Financial Models for Laboratory Decision Making

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**Introduction**

Laboratory personnel are periodically confronted with complex decisions such as buy versus lease, add a new test to the menu or bring a reference test in-house. Such decisions are often made with simple models that do not adequately capture risk, incorporate alternative courses of action, or allow for sequential decisions that evolve over time. As a result, decision makers often obtain suboptimal results.

In this webinar, cutting edge techniques that incorporate risk, facilitate the comparison of multiple alternatives, and provide insight into common laboratory decisions will be presented. Attendees will receive training in building financial models using Microsoft Excel and Palisade Decision Tools, a popular add-in.

Participants will learn to use decision trees and simulation models and then apply their knowledge to analyze whether to perform a test in house or send it to a reference laboratory.
Learning Objectives

- Determine when advanced modeling techniques are likely to be helpful

- Explain how simulation models are used to incorporate risk analysis in decisions

- Build simple models using Excel add-ins to analyze problems using decision trees and simulation
Session Faculty
Robert Schmidt, MD, PhD, MBA

• Medical Director, ARUP Laboratories

• Areas of Expertise
  o Quantitative Analysis/Modeling
  o Clinical Epidemiology
  o Operations Management
  o Diagnostic Testing
    ➢ Cost Effectiveness Analysis
    ➢ Meta-Analysis
    ➢ Literature Evaluation
    ➢ Laboratory Utilization

• Past Life
  o Assistant Professor, Operations Management, University of Minnesota
  o Associate Professor, Operations Management, University of Southern California
Session Faculty
Suzanne Carasso, MBA, MT (ASCP)
Director, Business Solutions Consulting, ARUP Laboratories

• Consulting Director, ARUP Laboratories

• Areas of Expertise:
  o Healthcare strategies for transitioning from volume to value based care
  o Laboratory legal structure and business models
  o Value analysis and development of lab value proposition
  o Strategy/business planning
  o Market, operations and financial analyses

• Education
  o B.S. Medical Technology, University of Tennessee
  o MBA, University of Colorado at Denver
The purpose of this webinar is to educate participants to make better decisions in the clinical and anatomic pathology laboratory using financial models and risk-based analysis.

- Understand financial models
- Analyze risk
- Demonstrate tools for risk analysis
What is a financial model?

