Classic Income Method—Discounted Future Economic Benefits (DFEB) Analysis

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AGENDA

1. **What does “value” mean?**
2. What is financial modeling?
3. Basic arithmetic for a DFEB analysis
4. Projecting benefits
5. Developing a discount rate

A valuation analysis seeks to determine an asset's value, which begs the question:

What does "value" mean?

Value of a good or service =
The net benefits that come from an asset or service.

In finance speak =
The future ***profits*** or ***cash flows*** that come from an asset or service.

Simplified profit explanation

$$Revenues - Expenses = Profit\ (or\ Loss)$$

Revenues: Revenue is the money a company earns for selling its goods or services. Revenues are frequently expressed in terms of "sales."

Expenses: Revenues do not come free. A company must spend money to make money, which is reflected in its expenses.

- ✓ Like any other good or service, revenues must be ***bought.***
- ✓ Expenses are the ***price*** for obtaining the revenues.

Profits: The extra amount after subtracting the expenses from the revenues.

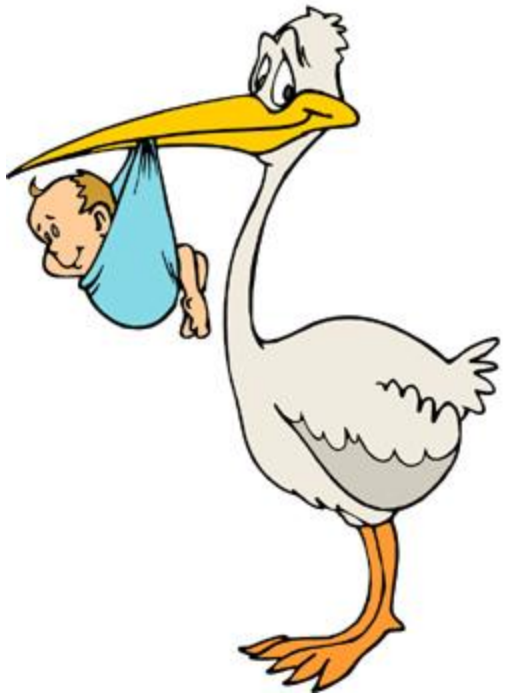
Simplified value explanation

Value = How much are you willing to pay today for profits you may receive in the future?

Where do Profits Come From?

Profits are generated by:

1. Growing revenues more than costs; or
2. Cutting costs more than revenues



Revenue Growth Example

Acme acquired a profit generating asset.

	Acme's Results Pre-Asset	Acme's Results After Obtaining Asset
Revenues	$10 million	$15 million
Expenses	$8 million	$10 million
Profits	$2 million	$3 million

The asset increased Acme's revenues by $5 million and its costs by $2 million, thereby generating $3 million in profits.

Cost Cutting Example

Acme undertook a cost-saving strategy.

	Acme's Results Pre-Strategy	Acme's Results Post-Strategy
Revenues	$10 million	$9 million
Expenses	$8 million	$5 million
Profits	$2 million	$4 million

The strategy decreased Acme's revenues by $1 million and its costs by $3 million, thereby generating $2 million in profits.

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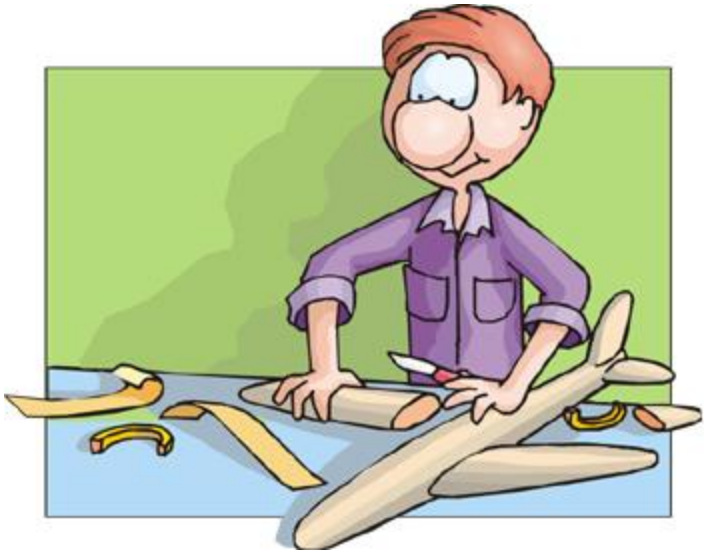
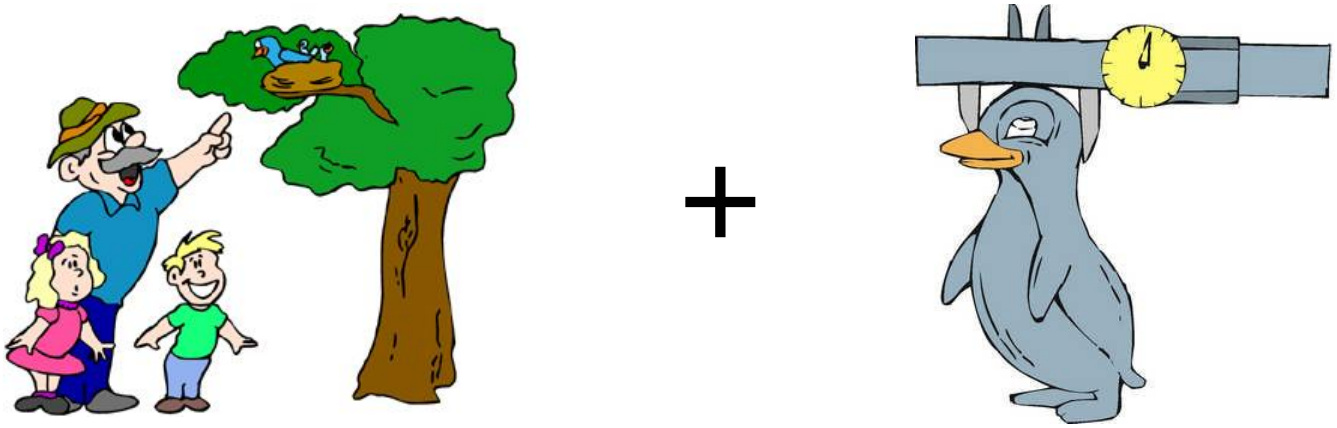
Building a financial model generally requires ***identifying*** and ***measuring*** the future profits associated with holding an asset and discounting them back to present value.



Identify and measure

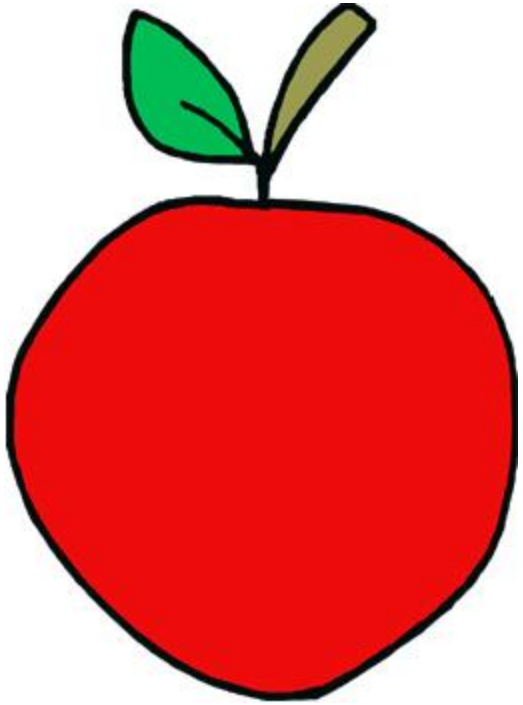
Valuation is fundamentally a 2-step "identification" + "measurement" exercise.



1. Identify the net benefits (e.g., profits); and
2. Measure the value for each benefit.

Let’s start with a simple example

Why do you buy an apple?



Let’s start with a simple example

Why do you buy an apple?

Probable Answer: You are hungry and you receive pleasure from eating apples.

Let’s start with a simple example

What benefits do you get from an apple?

Let's start with a simple example

What benefits do you get from an apple?

