OBJECTIVE INSIGHTS

Business Analysis for the Health Care Industry

Deal Valuation Techniques

Charley Hooper

President, Objective Insights, Inc.

Bio 2003 Meeting

24 June 2003

Outline

- **Historical Comparables**
  - Estimate Deal Market Value
- **Calculating Deal Intrinsic Value**
  - Net Present Value
  - Expected Net Present Value
  - Risk-Averse Expected Net Present Value
  - Options
  - Monte Carlo Simulation

Main Elements That Influence Deal Value

Deal Intrinsic Value: Cash Flow and Risk

Market Conditions: Supply and Demand
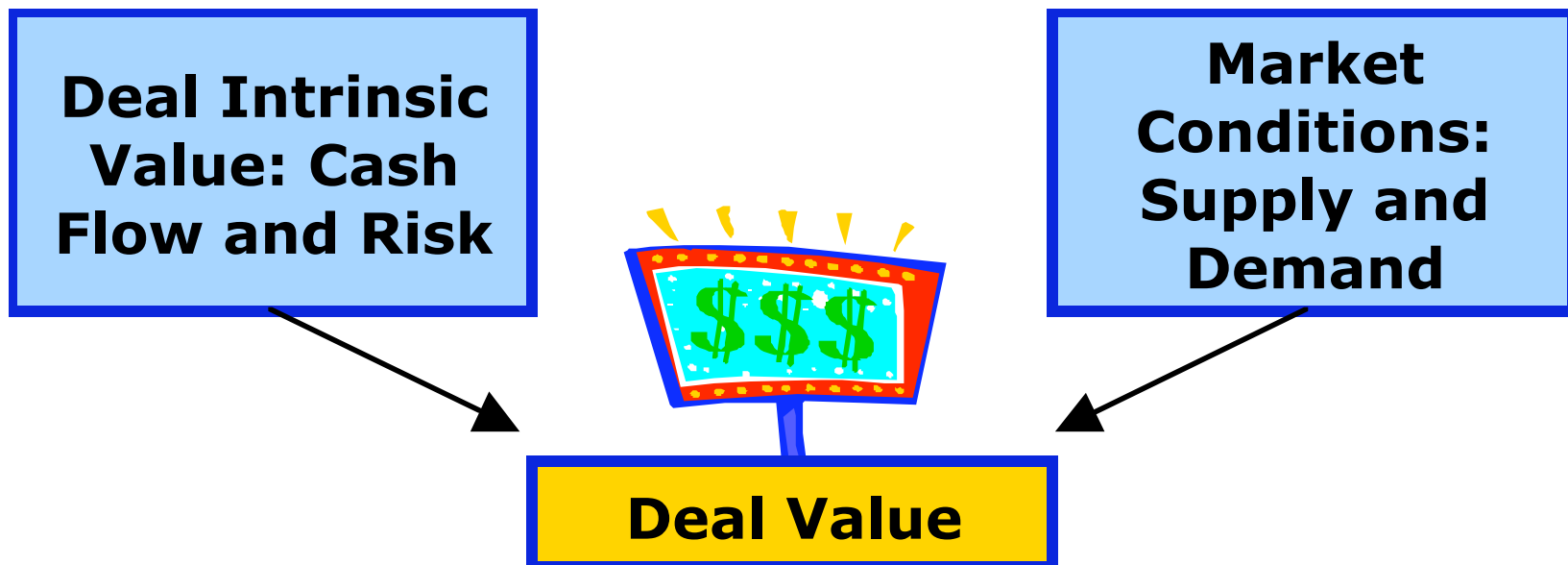
Deal Value

Historical Comparables

- Analyze past deal values and deal terms
- What companies are actually paying
  - Theory versus practice
- Where to get comparables:
  - Press releases
  - BioSpace
  - Recombinant Capital (Recap)
  - BioCentury
  - Windhover
- More exceptions than rules?
  - Different therapeutic areas (oncology vs. inflammation)
  - Market conditions are different