<table>
<thead>
<tr>
<th>Expenses</th>
<th>Pre-launch</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenue</td>
<td>$750,000</td>
<td>$2,700,000</td>
<td>$5,100,000</td>
<td>$7,500,000</td>
<td>$9,900,000</td>
<td>$25,950,000</td>
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<tr>
<td>Outreach Program Manager (Pre=1)</td>
<td>$124,800</td>
<td>$128,544</td>
<td>$132,400</td>
<td>$136,372</td>
<td>$140,463</td>
<td>$144,677</td>
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<tr>
<td>Marketing/Sales Rep (Yr&gt;201, Yr&gt;2=2)</td>
<td>$86,260</td>
<td>$135,117</td>
<td>$119,170</td>
<td>$143,342</td>
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<tr>
<td>Commissions</td>
<td>$28,300</td>
<td>$72,000</td>
<td>$72,000</td>
<td>$72,000</td>
<td>$72,000</td>
<td>$72,000</td>
</tr>
<tr>
<td>IT Development/Customer Support (Pre=0.5, Yr&gt;2=2)</td>
<td>$11,000</td>
<td>$83,336</td>
<td>$127,836</td>
<td>$111,463</td>
<td>$135,409</td>
<td>$139,471</td>
</tr>
<tr>
<td>PSC Phlebotomists (Yr=142,4, Yr=24=8, Yr=37=2)</td>
<td>$119,808</td>
<td>$248,210</td>
<td>$386,720</td>
<td>$377,722</td>
<td>$389,024</td>
<td>$389,024</td>
</tr>
<tr>
<td>Benefits @ 23%</td>
<td>$39,000</td>
<td>$77,812</td>
<td>$127,077</td>
<td>$210,419</td>
<td>$216,191</td>
<td>$222,137</td>
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<td>Total Salary Expense</td>
<td>$195,000</td>
<td>$389,610</td>
<td>$785,383</td>
<td>$1,052,093</td>
<td>$1,080,956</td>
<td>$1,110,685</td>
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<tr>
<td>Cost/Test (supplies/disposables/reagents)</td>
<td>$194,890</td>
<td>$701,603</td>
<td>$1,325,251</td>
<td>$1,948,898</td>
<td>$2,372,547</td>
<td>$2,372,547</td>
</tr>
<tr>
<td>Reference Testing</td>
<td>$50,100</td>
<td>$180,581</td>
<td>$340,681</td>
<td>$501,002</td>
<td>$588,323</td>
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<tr>
<td>Billing</td>
<td>$60,000</td>
<td>$202,500</td>
<td>$357,000</td>
<td>$325,000</td>
<td>$383,000</td>
<td>$383,000</td>
</tr>
<tr>
<td>Sales Entertainment/Expenses</td>
<td>$12,000</td>
<td>$24,000</td>
<td>$24,000</td>
<td>$24,000</td>
<td>$24,000</td>
<td>$24,000</td>
</tr>
<tr>
<td>Sales - cell phones</td>
<td>$1,200</td>
<td>$2,400</td>
<td>$2,400</td>
<td>$2,400</td>
<td>$2,400</td>
<td>$2,400</td>
</tr>
<tr>
<td>Mileage</td>
<td>$8,250</td>
<td>$16,500</td>
<td>$16,500</td>
<td>$16,500</td>
<td>$16,500</td>
<td>$16,500</td>
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<tr>
<td>Courier</td>
<td>$45,000</td>
<td>$162,000</td>
<td>$306,000</td>
<td>$450,000</td>
<td>$594,000</td>
<td>$594,000</td>
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<tr>
<td>IT Solution</td>
<td>$100,000</td>
<td>$42,000</td>
<td>$42,000</td>
<td>$42,000</td>
<td>$42,000</td>
<td>$42,000</td>
</tr>
<tr>
<td>Client EMR Interface Estimates</td>
<td>$60,000</td>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
<td>$75,000</td>
</tr>
<tr>
<td>Client IT Hardware</td>
<td>$4,800</td>
<td>$6,000</td>
<td>$6,000</td>
<td>$6,000</td>
<td>$6,000</td>
<td>$6,000</td>
</tr>
<tr>
<td>Marketing Expenses</td>
<td>$5,000</td>
<td>$5,000</td>
<td>$5,000</td>
<td>$5,000</td>
<td>$5,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Office Supplies</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
<td>$10,000</td>
</tr>
<tr>
<td>Patient Service Center Leases</td>
<td>$140,000</td>
<td>$280,000</td>
<td>$420,000</td>
<td>$420,000</td>
<td>$420,000</td>
<td>$420,000</td>
</tr>
<tr>
<td>Total Operating Expenses</td>
<td>$100,000</td>
<td>$612,990</td>
<td>$1,687,114</td>
<td>$2,929,832</td>
<td>$4,025,800</td>
<td>$5,121,768</td>
</tr>
<tr>
<td>Total Expenses</td>
<td>$295,000</td>
<td>$1,002,600</td>
<td>$2,472,497</td>
<td>$3,981,925</td>
<td>$5,106,756</td>
<td>$6,232,452</td>
</tr>
<tr>
<td>Contribution</td>
<td>($295,000)</td>
<td>($252,600)</td>
<td>$227,503</td>
<td>$1,118,075</td>
<td>$2,393,244</td>
<td>$3,667,548</td>
</tr>
</tbody>
</table>
Financial Model

Inputs → Calculations → Outputs
Financial Model

Inputs:

------------
Costs
Revenues

Calculations

Outputs:

------------
Profits
NPV
Financial Models

- Always wrong
- Sometimes useful
Examples of “Wrong” Models

• Ideal gas laws
• Newtonian fluids
• Laws of motion (ignore friction, point masses)
• Perfect competition
How are models useful?

• Eliminate bad ideas

• Provide insight
  o Relationships between variables
  o Uncertainty

• Provide predictions
  o Don’t need to be perfect
  o “fit for use”
Simple Example

Cost = Labor + Reagents + Overhead

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>10,000</td>
</tr>
<tr>
<td>Reagents</td>
<td>5,000</td>
</tr>
<tr>
<td>Supplies</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,000</strong></td>
</tr>
</tbody>
</table>
What about uncertainty?