- ✓ It is healthy and provides sustenance for your body
- ✓ It tastes good, and provides you enjoyment when you eat it

Let’s start with a simple example

What then is a fair price to pay for that apple?

Let's start with a simple example

What then is a fair price to pay for that apple?

Possible Answer: Any price less than

- ✓ The value of the sustenance it provides to your body (SV, or sustenance value) +
- ✓ The value of the enjoyment you get from eating the apple (EV, or enjoyment value)

Let's start with a simple example

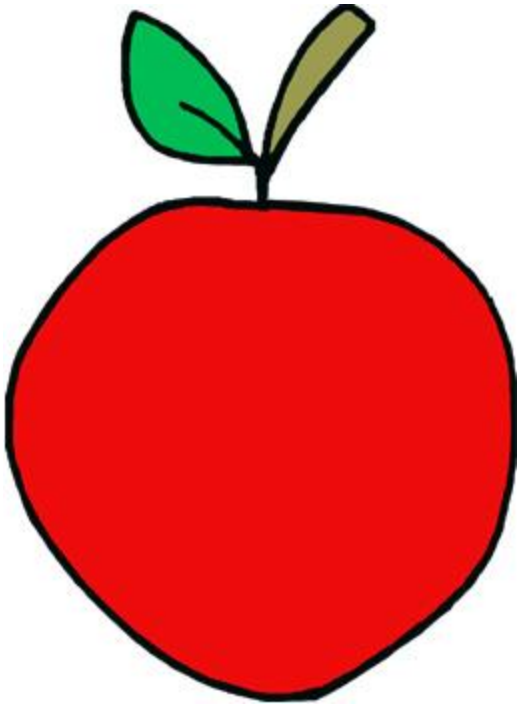
Assume

- SV for the apple = $1.00
- EV for the apple = $0.50

$1.00 + $0.50 = $1.50

You should be willing to pay any price up to $1.50 for the apple.

What did we just do to come up with the value for the apple?



= Up to $1.50

What did we just do to value the apple?

First: We ***identified*** the benefits of owning the apple

- ✓ Sustenance
- ✓ Enjoyment

Second: We ***measured*** the benefits

- ✓ Sustenance value = $1.00
- ✓ Enjoyment value = $0.50

We can do the same thing for ANY good, service, or decision.

Let’s give it a try . . .

What future benefits come from obtaining a patent?

What are economic benefits?

Intellectual property rights can generate both ***direct*** and ***indirect*** benefits for holders.

- **Direct economic benefits =** Direct cash flow stream that comes from the asset.
- **Indirect economic benefits =** Additional benefits that eventually boost the asset holder's bottom line, but take a more circuitous route.

Common Ways to Generate Direct or Indirect Benefits from Intellectual Property

	Common ways to generate cash flow	
	Directly	**Indirectly**
Patents	• Practice invention and premium price the product • License patent and associated know-how • Sue others for infringement	• Cross-licensing • Increase goodwill by signaling technological strength
Trademarks	• Premium price trademarked product • License trademark and associated goodwill • Sue other for infringement	• Prevent imitators from free-riding on goodwill • Use trademark associated with patented product to bolster sales after patent expiration
Copyrights	• Sell the copyrighted work • License the right to reproduce, prepare derivative works, distribute copies, perform, or display the copyrighted work • Generate revenue from compulsory licensing schemes • Sue others for infringement	• Encourage increased creativity by insuring reward • Prevent unauthorized copying and use that can erode revenue

Let’s look at a few examples of patents generating economic benefits . . .

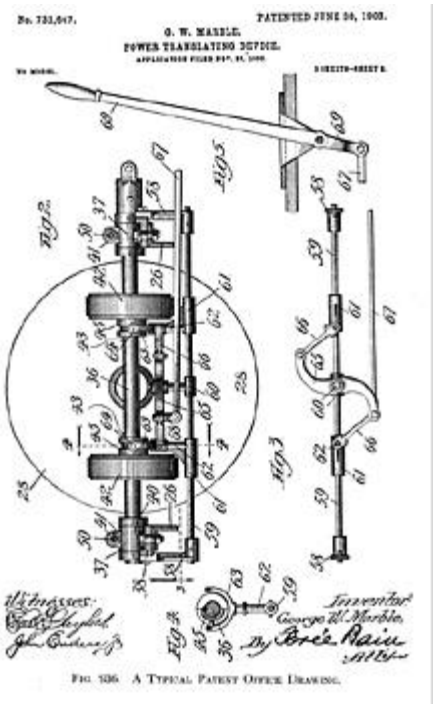


Fig. 536. A Typical Patent Office Drawing.

Remember!!!

When identifying benefits for a commercial asset, it is critical to ***tie*** the benefit back to the company's profits.

Example—Patents

Possible benefits:

1. Ability to exclude competitors.
    - Allows holder to premium price
    - Premium pricing allows holder to increase revenues more than costs
    - Increased costs from maintaining/managing patent and potentially increased manufacturing costs

	Acme's Results Without Patent	**Acme's Results With Patent**
Revenues	$10 million	$12 million
Expenses	$8 million	$8.5 million
Profits	$2 million	$3.5 million

Example—Patents

Possible benefits:

2. Ability to license patent to 3rd parties.
    - Allows holder to generate licensing revenue
    - Licensing costs are generally low, so much (if not most) of the licensing revenue can translate into profits

	Acme's Results Without Patent	**Acme's Results With Patent**
Regular Revenues	$10 million	$10 million
Licensing Revenues		$2 million
Regular Expenses	$8 million	$8 million
Licensing Expenses		$0.5 million
Profits	$2 million	$3.5 million

Example—Patents

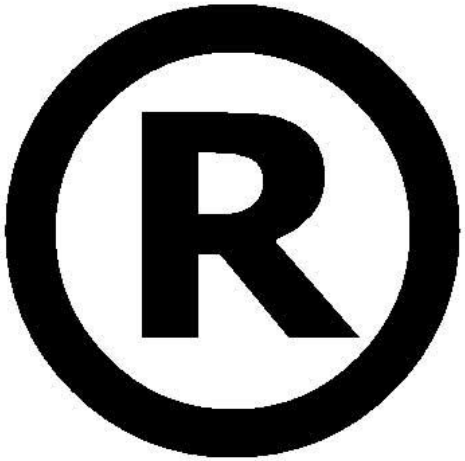
Possible benefits:

3. Certification benefit (signals the holder's strength to customers, employees, and suppliers)
    - Easier to obtain customers (holder obtains more customers and cost to obtain them is lower)
    - Easier to obtain employees (holder obtains more productive employees and cost to obtain them is lower)
    - Easier to obtain customers (holder receives better terms from suppliers)

	Acme's Results Without Patent	**Acme's Results With Patent**
Regular revenues	$10 million	$10 million
Additional revenues from additional customers		$0.5 million
Additional revenues due to better employees		$0.5 million
Regular expenses	$8 million	$8.25 million
Reduction in customer acquisition costs		($0.25 million)
Reduction in employee acquisition costs		($0.25 million)
Reduction in supplier costs		($0.5 million)
Profits	$2 million	$3.75 million

TM

. . . and trademarks?