OBJECTIVE INSIGHTS
Business Analysis for the Health Care Industry

Comparables Depend Heavily on Market Conditions

- ■ Example:
  - – $300 million for one Phase III product a few years ago
  - – $50 million recently
- ■ Intrinsic value is still very important
  - – Provides basis for deal value
    - » An anchor against the market storm
  - – Can help with negotiations
  - – Cash flow is cash flow

OBJECTIVE INSIGHTS
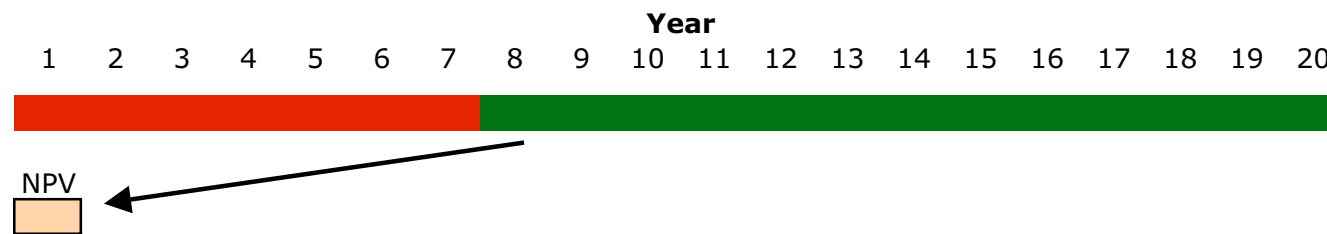*Business Analysis for the Health Care Industry*

Calculating Intrinsic Value

- Net present value (NPV)

- Expected net present value (ENPV or EV)

- Risk-averse expected net present value (REV)

- Options

- Monte Carlo Simulation

OBJECTIVE INSIGHTS
Business Analysis for the Health Care Industry

Net Present Value

- ■ Net cash flow discounted back to today

Year

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |

NPV

- ■ Discount rate to use
  - – Use risk-free discount rate if assuming product will launch
  - – Use risk-free discount rate and multiply NPV by PTS (probability of technical success)
    - » Okay for projects with low expenses relative to revenues and high PTS
 - – Use higher discount rate for crude approximation of risk

Net Present Value Limitations

- Risk-free discount rate assumes product will launch (all or nothing)
- Bigger discount rate is a crude approximation for EV
  - We know that each stage of development has its own probability of occurring
  - Real example: 40% discount rate has a mean absolute percentage error of 58%
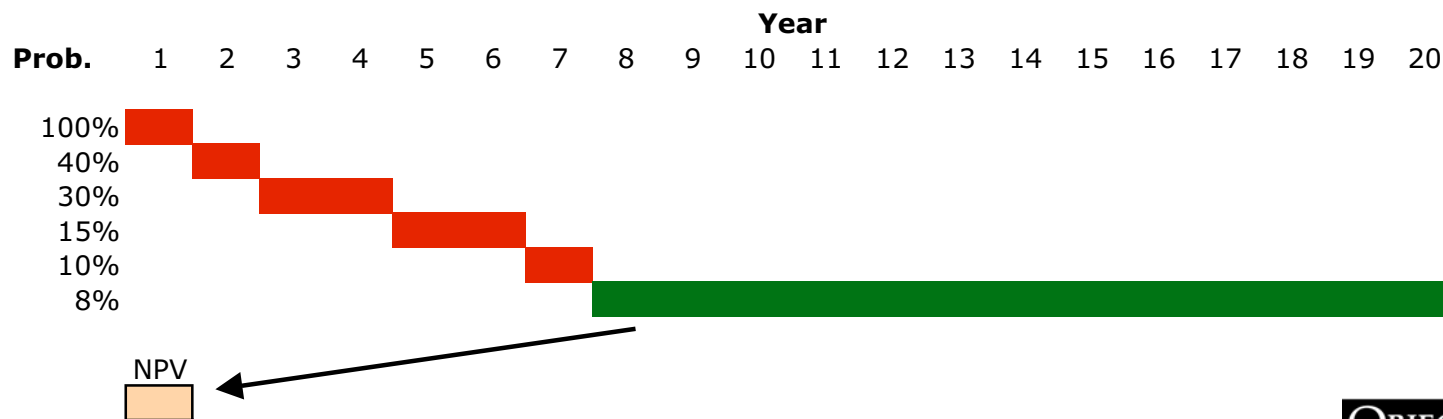
Expected Net Present Value

