

The Use of Decision Tools in Biotechnology Project and Portfolio Decision Making

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Vertex Pharmaceuticals Inc



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- ❑ Introducing decision tools & analytics to Vertex's corporate strategy process
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Vertex Pharmaceuticals Inc.

History

- Founded in 1989, public in 1991 (ticker: VRTX)
- Developed 2 HIV drugs to date, commercialized by GSK

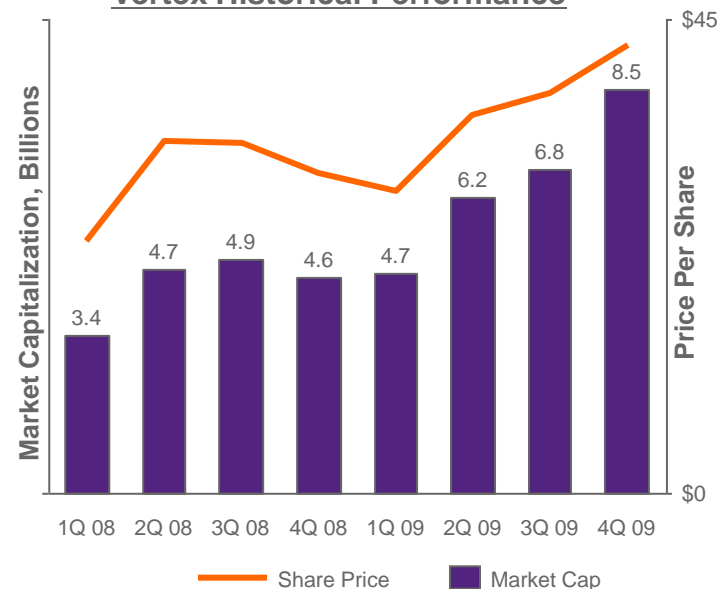
Financials

- 1 profitable quarter
- Over \$3B in cumulative losses to date
- Raised over \$1B in the last 2 years (43% stock dilution)
- NASDAQ 100 index best performing stock in 2008

Pipeline

- 2 drugs in Ph.3 trials: HCV & Cystic Fibrosis
- 4 drugs in Ph.2 trials
- 2009 R&D expense - \$551M

Vertex Historical Performance



My Background

- Raised in Moscow, Russia
- Moved to US to go to college
- Changed 3 industries prior to joining the world of biotech
- No math / science / excel modeling background
- Internship with Vertex during second year of MBA
- Currently work in the strategic finance



Introducing Decision Tools into Corporate Strategic Planning

2005

- Basic LRP Model

2006 - 2007

- Scenario based planning with expected values / probabilization

2008 - 2009

- Introduce decision tools concepts & outputs to existing scenario based planning

2010

- Utilize decision tool & process to better test key drivers & assumptions
- Use tools more broadly



Applying Decision Tools within Corporate Strategy & Analytics

Used for

- Long-range planning
- Portfolio optimization process

How

- Revenue & growth projections
- Budgeting
- Resource Allocation

Why

- Prepare for the “what if” outcomes
- Provide key stakeholders with a range of outcomes
- Align corporate goals with portfolio strategy

Fun Facts

- Long-range planning takes place once a year
- Portfolio process takes place twice a year
- All functions of the company get involved

Building a Portfolio Tool for Vertex

What

- Dynamic revenue and expense forecasting methodology
- Monte-Carlo simulation

Why

- Show boundaries
- Vertex portfolio was expanding - binary scenarios becoming too numerous
- Provide better “risk-adjustment” process
- Take into consideration key stakeholders’ risk tolerance

Fun Facts

- No excel modeling experience prior to this project
- Academic knowledge of finance (not applicable to this project)
- Lots of internal and external help whenever possible

Building a Portfolio Tool for Vertex

How does it work?

- Key assumptions from the long-range plan
- Simulate pass or fail by stage, for each program
- Some simulation of commercial outcomes
- Certain programs are correlated

Outputs

- Program contribution (revenue, development costs, EBIT)
- Both strategic outputs & operational metrics
- 10th, 90th & 50th percentiles

Fun Facts

- 3mo to build & 1.5yrs of continuous revision
- Original model was 25MB & took 3+ hrs to run
- Runs one scenario at a time (26 assets x 6 outcomes for each asset)
- Need approx. 23,000 iterations

Communicating Results to Non - Statisticians

How

- Know your audience
- Simple and easy to read outputs – no statistics background necessary
- Added simulation results to an already established process

Why was it successful?