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>min</th>
<th>most likely</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>10,000</td>
<td>7,000</td>
<td>10,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Reagents</td>
<td>5,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,500</td>
</tr>
<tr>
<td>Supplies</td>
<td>2,000</td>
<td>1,800</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Total</td>
<td>17,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Old Way (point estimate)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>10,000</td>
</tr>
<tr>
<td>Reagents</td>
<td>5,000</td>
</tr>
<tr>
<td>Supplies</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17,000</strong></td>
</tr>
</tbody>
</table>
New Way (probabilistic estimate)

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>min</th>
<th>most likely</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>10,000</td>
<td>7,000</td>
<td>10,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Reagents</td>
<td>5,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,500</td>
</tr>
<tr>
<td>Supplies</td>
<td>2,000</td>
<td>1,800</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Total</td>
<td>17,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations

Labor cost

Total cost
How to do it (continued)

• Open Excel
• Click the @Risk Toolbar
How to do it (continued)

- Click on Cell B2
- Click on Define Distributions
How to do it (continued)

Click on Triang

![Triangulation Interface]

- Name: Labor / Cost
- Cell Formula: 10000

Select the distribution to use in this formula to replace the value 10000:

- BetaGeneral
- Binomial
- Cumul
- Discrete
- Expon
- Gamma
- General
- Histogrnm
- Lognorm
- Normal
- Pert
- Poisson
- Triang
- Trigen
- Uniform
- Vary

Make Favorite | Select Distribution | Cancel
How to do it (continued)
Enter minimum, most likely, maximum
How to do it (continued)

- Repeat for Reagent Costs
- Repeat for Supplies
  - Enter min, most likely, max
How to do it (continued)

- **Designate Output Cell**
  - Click on B5 (Total)
  - Click on Add Output
How to do it (continued)

Click OK on dialog box
How to do it (continued)
Set the iterations to 1000
Click “Start Simulation”

Example 1 Simple Micro Excel

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
<th>min</th>
<th>most likely</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labor</td>
<td>10,000</td>
<td>7,000</td>
<td>10,000</td>
<td>18,000</td>
</tr>
<tr>
<td>Reagents</td>
<td>5,000</td>
<td>4,000</td>
<td>5,000</td>
<td>6,500</td>
</tr>
<tr>
<td>Supplies</td>
<td>2,000</td>
<td>1,800</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Total</td>
<td>17,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Voila!

![Histogram of Total / Cost values with statistical measures: Minimum 13,899.79, Maximum 26,328.91, Mean 19,100.15, Std Dev 2,412.86, Values 1000.](image-url)
Each input has a distribution
Repeat calculations 1,000 times
obtain inputs from distributions

<table>
<thead>
<tr>
<th>Trial</th>
<th>Total Cost</th>
<th>Labor</th>
<th>Reagents</th>
<th>Supplies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15,125</td>
<td>8,578</td>
<td>4,165</td>
<td>2,381</td>
</tr>
<tr>
<td>2</td>
<td>20,386</td>
<td>12,685</td>
<td>5,344</td>
<td>2,358</td>
</tr>
<tr>
<td>3</td>
<td>18,825</td>
<td>12,745</td>
<td>4,061</td>
<td>2,019</td>
</tr>
<tr>
<td>4</td>
<td>17,812</td>
<td>10,168</td>
<td>5,594</td>
<td>2,050</td>
</tr>
<tr>
<td>5</td>
<td>22,887</td>
<td>15,754</td>
<td>4,769</td>
<td>2,363</td>
</tr>
<tr>
<td>6</td>
<td>18,497</td>
<td>11,668</td>
<td>4,256</td>
<td>2,573</td>
</tr>
<tr>
<td>7</td>
<td>17,962</td>
<td>10,822</td>
<td>4,484</td>
<td>2,655</td>
</tr>
<tr>
<td>8</td>
<td>17,584</td>
<td>11,084</td>
<td>4,592</td>
<td>1,908</td>
</tr>
<tr>
<td>9</td>
<td>19,706</td>
<td>12,833</td>
<td>4,694</td>
<td>2,179</td>
</tr>
</tbody>
</table>
The Question:

How can we apply this theory to a realistic laboratory scenario?
The Answer:

Create a realistic scenario.
The Scenario:
Build a financial model using a sales forecast and five-year proforma to determine the rate at which the laboratory sales team will capture the attainable market

The Process:

• Define inputs for sales forecast
• Identify sources of uncertainty in sales forecast
• Develop 5-year forecast and financial projections
• Evaluate net present value
• Analyze one-way sensitivity analysis: Tornado Diagram
• Analyze two-way sensitivity analysis: Strategy Map
Sales Forecast requires five inputs

- Total Available Market (TAM)
- Attainable Market Share (AMS)
- Current Market Share (CMS)
- Sales Rate per person year (SRPY)
- Number of sales persons (N)

**Example Calculations**

- **Total Available Market (TAM)**: $8,000,000
- **Attainable Market** = AMS \times TAM = $4,800,000
- **Current Market** = CMS \times TAM = $2,400,000
- **Sales rate** = SRPY \times N
## Sales Forecast – Sources of Uncertainty