- ## Expected net present value (ENPV or EV)
  - Multiply discounted cash flow of each phase by its probability

- ## Gives a better result and is easy and straight-forward

Year

Prob. | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

NPV PA-NPV

100%
40%
30%
15%
10%
8%

EV
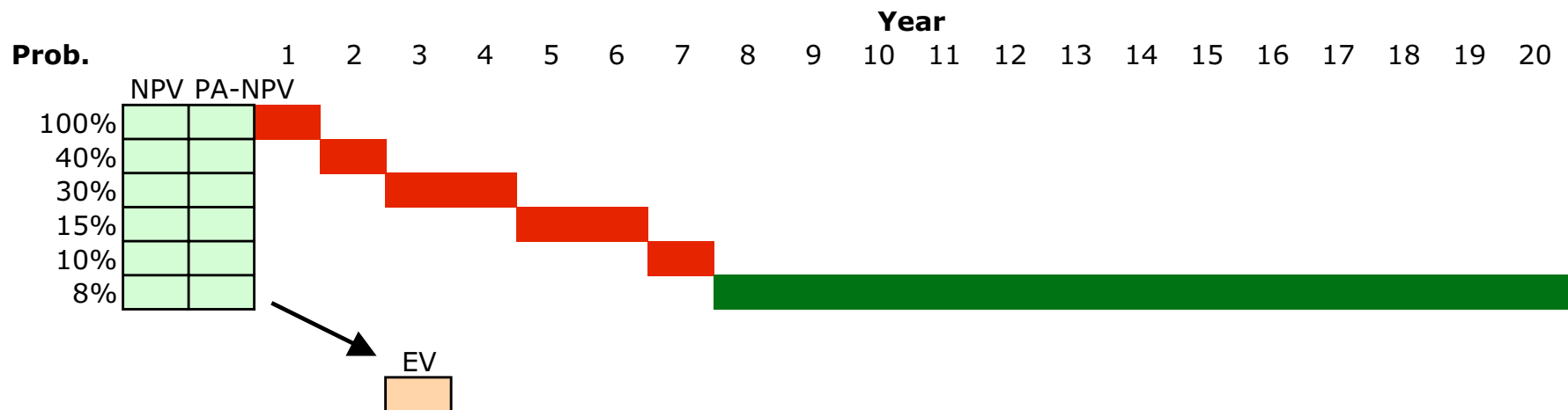
Risk-Averse Expected Value

- **Risk is discussed, but rarely explicitly managed**
  - Objective: Variability of result
  - Subjective: Results affect us asymmetrically
- **People and companies are risk-averse**
  - Some losses are too big for us to handle
  - We have a tolerance to risk
- **Insure your house and car?**
  - The expected value is negative (that's how insurance companies stay in business)
  - The risk-averse expected value is positive
- **Decisions may include potential losses that would be difficult or impossible to recoup**
  - Approach: Pre-adjust gains and losses to account for risk tolerance
  - Share risky situations based on risk tolerances

Options

- Options used since ancient Greece (Aristotle mentions)
- Options approach is great for thinking
  - Escape route (commit only the irrevocable part of a decision)
  - Right to some future opportunity at minimal cost
- Financial options were a huge advance in financial analysis
  - Essential component of modern economics and modern global economies
    » Control risk and lock in opportunities at minimal cost
  - 1997 Nobel Prize in Economics
    » Robert C. Merton (Harvard) and Myron S. Scholes (Stanford) working with Fischer Black
  - Financial options designed for short-term analysis of liquid, well-established securities
- Real options are problematic for assessing pharmaceuticals in development
  - Long-term (10-20 years)
  - Ill-liquid (project isn't bought and sold every day on financial market)
  - Not well-established (project currently in development)