- Simplicity
- Identified and focused on what's important
- Introduced new concepts at the right time
- Implemented tools one process at a time

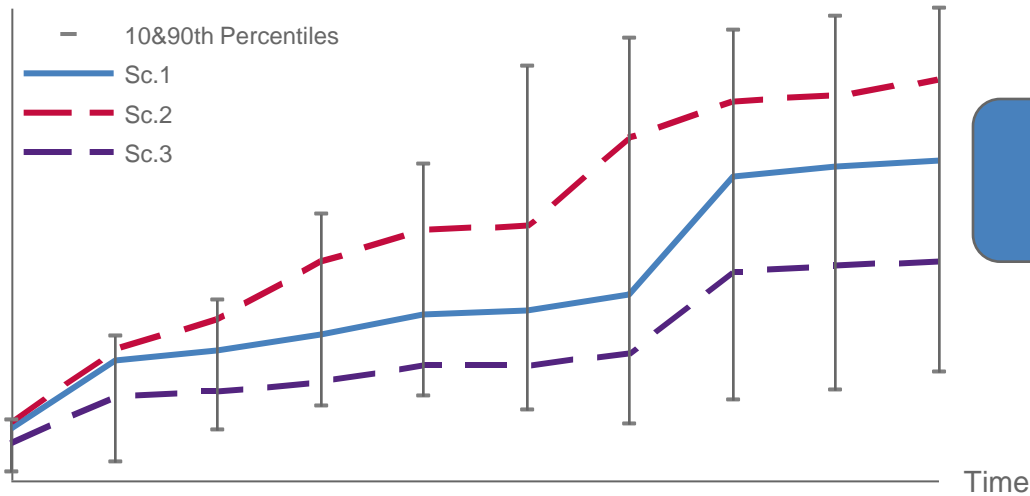
Fun Facts

- Explained the difference between Monte-Carlo and Latin Hypercube sampling to a senior executive
- Once the tool was complete, the whole group took Palisade training online



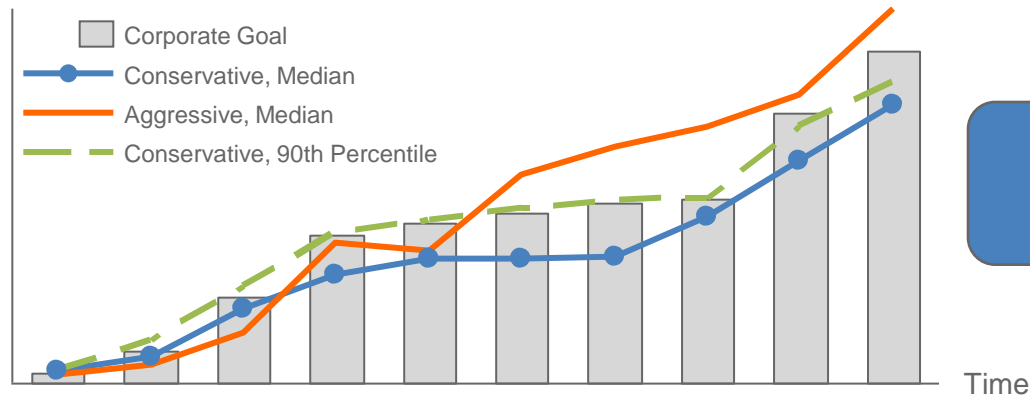
Corporate Strategy: Sample Outputs

Revenue (\$B)



How likely is particular scenario to occur?

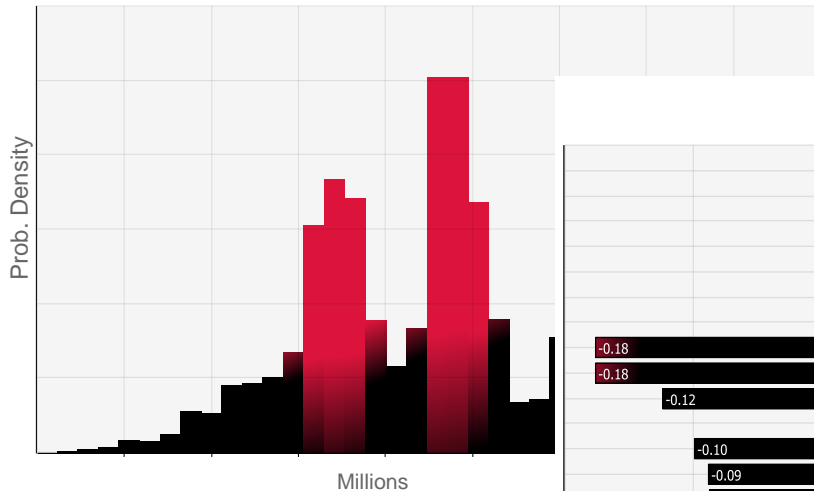
EBIT (\$B)