Example—Trademarks

Possible benefits:

1. Signals quality to customers.
    - Allows holder to premium price
    - Premium pricing allows holder to increase revenues more than costs
    - Increased costs from managing/building trademark

	Acme's Results Without Trademark	**Acme's Results With Trademark**
Revenues	$10 million	$12 million
Expenses	$8 million	$8.5 million
Profits	$2 million	$3.5 million

Example—Trademarks

Possible benefits:

2. Increase sales by lowering search costs for customers.
    - Allows holder to attract more customers

	Acme's Results Without Trademark	Acme's Results With Trademark
Revenues	$10 million	$12 million
Expenses	$8 million	$8.5 million
Profits	$2 million	$3.5 million

Example—Trademarks

Possible benefits:

3. Ability to license trademark to 3rd parties.
    - Allows holder to generate licensing revenue
    - Licensing costs are generally low, so much (if not most) of the licensing revenue can translate into profits

	Acme's Results Without Trademark	**Acme's Results With Trademark**
Regular Revenues	$10 million	$10 million
Licensing Revenues		$2 million
Regular Expenses	$8 million	$8 million
Licensing Expenses		$0.5 million
Profits	$2 million	$3.5 million

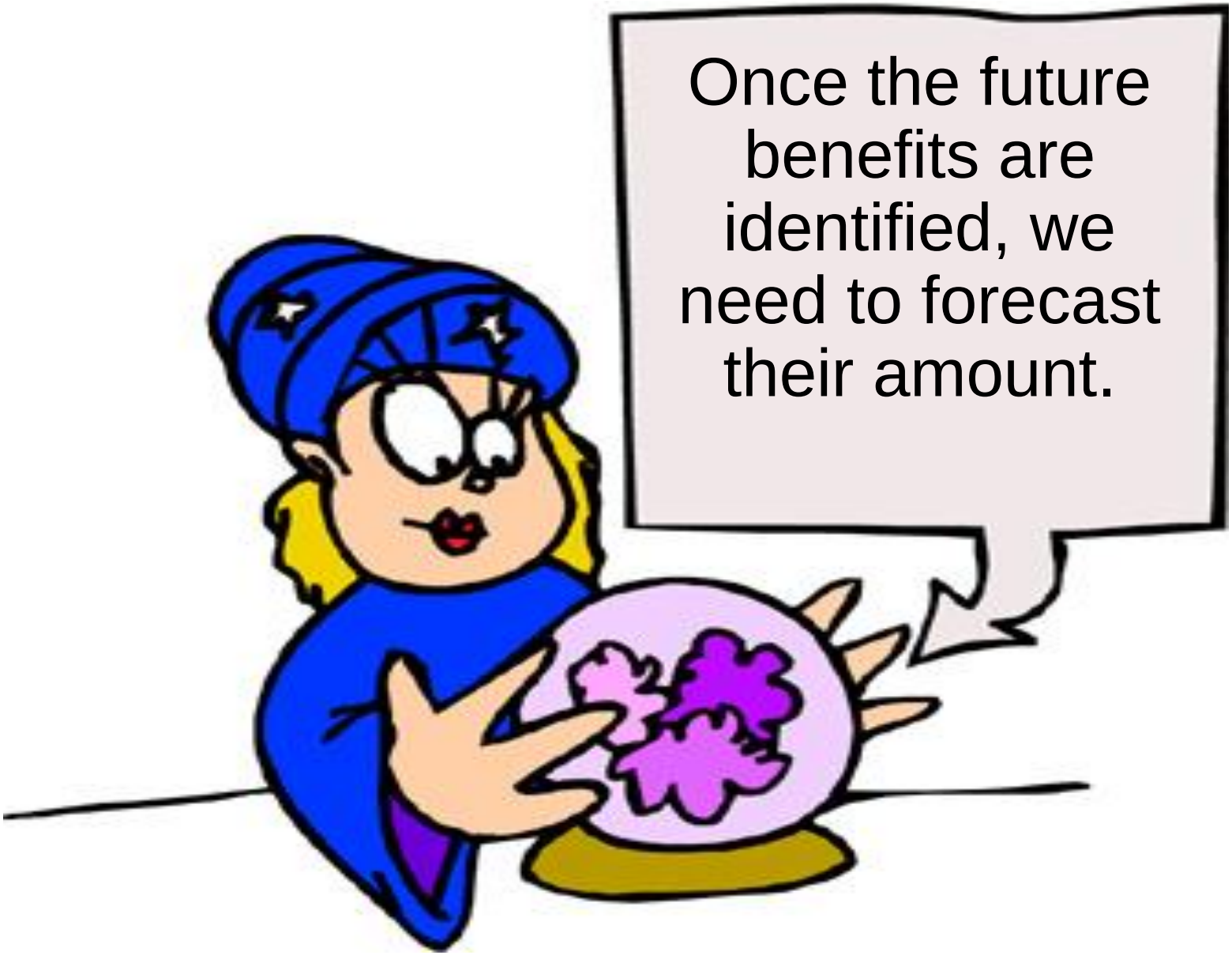
Typical university/research institute goals when developing patented technology?

Direct Benefit

1. Receive revenues

Less Direct Benefits

1. Effectively disseminate the technology so that it can best benefit the public
2. Encourage local, technology-based economic development
3. Improve the country's overall innovation system
4. Create incentives to attract the best researchers


Once the future benefits are identified, we need to forecast their amount.

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5. Developing a discount rate

Discounted future economic benefits

Classic Income-Based Method = Discounted Future Economic Benefits (DFEB) Analysis

Commonly referred to as a Discounted Cash Flow (DCF) analysis

Discounted future economic benefits

We refer to it as a DFEB analysis, rather than a DCF analysis, because free cash flow is not the only relevant measurement of future net economic benefits.

Free cash flow

Free cash flow =

Net income (after tax) +
Noncash charges (e.g., amortization and depreciation) –
Net capital expenditures –
Changes in net working capital +
Changes in long-term debt

Alternatives to free cash flow

Calculating free cash flow is not always practical, so a valuator may use an alternative income measurement for the DFEB analysis, such as:

- Net income (after tax)
- Pretax income
- Operating profit

Income statement (or profit & loss statement)

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	$2,000,000	$3,000,000	$3,800,000	$4,300,000	$4,800,000
Production costs	$800,000	$1,200,000	$1,520,000	$1,720,000	$1,920,000
Gross profit	$1,200,000	$1,800,000	$2,280,000	$2,580,000	$2,880,000
Operating costs:					
Selling expenses	$360,000	$540,000	$684,000	$774,000	$864,000
R&D expenses	$100,000	$150,000	$190,000	$215,000	$240,000
G&A expenses	$240,000	$360,000	$456,000	$516,000	$576,000
Operating profits	$500,000	$750,000	$950,000	$1,075,000	$1,200,000
Other income (expenses)					
Net interest income (expense)	$100,000	$200,000	($200,000)	($250,000)	$150,000
Depreciation and amortization	($200,000)	($225,000)	($250,000)	($200,000)	($220,000)
Extraordinary income (loss)	—	—	$300,000	($100,000)	—
Pre-tax income	$400,000	$725,000	$800,000	$525,000	$1,130,000
Income taxes	$80,000	$145,000	$160,000	$105,000	$226,000
Net income	$320,000	$580,000	$640,000	$420,000	$904,000

Need to adjust discount rate

When choosing the specific measurement for the DFEB, the valuator needs to be careful to apply a discount rate that is appropriate for that specific income measurement.

Basic arithmetic of DFEB calculation

$$PV = EB_0 + \frac{EB_1}{1 + r_1} + \frac{EB_2}{(1 + r_2)^2} + \frac{EB_3}{(1 + r_3)^3} + \ldots + \frac{EB_n}{(1 + r_n)^n}$$

Where:

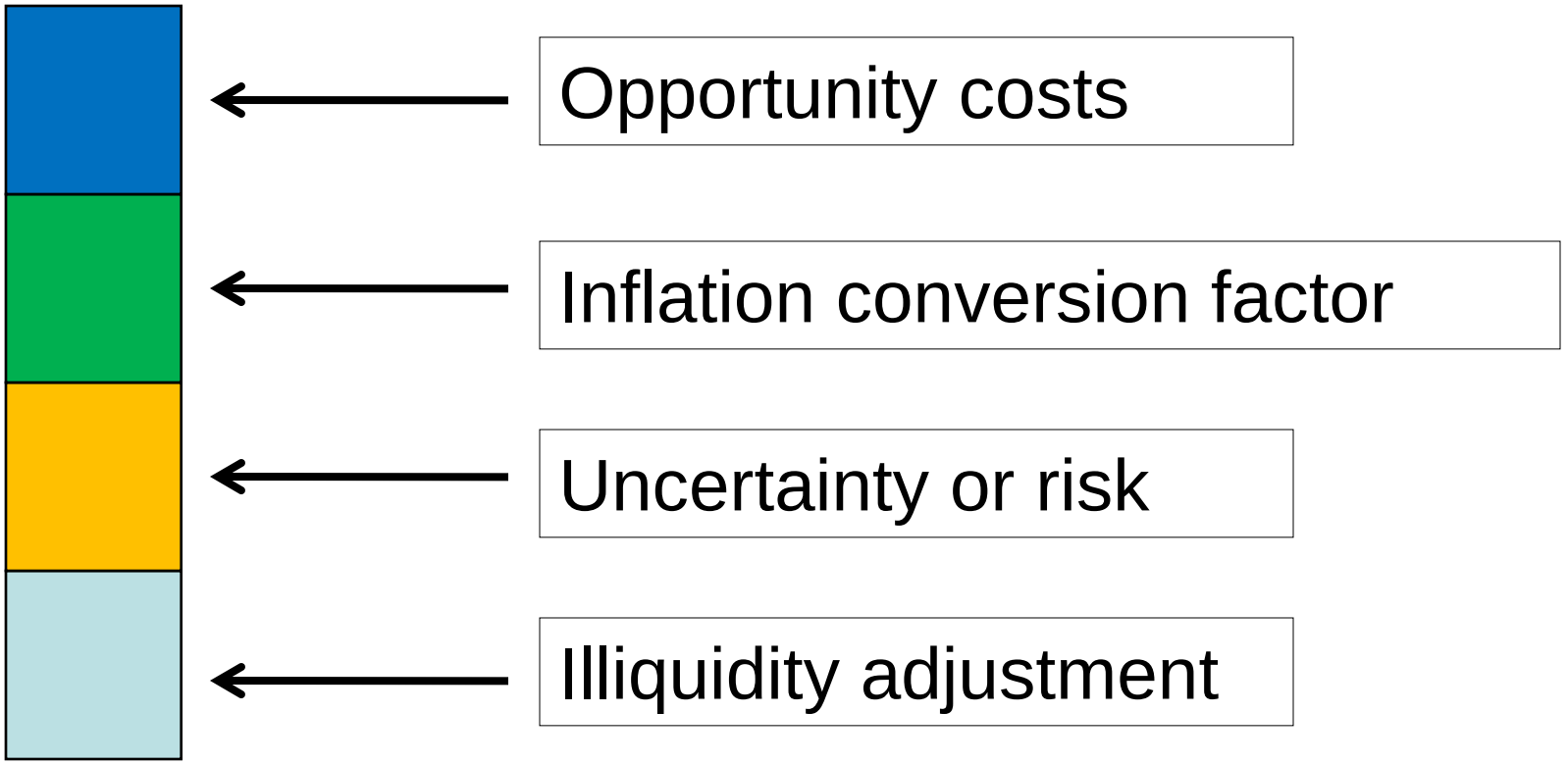
PV	=	Present value
EB	=	Economic benefit
$EB_{1,2,3\ etc.}$	=	Economic benefit in the first, second, third periods (and so on) of the stream of benefits
EB_n	=	Economic benefit in the last period of the stream of benefits
$r_{1,2,3\ etc.}$	=	Discount rate in the first, second, third periods (and so on)

Intro to discount rate

Because the benefits are received over time, the discount rate is needed to account for:

1. The time value of money; and
2. Risk component

Components of the discount rate



Basic arithmetic of DFEB calculation

The DFEB analysis seeks to calculate the ***present value*** of the ***future benefits*** that come from a particular good or service. The present values are simply added together.

Adding up the present value of the future benefits

	Future Year					
	1	**2**	**3**	**4**	**5**	**Total**
Projected free cash flow	$1.0 million	$1.5 million	$2.0 million	$1.5 million	$2.5 million	$8.5 million
Discount rate	25%	25%	25%	25%	25%	
Present value	$0.8 million	$1.0 million	$1.0 million	$0.6 million	$0.8 million	$4.2 million

Over the next five years, the firm projects that it will receive $8.5 million in free cash flow. However, due to the 25 percent discount rate, the cash flow stream's present value is roughly half that amount at $4.2 million. The math behind the calculation is:

Year 1 **Year 2** **Year 3** **Year 4** **Year 5** **PV**

$$\frac{\$1 \text{ million}}{1.25} + \frac{\$1.5 \text{ million}}{1.25^2} + \frac{\$2.0 \text{ million}}{1.25^3} + \frac{\$1.5 \text{ million}}{1.25^4} + \frac{\$2.5 \text{ million}}{1.25^5} = \$4.2 \text{ million}$$

DFEB arithmetic is not overly challenging

Conducting a DFEB requires only two inputs:

1. Projections (by period) of the anticipated economic benefits; and
2. The discount rate for each of the projected economic benefit receipts

Example: Opportunity to buy a patent portfolio

Example—Portfolio of patents that will be practiced

- Acme has been presented with an opportunity to acquire a portfolio of patents for $1.0 million that would allow Acme to manufacture and sell a new electronic component (the Device).
- Acme forecasts selling the Device for seven years, at which time the technology will become obsolete and Acme would stop producing the Device.

Example—Portfolio of patents that will be practiced

Acme has forecasted the extra operating profits for the seven-year period and elected to use a 25 percent discount rate.

	Future Year							
	1	2	3	4	5	6	7	**Total**
Projected operating profits	$0.5 million	$1.5 million	$2.5 million	$2.0 million	$1.0 million	$1.0 million	$0.5 million	**$9.0 million**
Present value at a discount rate of 25%	$0.4 million	$0.96 million	$1.28 million	$0.82 million	$0.33 million	$0.26 million	$0.1 million	**$4.15 million**

Example—Portfolio of patents that will be practiced

The underlying math for the calculation is:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total PV

$$\frac{\$500{,}000}{1.25} + \frac{\$1{,}500{,}000}{1.25^2} + \frac{\$2{,}500{,}000}{1.25^3} + \frac{\$2{,}000{,}000}{1.25^4} + \frac{\$1{,}000{,}000}{1.25^5} + \frac{\$1{,}000{,}000}{1.25^6} + \frac{\$500{,}000}{1.25^7} = \$4.15 \text{ million}$$

Example—Portfolio of patents that will be practiced

Based on the portfolio's selling price, this ***looks to be a valuable acquisition opportunity*** for Acme.

Even if the acquisition involves significant (a) transaction costs to buy the portfolio and (b) tax liabilities on the profits, the portfolio projects to generate well more than $1.0 million of present-value benefits for Acme.

DFEB arithmetic is not overly challenging, but . . .

Caution: While the clean math of a DFEB analysis can convey an aura of precision, the quality of the analysis is **entirely dependent** on the quality of the inputs.

Garbage in

Garbage Out

Developing useful inputs is VERY challenging

- Predicting the future economic benefits is an inherently difficult exercise; and
- Choosing discount rates is not much easier.

High error rate

Inherent imprecision of the inputs, however, means that a DFEB analysis is likely to have a **large error rate.**

DFEB analysis

Why the specific focus on the DFEB analysis?

DFEB analysis is theoretically sound

DFEB is the most theoretically sound approach to value patent rights.

Like other assets, patent rights are held to generate benefits. Income-based methods (such as the DFEB) are the only valuation techniques that ***directly measure*** these benefits.

Second reason for the DFEB focus

Much of the value of the DFEB method is the thoughtful discipline that it requires of a valuator.

Let’s do an exercise . . .

(Exercise 1)

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Projecting future benefits

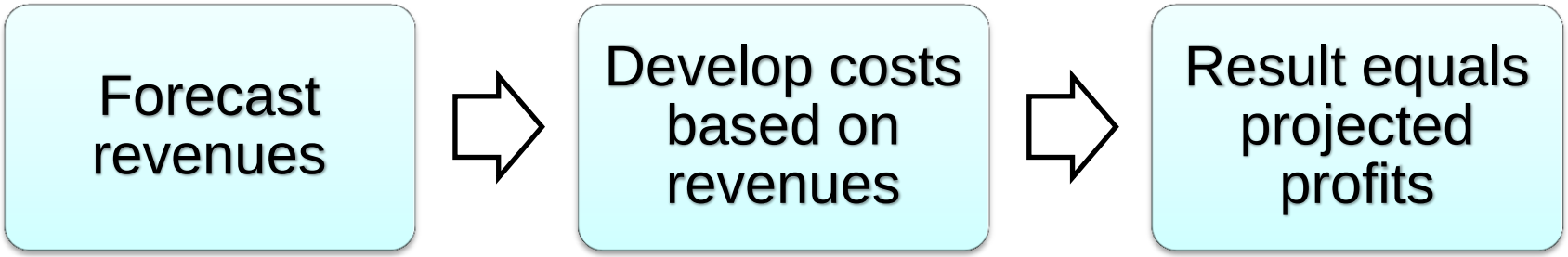
Revenue-centric models

The standard procedure for forecasting profits is to begin by forecasting the relevant revenues. Then, the costs for obtaining the revenues are deducted to arrive at the profit or cash flow estimates.