Black-Scholes Option Formula

- Needed for formula to determine option price (premium):
  - Current stock price (value of underlying asset)
  - Exercise (strike) price
  - Time until expiration
  - Risk-free interest rate
  - Volatility of stock price (asset)
- Black box formula
  - Complicated, difficult to understand formula
  - Artificial inputs
- *"Decision trees can be too bushy."* - Options Advocate
- *"Decision analysis has always handled real options."*
  - Stanford Professor Ronald A. Howard

OBJECTIVE INSIGHTS
Business Analysis for the Health Care Industry

Monte Carlo Simulation

- Gambling resort in Monaco in Southeastern France
- Technique to quantify risk to aid decision making
- Monte Carlo simulation
  - Easy way to try thousands of reasonable scenarios
  - 1,000 to 2,000 sample scenarios (iterations)
    - » Selected based on probabilities
  - Statistics
    - Mean • Median
    - Mode • Range
    - Min   • Max
    - Standard deviation
  - Probability density functions
  - Cumulative distribution functions
  - Deciles
  - Sensitivity analysis

Product Launch Date Risk

Monte Carlo Simulation Results

Launch Date
Probability Density Function
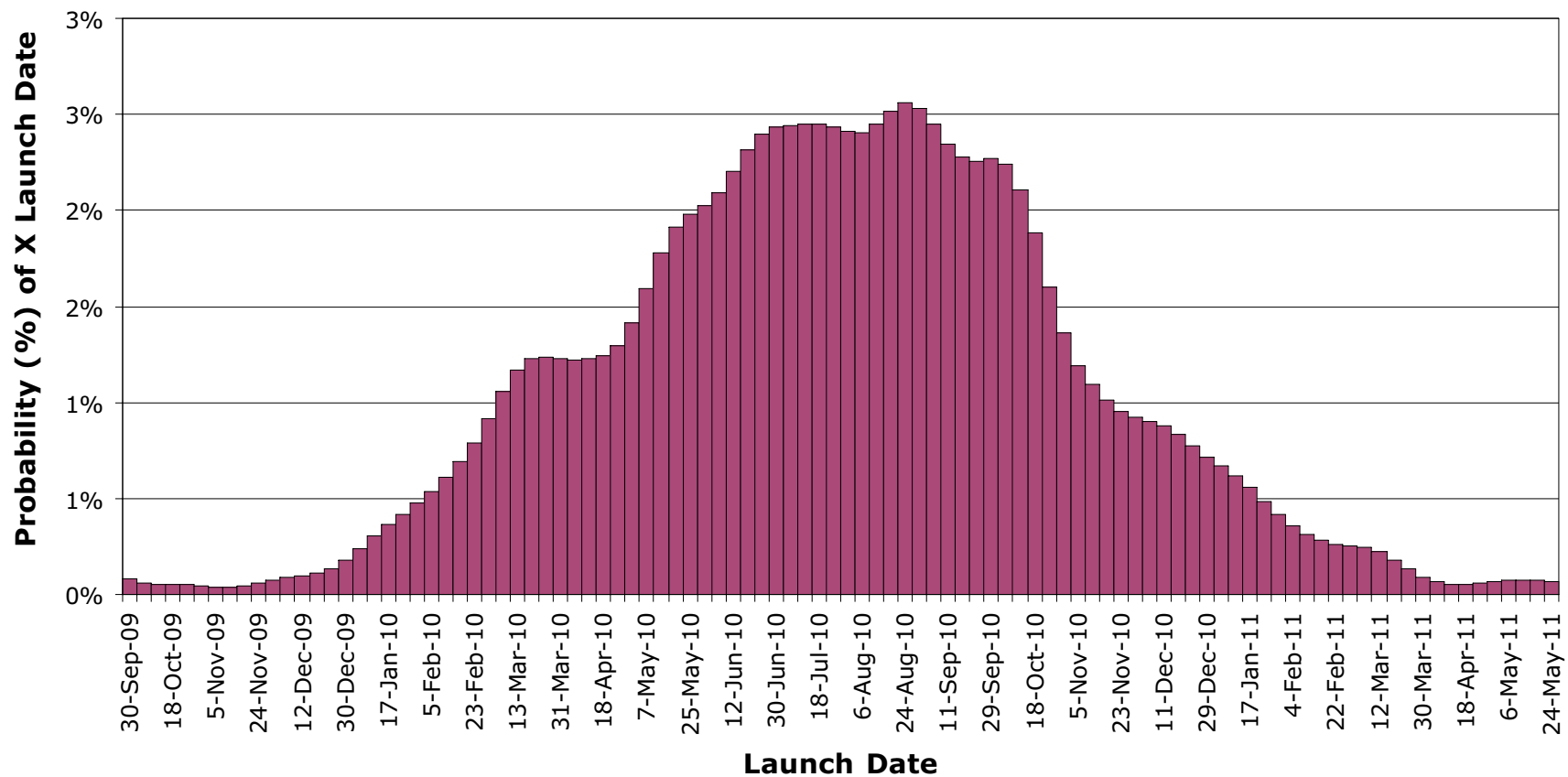
Revenue Risk