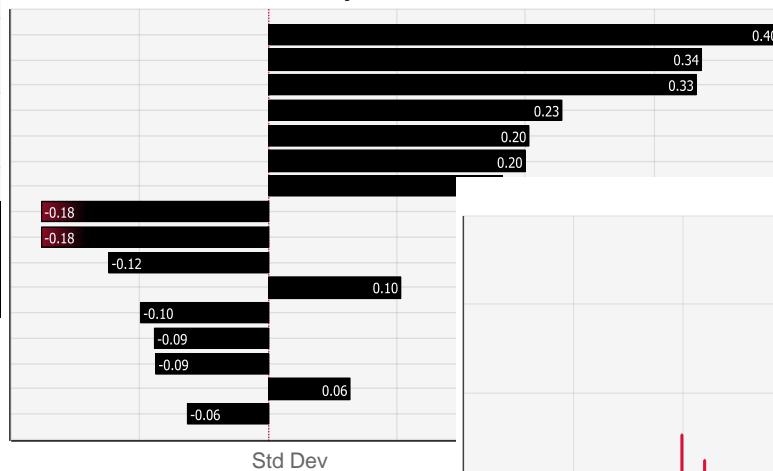
Conservative approach is unlikely to meet corporate goals, given current portfolio assumptions

Portfolio Tool: Sample Outputs

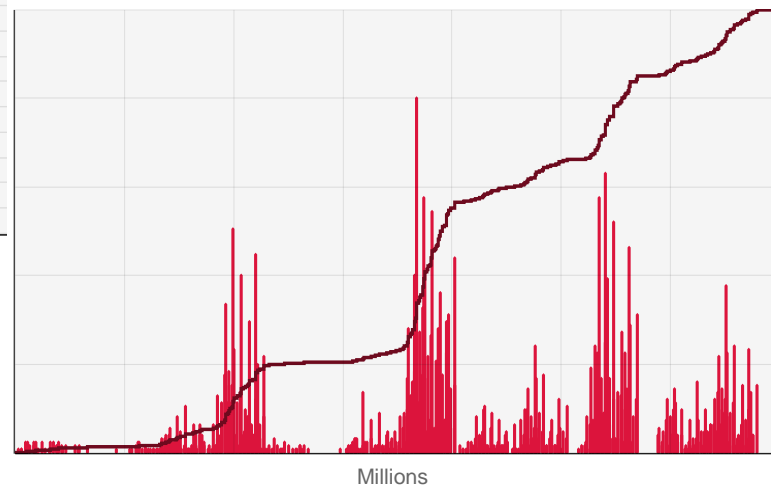
Portfolio eNPV To...



Portfolio eNPV To...
Regression Coefficie...



2010 Devl Co...



Key takeaways

Without a crisp analysis summary any tool could become obsolete.
Know your objective & goal upfront. It will save you a lot of “downtime”.



Adjusting for Risk using Monte-Carlo Simulation

Traditional eNPV Calculation Method

Traditional P&L		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
(SM)																							
Product Revenue		-	-	-	-	-	-	64	432	506	818	677	571	478	404	353	321	91	44	15	14	14	
Gross Margin		-	-	-	-	-	-	54	358	416	661	549	465	391	334	293	268	77	38	12	12	12	
Total Costs		23	19	42	40	95	81	49	40	32	26	26	26	26	26	26	26	3	1	-	-	-	
Operating Profit		(23)	(19)	(42)	(40)	(95)	(81)	5	318	384	636	523	439	366	308	267	242	75	36	12	12	12	
Tax		-	-	15	15	34	29	19	114	138	229	188	158	132	111	96	87	27	13	4	-	-	
Net Profit		(23)	(19)	(57)	(55)	(130)	(111)	(15)	203	246	407	335	281	234	197	171	155	48	23	8	-	-	
eNPV (\$M)		443																					