STEP 1: Project revenues
STEP 2: Subtract costs

The costs are frequently estimated as a percentage of the forecasted revenues, which causes “the revenue forecasts to drive the math for the entire projection exercise.”

Revenue-centric models



	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues:					
Units sold	0	1,000	5,000	10,000	50,000
Price per unit	$0	$300	$240	$180	$150
Total revenue	$0	$300,000	$1,200,000	$1,800,000	$7,500,000
Production costs:					
As % of revenues	0%	75%	65%	35%	35%
Estimated costs	$0	$225,000	$780,000	$630,000	$2,625,000
Gross profit	$0	$75,000	$420,000	$1,170,000	$4,875,000
Operating costs:					
Selling expenses (at 10% of total revenue)	$0	$30,000	$120,000	$180,000	$750,000
R&D expenses (at 6% of total revenue)	$0	$18,000	$72,000	$108,000	$450,000
General & administrative expenses (at 9% of total revenue)	$0	$27,000	$108,000	$162,000	$675,000
Initial overhead expenses (initial R&D, regulatory costs, salesperson training, manufacturing engineering)	$250,000	$0	$0	$0	$0
Operating profits	($250,000)	$0	$120,000	$720,000	$3,000,000

How do we develop the revenue projections?

Extrapolating from historical patterns

A common way to project future results is to extrapolate from historical patterns.

You **look behind** in order to **see forward**.

Extrapolating from historical patterns

1. **Model prior period analysis**

   - Identify a prior period that you believe represents a “normal” (i.e., not extraordinary) outcome.

   - Project that normal prior period forward at a growth rate you believe in.

Extrapolating from historical patterns

1. **Model prior period analysis**

EXAMPLE

Assume:

- Product generated $500,000 in sales last year, and $400,000 the year before that
- Last year's sales were inflated by a one-time $90,000 contract
- Valuator could take $410,000 as the starting
- Valuator believes the product's market is mature, and projects a growth rate of 3% per year for 3 years

Revenue Forecast Results:

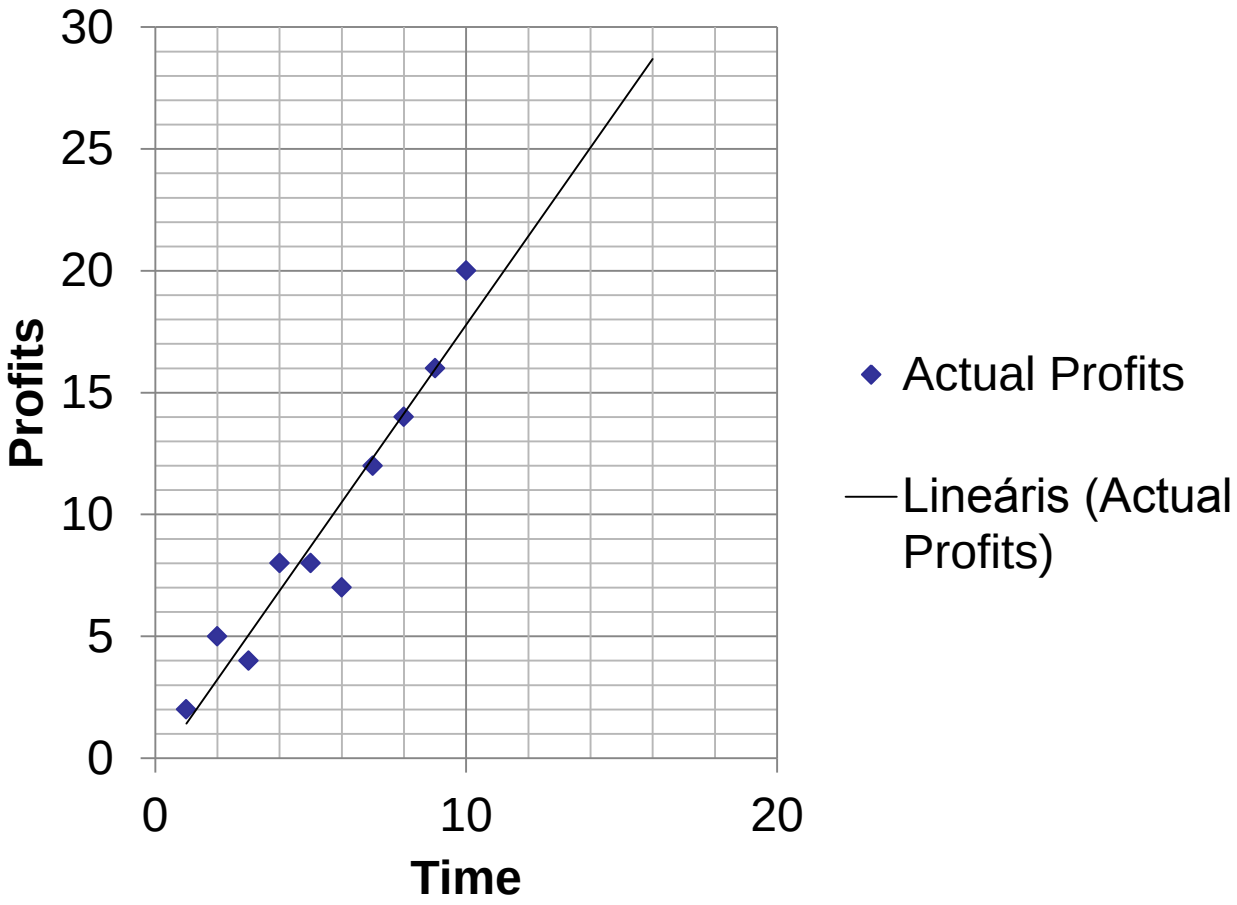
Y1 = $422,300 Y2 = $434,969 Y3 = $448,018

Extrapolating from historical patterns

2. Regression analysis

- Historical results are analyzed to determine a growth pattern.
- That growth pattern is then projected forward.

Regression Example



Year	Actual Profits
1	2
2	5
3	4
4	8
5	8
6	7
7	12
8	14
9	16
10	20
11	
12	
13	
14	
15	
16	

Using historical data is not problem-free

- No matter how often the refrain is repeated – past performance is no guarantee of future results – it is a difficult concept for most people to appreciate.
- Be careful about over-reliance on historical methods.

What happens when there is no historical track record?

When historical data is missing

Because intellectual property assets are often early-stage assets with little, or no, track record for generating profits, there may not be sufficient historical data for inferring future performance. A few techniques to consider when historical data is missing:

1. “Guesstimation” + growth escalation
2. Model growth curves
3. Building revenue forecasts from scratch

“Guesstimation” + growth escalation

One of the more common techniques to forecast revenues—and by far the simplest—is simple growth escalation.

> The valuator *guesstimates* the first year or two of sales and then applies an annual growth rate until sales reach maturity.