Monte Carlo Simulation Results

Product Revenues
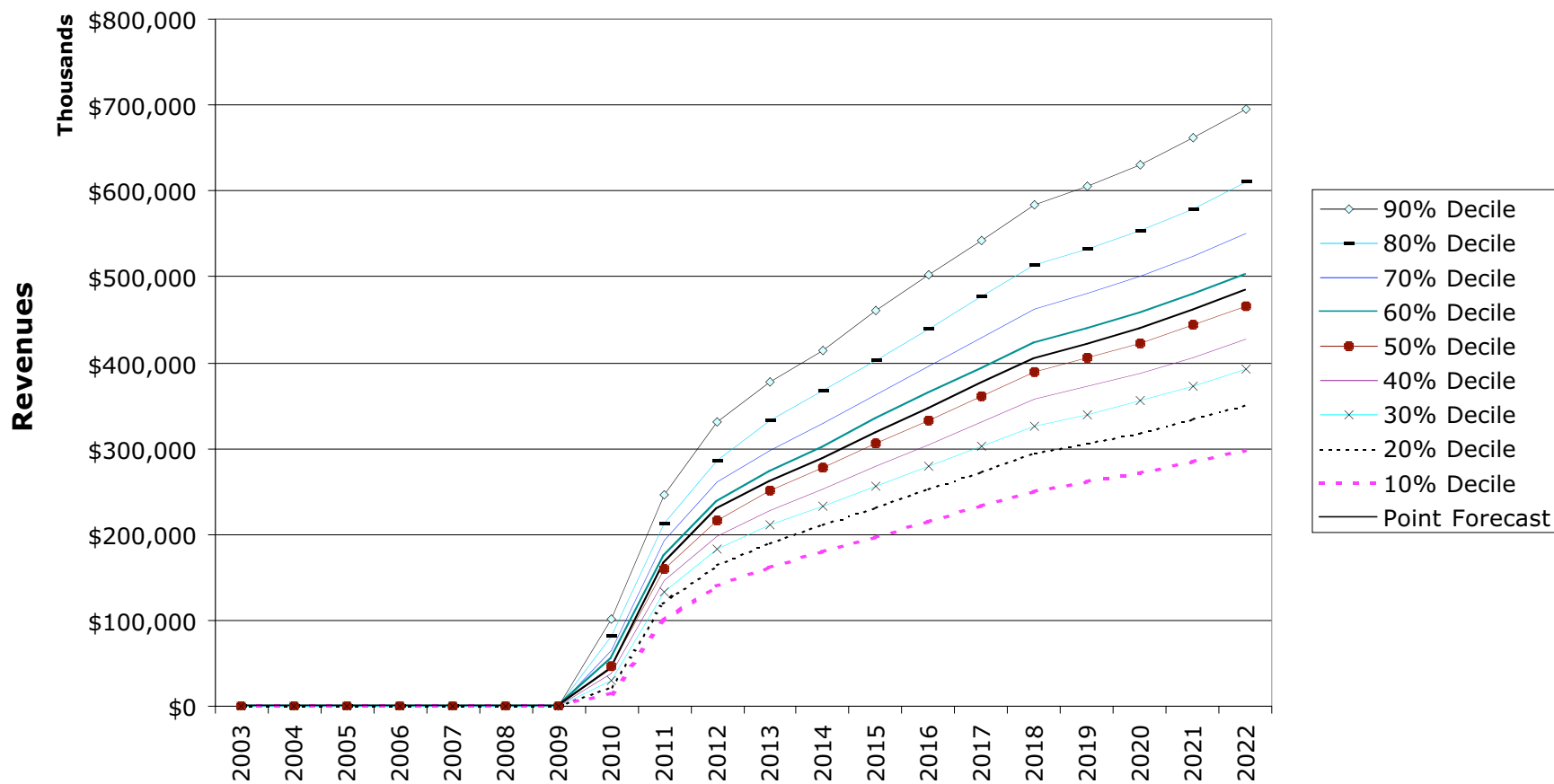
Sensitivity Analysis

- ■ Identify key drivers of analysis model
  - – Aids explaining and understanding the model and results
  - – Helps focus research on the most important questions
  - – Saves valuable time and money

- ■ Value of information
  - – Passive: How much is better information worth?
  - – Only buy information if it is worth the cost

- ■ Value of control
  - – Active: How much is it worth to control a variable (such as market share)?
  - – Take actions to increase profitability

Value of Information

Sensitivity Analysis

Variable	Percent of Total Variance of Yrs 1-10 Cash Flow
Peak Product Market Share	~14.6%
Starting Price per Tablet	~9.3%
Treated Monte Carlo Factor	~8.0%
Inc/Prev Monte Carlo Factor	~6.4%
Compliance Rate (%)	~6.4%
Eligible Monte Carlo Factor	~6.2%
General Pop Monte Carlo Factor	~6.1%
Amount of Levodopa per Dose	~5.3%
Phase IIB Clinical (Years)	~3.5%
Dose Per Day (Tablet per Day)	~2.9%
Phase III Clinical (Years)	~2.3%
NDA or BLA Approval (Years)	~1.8%
Pre-Clinical/Toxicology (Years)	~1.6%
Price Growth Rate	~1.6%
Sales Tier 2 Royalty	~1.4%
Product Revenue per Sales FTE ($M)	~1.4%
Pre-Clinical/Toxicology Other Variable ($)	~1.3%
Milestone Approval ($K)	~1.2%
NDA or BLA Approval Other Variable ($)	~1.2%
Phase III Clinical Variable Clinical ($)	~1.1%
Phase IIA Clinical Other Variable ($)	~1.1%
Milestone Phase IIA End ($K)	~1.0%