### Sales Forecast Inputs

<table>
<thead>
<tr>
<th>Sales Forecast Inputs</th>
<th>Input Value</th>
<th>Minimum</th>
<th>Most Likely</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Available Market (TAM)</td>
<td>$8,000,000</td>
<td>$7,000,000</td>
<td>$8,000,000</td>
<td>$9,000,000</td>
</tr>
<tr>
<td>Attainable Market Share (AMS)</td>
<td>60%</td>
<td>50%</td>
<td>60%</td>
<td>70%</td>
</tr>
<tr>
<td>Current Market Share (CMS)</td>
<td>30%</td>
<td>25%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>Sales Rate per person year (SRPY)</td>
<td>$73,333</td>
<td>$50,000</td>
<td>$70,000</td>
<td>$100,000</td>
</tr>
<tr>
<td>Number of sales people (N)</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR 1: Sales per year (SRPY x N)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Salary and Operation Inputs

<table>
<thead>
<tr>
<th>Salary and Operation Inputs</th>
<th>Input Value</th>
<th>Minimum</th>
<th>Most Likely</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Cost</td>
<td>$60,000</td>
<td>$40,000</td>
<td>$60,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>Total Salary Expense/yr</td>
<td>$366,000</td>
<td>$50,000</td>
<td>$60,000</td>
<td>$73,000</td>
</tr>
<tr>
<td>Total Operating Expense/yr</td>
<td>$3,000,000</td>
<td>$1,000,000</td>
<td>$3,000,000</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>Revenue Growth Rate:</td>
<td>5%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
</tr>
<tr>
<td>Inflation Rate</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Discount Rate</td>
<td>15%</td>
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</tr>
</tbody>
</table>
# Pro-Forma Financial Statement

## Estimated Financial Pro-forma

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Revenue</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Revenue</td>
<td>$2,400,000</td>
<td>$2,400,000</td>
<td>$2,400,000</td>
<td>$2,400,000</td>
<td>$2,400,000</td>
</tr>
<tr>
<td>Incremental New Sales Revenue</td>
<td>$440,000</td>
<td>$902,000</td>
<td>$1,387,100</td>
<td>$1,896,455</td>
<td>$2,400,000</td>
</tr>
<tr>
<td><strong>Total Sales Revenue (Current + New Sales Revenue)</strong></td>
<td>$2,840,000</td>
<td>$3,302,000</td>
<td>$3,787,100</td>
<td>$4,296,455</td>
<td>$4,800,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expenses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial Investment</td>
<td>$(60,000)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Salary Expense</td>
<td>$366,000</td>
<td>$378,200</td>
<td>$390,807</td>
<td>$403,834</td>
<td>$417,295</td>
</tr>
<tr>
<td>Total Operating Expense</td>
<td>$3,000,000</td>
<td>$3,100,000</td>
<td>$3,203,333</td>
<td>$3,310,111</td>
<td>$3,420,448</td>
</tr>
<tr>
<td><strong>Total Expenses</strong></td>
<td>$(60,000)</td>
<td>$3,366,000</td>
<td>$3,478,200</td>
<td>$3,594,140</td>
<td>$3,713,945</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cash Flow</strong></td>
<td>$(60,000)</td>
<td>$(526,000)</td>
<td>$(176,200)</td>
<td>$192,960</td>
<td>$582,510</td>
</tr>
</tbody>
</table>

## Return Analysis

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Discount Rate</strong></td>
<td>15%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NPV</strong></td>
<td>$287,715</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![5-Year Sales Forecast](image)
Estimated Net Present Value

- Minimum: -$7,593,761.56
- Maximum: $8,389,886.03
- Mean: $172,304.32
- Std Dev: $3,014,563.66

Values in Millions ($)

Values x 10^-7
Tornado Diagram
(One-Way Sensitivity Analysis)

Baseline = $172,304.32

NPV / Input Value
Inputs Ranked By Effect on Output Mean

Values in Millions ($)

- $4,769,798.52
- $699,482.41
- $649,010.12
- $512,617.62
- $237,434.60
- $152,671.25
- $140,451.47
- $95,631.96
- $56,968.23
- $49,288.50

NPV / Input Value

-5 -4 -3 -2 -1 0 1 2 3 4 5 6

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Strategy Map
(Two Way Sensitivity Analysis)
Value of Information

Uncertainty in Sales Forecast
- Driven by Uncertainty in sales
- Market Research reduces uncertainty
- How to evaluate?
Decision Scenario

Value of Info

Do Outreach Project?