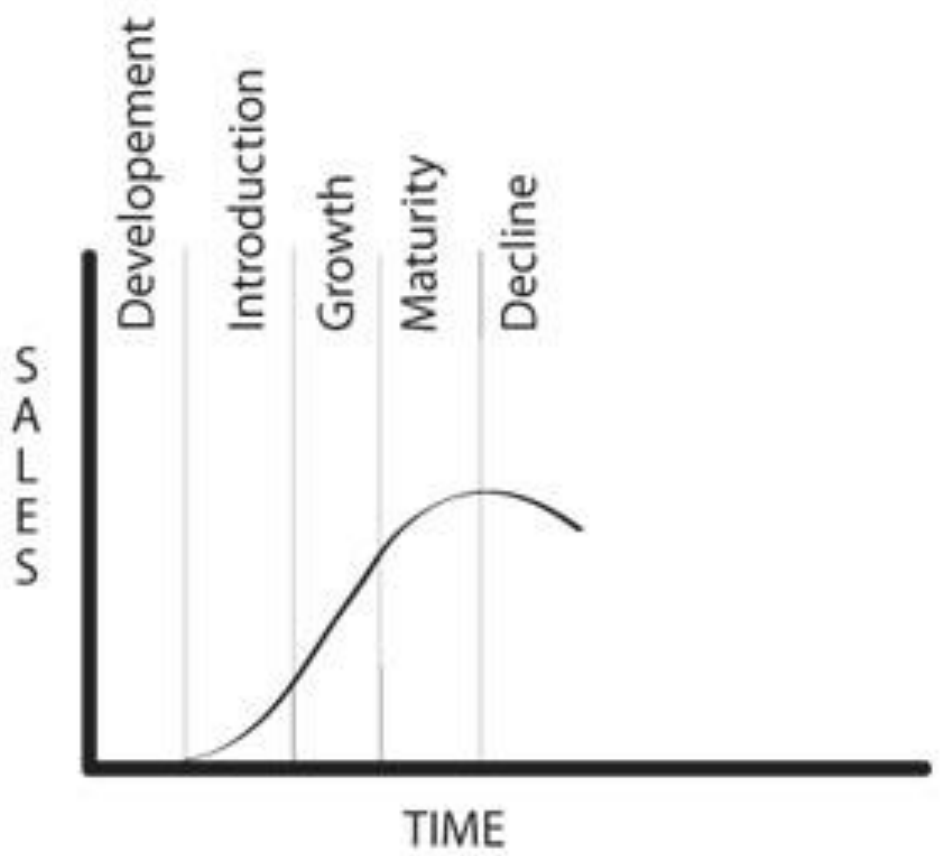
The valuator assumes sales will grow continuously throughout the product’s life cycle until it saturates the market. **The credibility of this assumption may be highly questionable**.

Model growth curves

Model growth curves provide a slightly more sophisticated approach to developing revenue forecasts. Frequently called ***sales curves* (S-curves)**, they are meant to approximate a new product's future performance based on the historical performance pattern of similar products or technologies.

Model growth curves

Typical Sigmoidal Growth Curve



Source: http://blog.metaprinter.com/2008/07/a-sigmoid-curve-in-action-the-newspaper-industry/

Building revenue forecasts from scratch

Two common ways to develop revenue forecasts:

1. Market size x market share
   - Project anticipated size of market
   - Project the percentage of that market the party will capture

2. Units sold x unit price
   - Project the number of units the party will sell
   - Project the unit price

Example: market size x market share

TechCo developed a specialized robotic device (the Device) for conducting stomach surgery. The Device allows surgeons to do stomach by placing a tube down the patient's throat, eliminating the need to cut the patient open.

Market Size: TechCo forecasts the market for stomach surgery devices will be as follows for the next five years:

Year 1	Year 2	Year 3	Year 4	Year 5
$50 million	$55 million	$60 million	$70 million	$75 million

Market Share: TechCo forecasts its market share of the stomach surgery device for the next five years will be:

Year 1	Year 2	Year 3	Year 4	Year 5
1%	2%	7%	10%	12%

Example: market size x market share

TechCo's revenue estimates for the next five years would be:

Year 1	Year 2	Year 3	Year 4	Year 5
$500,000	$1.1 million	$4.2 million	$7 million	$9 million

Example: units sold x unit price

TechCo developed a specialized robotic device (the Device) for conducting stomach surgery. The Device allows surgeons to do stomach by placing a tube down the patient's throat, eliminating the need to cut the patient open.

Units sold: TechCo forecasts the following unit sales of the Device for the next five years:

Year 1	Year 2	Year 3	Year 4	Year 5
0	1,000	5,000	10,000	50,000

Unit price: TechCo forecasts the unit price for the Device will be:

Year 1	Year 2	Year 3	Year 4	Year 5
$0	$300	$240	$180	$150

Example: units sold x unit price

TechCo's revenue estimates for the next five years would be:

Year 1	Year 2	Year 3	Year 4	Year 5
$0	$300,000	$1.2 million	$1.8 million	$7.5 million

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues:					
Units sold	0	1,000	5,000	10,000	50,000
Price per unit	$0	$300	$240	$180	$150
Total revenue	$0	$300,000	$1,200,000	$1,800,000	$7,500,000
Production costs:					
As % of revenues	0%	75%	65%	35%	35%
Estimated costs	$0	$225,000	$780,000	$630,000	$2,625,000
Gross profit	$0	$75,000	$420,000	$1,170,000	$4,875,000
Operating costs:					
Selling expenses (at 10% of total revenue)	$0	$30,000	$120,000	$180,000	$750,000
R&D expenses (at 6% of total revenue)	$0	$18,000	$72,000	$108,000	$450,000
General & administrative expenses (at 9% of total revenue)	$0	$27,000	$108,000	$162,000	$675,000
Initial overhead expenses (initial R&D, regulatory costs, salesperson training, manufacturing engineering)	$250,000	$0	$0	$0	$0
Operating profits	($250,000)	$0	$120,000	$720,000	$3,000,000

Using operating profits for DFEB analysis

I sometimes recommend using operating profits for the DFEB analysis.

When valuing a patent portfolio or a business line, I ***often*** recommend using operating profits.

Operating profits

- **Revenues =** money earned for selling a good or service
- **Production cost (aka cost of sales) =** cost to produce good or service
- **Operating costs (aka SG&A expenses) =** company's day-to-day operating expenses

Operating profits = are calculated by subtracting cost of sales and SG&A expenses from revenues.

Revenues	$12,000,000
Production costs	($5,000,000)
Gross profit	$7,000,000
Operating costs	($4,000,000)
Operating profits	$3,000,000

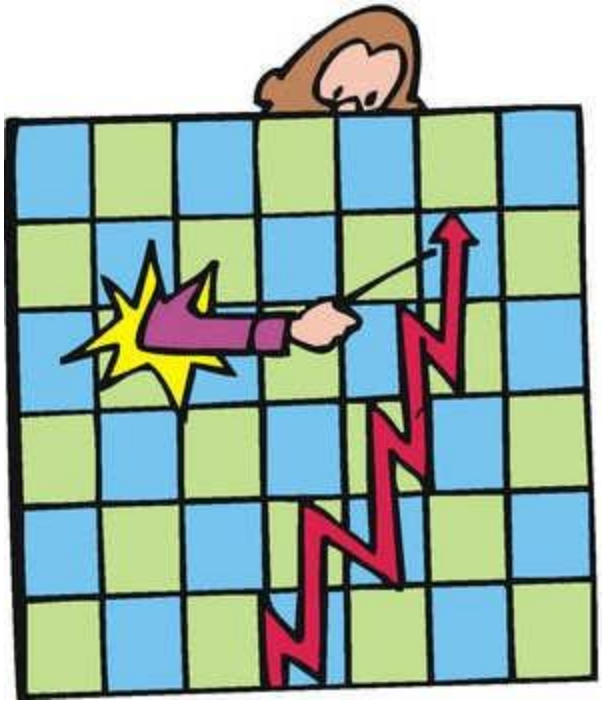
Operating profits

- Operating profits are the company's profits before interest expenses, depreciation, income taxes, and other exceptional items (see full income statement at end of this handout).
- Operating profits are frequently used when conducting a valuation analysis, because they capture the core economic task of producing and selling the good or service.
- The expenses that come after operating profits are often unique to the individual company, and tell us less about the value generated by the valued asset.

Income statement (or profit & loss statement)

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenues	$2,000,000	$3,000,000	$3,800,000	$4,300,000	$4,800,000
Production costs	$800,000	$1,200,000	$1,520,000	$1,720,000	$1,920,000
Gross profit	$1,200,000	$1,800,000	$2,280,000	$2,580,000	$2,880,000
Operating costs:					
Selling expenses	$360,000	$540,000	$684,000	$774,000	$864,000
R&D expenses	$100,000	$150,000	$190,000	$215,000	$240,000
G&A expenses	$240,000	$360,000	$456,000	$516,000	$576,000
Operating profits	$500,000	$750,000	$950,000	$1,075,000	$1,200,000
Other income (expenses)					
Net interest income (expense)	$100,000	$200,000	($200,000)	($250,000)	$150,000
Depreciation and amortization	($200,000)	($225,000)	($250,000)	($200,000)	($220,000)
Extraordinary income (loss)	—	—	$300,000	($100,000)	—
Pre-tax income	$400,000	$725,000	$800,000	$525,000	$1,130,000
Income taxes	$80,000	$145,000	$160,000	$105,000	$226,000
Net income	$320,000	$580,000	$640,000	$420,000	$904,000

Projection period and terminal value . . .



