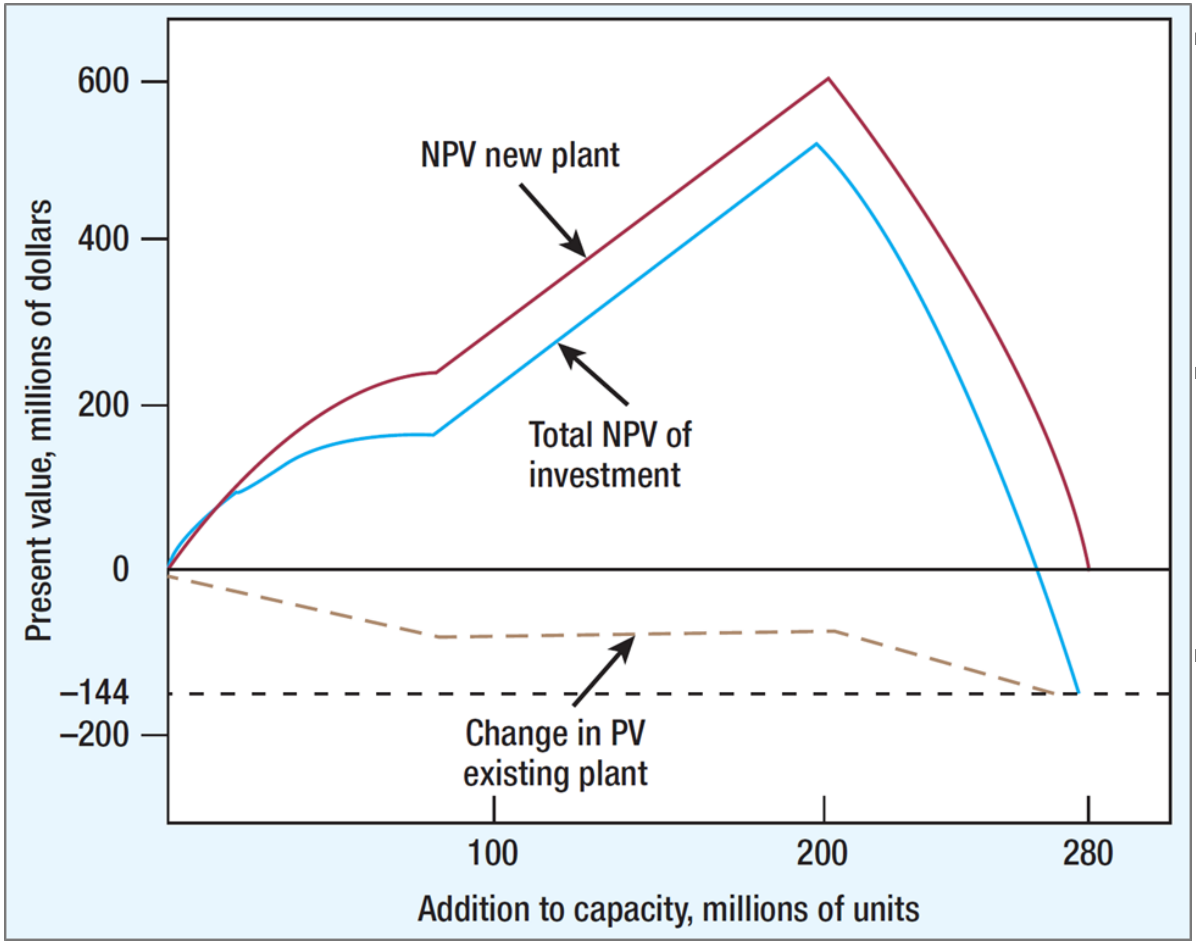
Alternative Expansion Plans

- Marvin's expansion has a positive NPV, but perhaps Marvin would do better to build a larger or smaller plant.
- Need to estimate how additional capacity affects prices. Then calculate the NPV of new plant plus change in the PV of existing plant.
- The total NPV of Marvin's expansion plan is:

  Total NPV = NPV of new plant + change in PV of existing plant

- Figure 11.3. on next slide shows how total NPV would be affected by a smaller or larger expansion.

Alternative Expansion Plans: Effect on NPV



- Marvin's 100-million-unit expansion has a total NPV of \$227m (total NPV = NPV new plant + change in PV existing plant = \$299m − \$72m = \$227m).
- If Marvin builds 280 million units of new capacity, total NPV is −\$144m (PV of cashflows from new plant = 0 and value of old plant reduced by \$144m).
- Total NPV is maximized if Marvin builds 200 million units of new capacity and set price just below \$6 to drive out the 2032 manufacturers. Output is, therefore, less and price is higher than either would be under free competition.

Lessons from Marvin Enterprises Example

- ***An investment's NPV depends on the time before competition erodes any advantage***.
  - Prolonged economic rents→ entry of rival producers. Be suspicious of any investment proposal predicting stream of economic rents into the indefinite future. Estimate when competition will drive the NPV down to zero and think what that implies for the price of your product.
- ***Investments in high tech industries are particularly exposed to innovation by competitors.***
  - Many companies identify major growth areas and then concentrate investment in these areas. Risk of existing plants becoming obsolete by changes in technology. Growth industries unforgiving to technological laggards.

Lessons from Marvin Enterprises Example

- ***New investments may impact the value of existing asset.***
  - Include project's impact on the rest of the firm when estimating incremental cash flows; Cannibalization and other negative externalities. Losses on existing plants may completely offset the gains from a new technology. Risks of deliberately slowing down introduction of new products - opens up opportunities for competitors.
- ***Opportunity costs include the salvage value of existing assets.***
  - The economic rents earned by any asset are equal to the total extra costs that would be incurred if that asset were withdrawn.
  - Higher salvage value $\Rightarrow$ competitors incur higher costs $\Rightarrow$ require higher price to stay in business $\Rightarrow$ Marvin earns higher economic rents. Higher salvage value gives firm option to abandon project if things go wrong. But competitors more likely to enter your market if they know that you can easily bail out. If you have no alternative but to stay and fight, competitors more cautious about entering and competing.