Percent of Total Variance of Yrs 1-10 Cash Flow
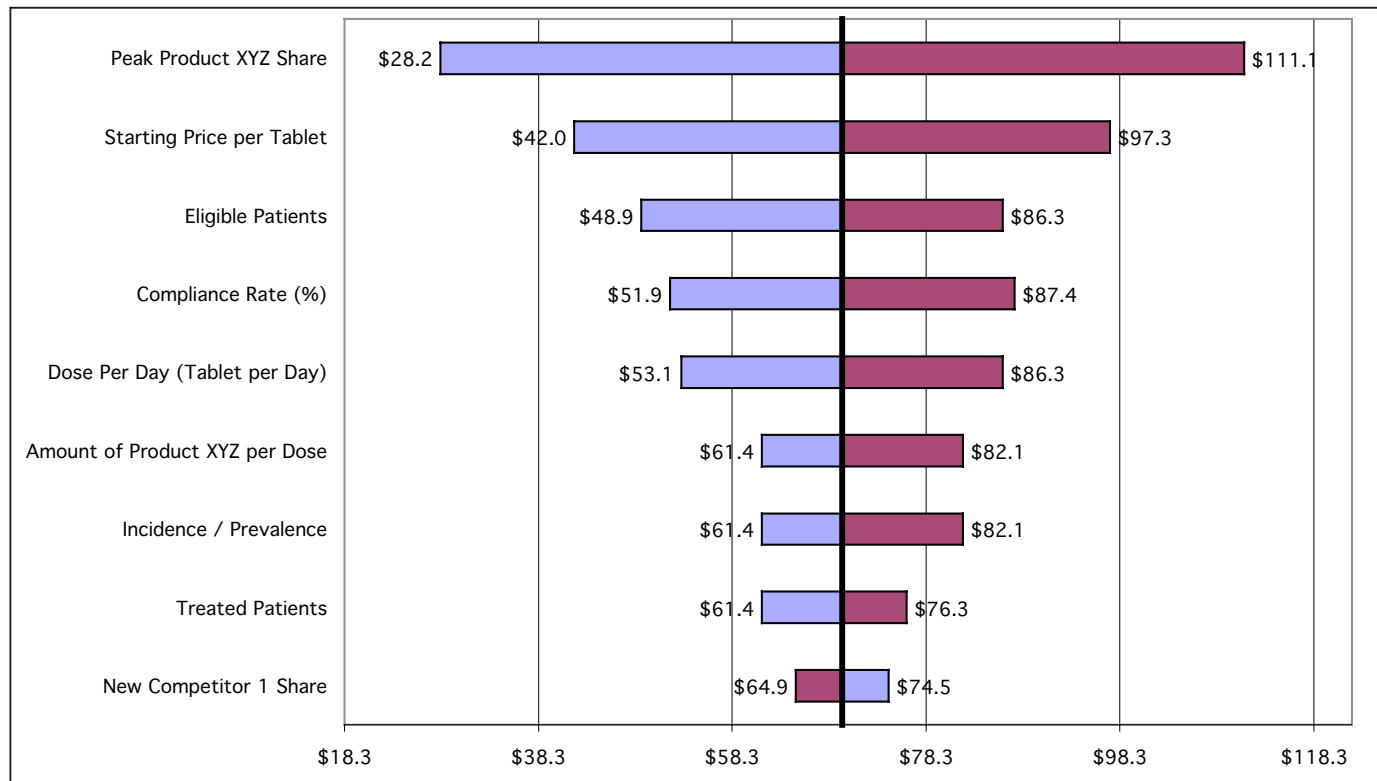
OBJECTIVE INSIGHTS
Business Analysis for the Health Care Industry

Value of Control

Peak Product XYZ Share is the variable that produces the greatest swing value on expected net present value.

Product XYZ Leverage Diagram
Base Value: $42.7 Million

Variable	Low	High
Peak Product XYZ Share	$28.2	$111.1
Starting Price per Tablet	$42.0	$97.3
Eligible Patients	$48.9	$86.3
Compliance Rate (%)	$51.9	$87.4
Dose Per Day (Tablet per Day)	$53.1	$86.3
Amount of Product XYZ per Dose	$61.4	$82.1
Incidence / Prevalence	$61.4	$82.1
Treated Patients	$61.4	$76.3
New Competitor 1 Share	$64.9	$74.5

Axis: $18.3 $38.3 $58.3 $78.3 $98.3 $118.3

Deal Valuation Techniques

Charley Hooper

President, Objective Insights, Inc.

Bio 2003 Meeting

24 June 2003