Projection period—remaining useful life

- A DFEB calculates the benefits of assets for their remaining ***useful life***. An asset's useful life is the period of time it generates profits for its holder.
- Few assets produce benefits in perpetuity. Therefore, the valuator must determine the period of time during which the valued assets are likely to produce benefits.

Intellectual property assets provide an illustrative example . . .

Projection period—remaining useful life

The useful life for an intellectual property asset can end in two ways.

1. Expiration of legal life
2. General obsolescence

Expiration of legal life—patents

The legal life of an intellectual property asset can expire. Patents, for example, have finite legal lives.

- Maximum legal life of patent = 20 years from earliest filing date
- Patent can also expire for failure to pay maintenance fees
- Patent can be invalidated

Expiration of legal life—trademarks

Trademarks do not have finite legal terms, so their useful life is not limited by a predetermined legislative term but instead by market, cultural, and societal considerations.

General obsolescence

An asset's useful life may also end before the expiration of its legal life.

General obsolescence—patents

In the case of a patent:

- A superior technology may replace the patented technology; or
- Product that employs the patented technology may stop selling.

Useful life

When running a DFEB analysis, the valuator must determine the probable useful life for the valued-assets and generate projections for that period of time.

If the valuator believes the asset's useful life is seven years, she must generate benefit projections for the next seven years.

Terminal value

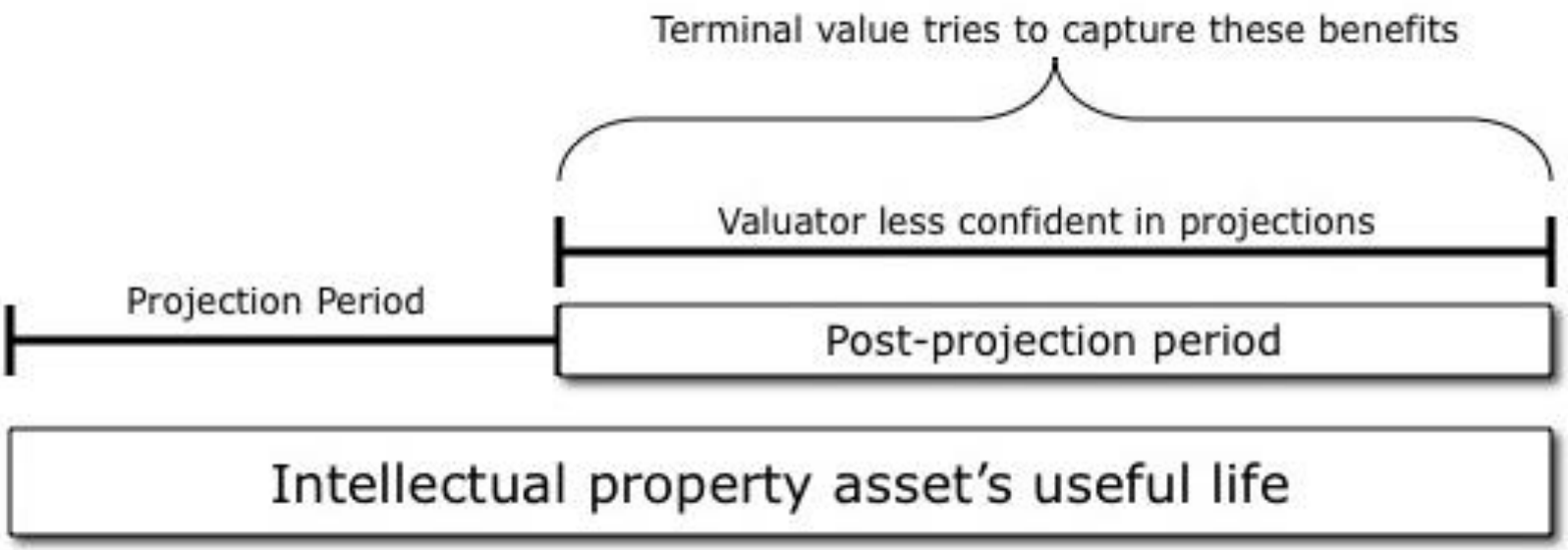
If the benefits stretch too far into the future, the valuator may not feel confident generating projections until the assets' useful life is exhausted.

Terminal value

For example, if the valuator believes an asset has a useful life of 25 years, it would be unrealistic to generate benefit projections that far into the future. **Most valuators limit themselves to a five- or ten-year projection period.**

Terminal value

Terminal value represents the benefits the asset should generate from the conclusion of the projection period until the end of its useful life.



Terminal value

The formula for the DFEB analysis with a terminal value is:

$$PV = EB_0 + \frac{EB_1}{1 + r_1} + \frac{EB_2}{(1 + r_2)^2} + \frac{EB_3}{(1 + r_3)^3} + \cdots + \frac{EB_n}{(1 + r_n)^n} + \frac{\text{terminal value}_n}{(1 + r_n)^n}$$

For now, we will assume around the terminal value issue. We will examine terminal value later when we look at how to value a startup company.

Let’s do an exercise . . .

(Exercise 2)