4805000

Yes

TRUE

0

High

61.0%

7000000

Medium

32.0%

2000000

Low

7.0%

-1500000

No

FALSE

0.0%

0

Sales Growth

4805000

-1500000
Value of Information

- **Sales Growth**
  - High: 61.0% 7000000
  - Medium: 32.0% 2000000
  - Low: 7.0% -1500000

- **Buy Information?**
  - Value of Info: 4805000

- **Analyst Forecast**
  - High: 0.0% 0
  - Medium: 50.0% 0
  - Low: 50.0% 0
Value of Information

Analyst 1

Analyst 2 (well connected)
Value of Perfect Information

What is the most you would pay Analyst 2?

Value of Perfect Info = 4,910,000 – 4805000 = 105,000
How to build a decision tree

- Open Decision Tree Example
- Open Precision Tree
- Click on any cell
- Click on Decision Tree
- Click OK
Give the tree a name
Click OK
Name the Decision “Buy Info”
Name the branches yes and no
Right click on upper terminal node
Click “node settings”
Change to chance
Right Click chance node
Add branch
Rename branches high medium low
Link to the probabilities and payoffs
probabilities above the line
payoffs below
Use absolute references (click F4)
Right click on the chance node
Copy Subtree
Right click on end node of “Yes” Branch
Paste subtree

<table>
<thead>
<tr>
<th>Prob</th>
<th>Payoff</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>0.61</td>
</tr>
<tr>
<td>Medium</td>
<td>0.32</td>
</tr>
<tr>
<td>Low</td>
<td>0.07</td>
</tr>
</tbody>
</table>
Change the payoffs on the lower subtree to zero change each end node on the lower subtree to a “go vs no go” decision
Predicting the Impact of the FDA ruling on LDTs

<table>
<thead>
<tr>
<th>Test Category</th>
<th>Risk</th>
<th>Approval</th>
<th>Approval Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>none</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Medium</td>
<td>510k</td>
<td>50-250k</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>PAM</td>
<td>2.5-5.0M</td>
</tr>
</tbody>
</table>
## Classification Probability

<table>
<thead>
<tr>
<th>Test</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>80</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>.....</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td>10</td>
<td>90</td>
</tr>
</tbody>
</table>
## Cost of Approval Process

<table>
<thead>
<tr>
<th>Class</th>
<th>Minimum</th>
<th>Most Likely</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Class 2</td>
<td>50,000</td>
<td>150,000</td>
<td>250,000</td>
</tr>
<tr>
<td>Class 3</td>
<td>2,000,000</td>
<td>3,500,000</td>
<td>5,000,000</td>
</tr>
</tbody>
</table>
Distribution of Approval Cost

Values in Millions ($)

- Minimum: $1,944,314.67
- Maximum: $27,797,931.07
- Mean: $14,264,953.03
- Std Dev: $3,749,277.22

Values x 10^-7

Total

- 5.0%
- 90.0%
- 5.0%
Should we perform this test in-house?

<table>
<thead>
<tr>
<th></th>
<th>actual</th>
<th>min</th>
<th>likely</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>demand</td>
<td>1833</td>
<td>1000</td>
<td>1500</td>
<td>3000</td>
</tr>
<tr>
<td>price</td>
<td>34</td>
<td>32</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>send out cost</td>
<td>30</td>
<td>29</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>reagent cost</td>
<td>20</td>
<td>19</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>QC volume</td>
<td>843</td>
<td>730</td>
<td>800</td>
<td>1000</td>
</tr>
</tbody>
</table>

Revenue 62,333
In House Cost 54,426
Send Out Cost 55,611

In House Profit 7,908
Send Out Profit 6,722
Difference 1,186
Difference (In-house vs send-out)

-5,760 to 10,124

-11,030.78 to 16,410.98

Mean: 1,188.67

Std Dev: 4,918.53

Values: 1000
Quick Review

• Financial Modeling
  o Risk Analysis
    ➢ Uncertainty in inputs
    ➢ Uncertainty in outputs
  o Identify Risk Drivers
  o Value of Information
Is it worth the trouble?

• Easy to do
• Gain insight
  o Focus on the important stuff
  o Ignore the trivia
• Manage Risk
  o Identify weak spots
  o Develop options
• Increase Value
Sources for Simulation Software

• Crystal Ball (Oracle)
• @Risk (Palisade)
• Risk Solver Pro (Frontline Systems)
• Many others
Discussion:
Where can this be applied?

What problems would you like to see solved?
Summary

• Financial Modeling Adds Value
  o Can be applied to many problems
  o Simple tools are available

• We would like to know:
  o What risky decisions do you make?