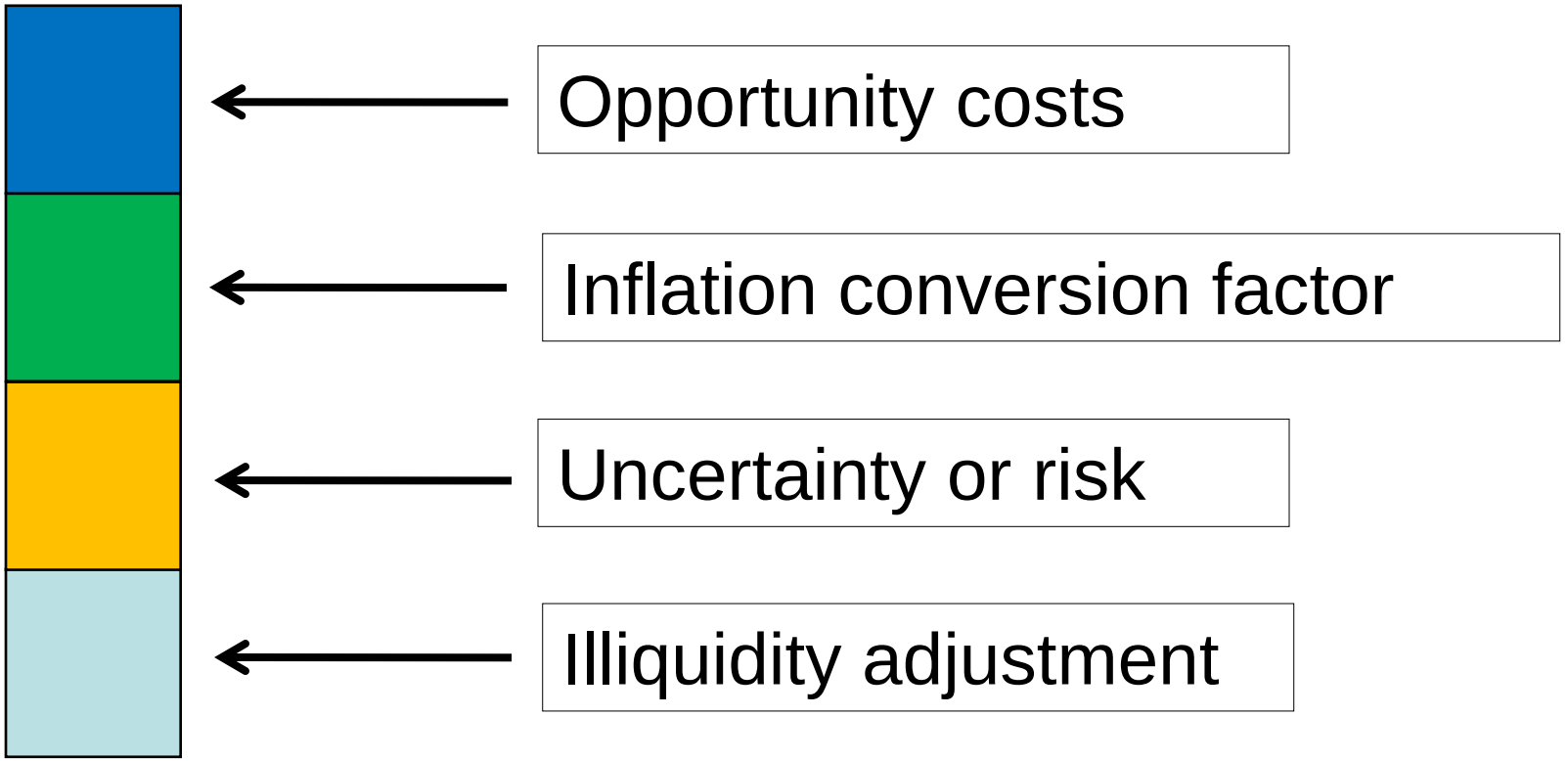
AGENDA

1. What does “value” mean?
2. What is financial modeling?
3. Basic arithmetic for a DFEB analysis
4. Projecting benefits
5. **Developing a discount rate**

Projecting discount rates

Once we have our profit projections, then we apply the discount rate.

Components of the discount rate



Opportunity costs

When receipt of a benefit is delayed, the recipient must forego the opportunity to invest the benefit in some productive manner.

For example, the following opportunities may be sacrificed:

- ✓ Interest income
- ✓ Ability to pursue other investments

Inflation

Inflation reduces the amount of benefits received in the future.

Uncertainty or risk

This component addresses the uncertainty (or risk) surrounding the future performance of the venture.

Projections of net economic benefits are simply that; they are just projections.

Uncertainty or risk (continued)

The risk component is generally the most subjective. Because DFEBs (or DCFs) are usually limited to a small handful of projected earnings streams (rather than every potential earnings stream), this component is crudely used to represent any variability associated with future performance.

- ✓ Less certain projects = higher percentage
- ✓ More certain projects = lower percentage

Illiquidity

The liquidity of an asset refers to the ease with which its owner can convert it into cash.

The ability to immediately exit an investment has value to investors and will factor into the price they are willing to pay for it.

Illiquidity (continued)

Assuming two investments that are similar in all respects except for the ability to resell the investment, the investment with more impediments to its resale will trade at a discount to the investment that can be freely sold, as investors will treat the investment that is not immediately marketable as bearing an additional “cost.”

This cost is meant to compensate the investor for the possibility that she may not be able to exit the investment when she believes it has reached its optimal value.

How big should discount rates be? Let us consider what venture capital firms do.

Discount rates for early-stage technologies

For early-stage technologies, the uncertainty/risk element of the discount rate can be so large that it becomes the overriding element in determining the discount rate.

Discount rates for early-stage technologies

For early-stage technologies, uncertainty surrounds almost all the critical aspects that go into the patent rights' ability to generate an earnings stream:

- Will the technology work?
- Will customers want to use the technology?
- Can the technology be commercialized?
- Can the firm develop a business plan to capitalize on the technology?
- Does the firm have access to sufficient funds to execute the business plan?
- How strong are the firm's patent rights?
- How will competing firms react to the new technology?

Venture capital rates of returns

Venture capitalists tend to deal with this enormous risk issue by grouping startup companies into four primary categories and favoring certain discount rates for each category:

1. Seed Stage
2. Early Stage
3. Intermediate Stage
4. Later (or Expansion) Stage

The four growth stages for a startup

1. **Seed Stage:** Company has an idea and is working on the technology, but has to develop a proven prototype
2. **Early Stage:** Company has a proven technology (e.g., a prototype), but is still at the pre-sales stage. Probably needs further development to prove the commercial viability of the technology.

The four growth stages for a startup

3. **Intermediate Stage:** Company has begun production and has some sales, but rapid expansion has not yet been attempted.
4. **Later Stage:** Company is relatively mature and has shown some success at scaling up its business.

Typical VC Discount Rates

Stage of Development	Discount Rate
Seed Stage	60 to 100+%
Early Stage	40 to 70%
Intermediate Stage	30 to 50%
Later Stage	20 to 35%

Source: Based on a table in Gordon V. Smith & Russell L. Parr, Intellectual Property: Valuation, Exploitation, and Infringement Damages 292 (Wiley, 2005)

Three common discount rate questions

1. Should the valuator use a constant or a variable discount rate?

2. Should the discount rate be applied at the end of each year or more frequently?

3. How do different earnings measurements (e.g., free cash flow v. operating profits) affect the discount rate analysis?

Constant v. variable discount rate

Argument for varying the discount rate: The risk may be greater—or less—later in the projection period.

Argument for a constant discount rate: It is already sufficiently challenging to develop one discount rate. The valuator can try to develop a discount rate that reflect the average risk throughout the projection period.

End-of-year v. midyear discounting convention

End-of-year discounting convention: Assumes the firm receives its net economic benefits once per year at the end of each year in the forecast. The discount is therefore applied at the end of year in the forecast period.

$$PV = EB_0 + \frac{EB_1}{1 + r_1} + \frac{EB_2}{(1 + r_2)^2} + \frac{EB_3}{(1 + r_3)^3} + \cdots + \frac{EB_n}{(1+ r)^n}$$

End-of-year v. midyear discounting convention

Midyear discounting convention: Assumes the firm receives its net economic benefits once per year at the middle of the each year in the forecast. It ***tries*** to approximate an even receipt of net economic benefits throughout the year.

$$PV = EB_0 + \frac{EB_1}{(1 + r_1)^{0.5}} + \frac{EB_2}{(1 + r_2)^{1.5}} + \frac{EB_3}{(1 + r_3)^{2.5}} + \cdots + \frac{EB_n}{(1 + r)^{n-0.5}}$$

End-of-year v. midyear discounting convention

There is no definitive rule for when to apply one convention versus the other.

Using the midyear discounting convention will increase the present value calculation, because it assumes the firm receives its net economic benefits earlier.

Matching the discount rate to the earnings measure

- Most analyses on how to develop discount rates focus on how to develop discount rates for free cash flows.

- Free cash flows are the ideal measurement, because they measure **received** benefits.

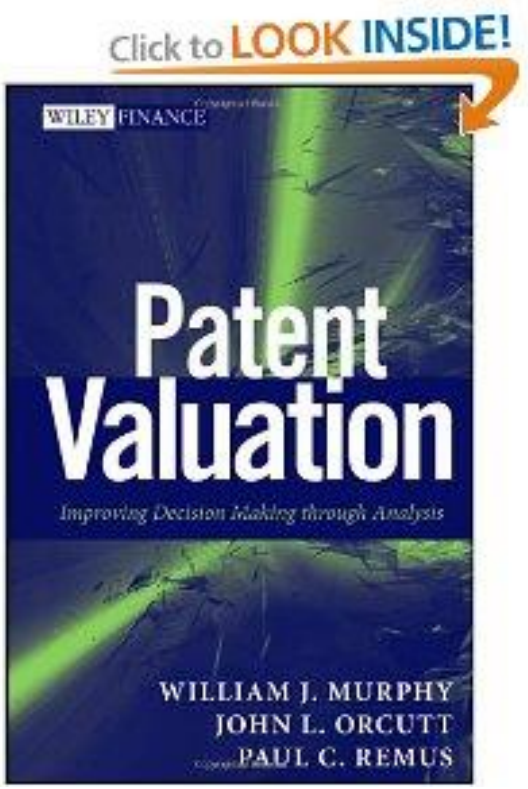
Matching the discount rate to the earnings measure

- Other earnings measurements—such as net income (after tax), pretax income, and operating profit—do **NOT** track benefits that are actually received.
- Instead, they measure benefits **earned**.
- They require a **higher** discount rate to account for benefits that will be earned, but not collected.

Let’s do an exercise . . .

(Exercise 3)

John Orcutt is the author of . . .



Available at: http://www.amazon.com/Patent-Valuation-Improving-Decision-Analysis/dp/1118027345

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