Stage	Start	POS	Cume
Predclin	2007	100%	100%
Phase1	2007.75	100%	100%
Phase2a	2010.25	50%	56%
Phase2b	2012.5	60%	34%
Phase3	2014.25	75%	25%
USFiling	2016	90%	23%
Cumulative			23%

Probability of starting Ph 3: probability of Ph 2a x probability of Ph 2b or 56% x 60% = 34%
 Probability of incurring costs in 3Q 2012: 34%
 Probability of incurring revenues (launching the drug): 23%

Risk – adjusted P&L		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Probability		100%	100%	56%	56%	34%	34%	25%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	
Product Revenue		-	-	-	-	-	-	16	99	116	188	156	131	110	93	81	74	21	10	3	
Gross Margin		-	-	-	-	-	-	14	82	96	152	126	107	90	77	67	62	18	9	3	
Total Costs		23	19	23	23	32	28	12	9	7	6	6	6	6	6	6	6	1	0	-	
Operating Profit		(23)	(19)	(23)	(23)	(32)	(28)	1	73	88	146	120	101	84	71	62	56	17	8	3	
Tax		-	-	8	8	12	10	5	26	32	53	43	36	30	26	22	20	6	3	1	
Net Profit		(23)	(19)	(32)	(31)	(44)	(38)	(4)	47	56	94	77	65	54	45	39	36	11	5	2	
eNPV (\$M)		61																			

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Portfolio Tool Risk-adjustment Method

Problem:

Traditional risk-adjustment method shows only a portion of costs/revenue associated with the drug. When failing a stage, company incurs all of the development costs associated with that stage and not just "62%" of the cost. When drug is approved, company incurs all of the revenue and not just "23%" of it.

Portfolio Tool Approach

Iteration	Outcome	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Fail in Ph 2a	(6)	-	-	-	-	-	-	-	-	-	-
2	Fail in Ph 2b	(23)	(19)	(16)	-	-	-	-	-	-	-	-
3	Fail in Ph 3	(15)	(19)	(57)	(55)	(42)	-	-	-	-	-	-
4	Fail in Regulatory	(15)	(19)	(57)	(55)	(130)	(111)	-	-	-	-	-
5	Launch the drug	(23)	(19)	(57)	(55)	(130)	(111)	(15)	203	246	407	335

Solution:

Simulate pass / fail by stage. Incur all of costs/revenue for that time period if the drug "passed" the stage. Estimate "true average" eNPV of a project

By asset, eNPV & 50th percentile line should converge.
 Then overlay scenarios to relate back to senior management.



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Using Palisade Suite Outside of Corporate Finance

Who

- Business development team
- Commercial group
- Scientists & program leaders

What

- Bidding & term sheet process
- Sales forecasting (share, price, competition)
- Sensitivity analysis

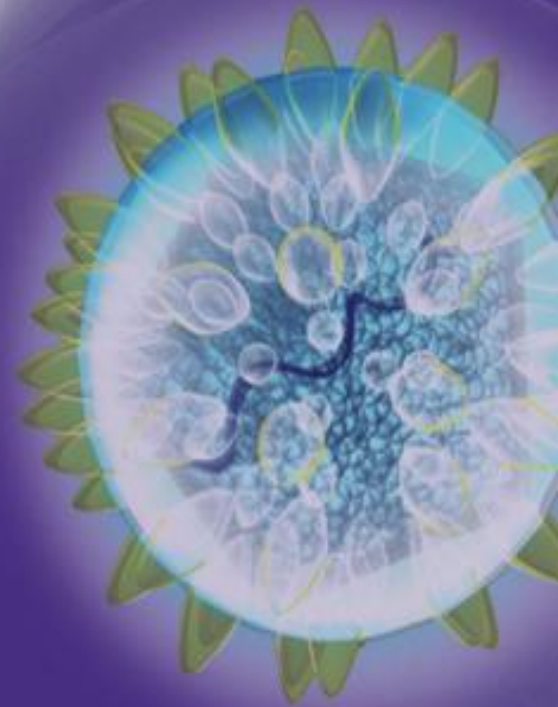
How

- @ Risk
- Top Rank
- Precision Tree

Why

- Ability to show multiple outcomes with assigned probabilities
- Generate average of outcomes
- Identify key drivers and pressure-test assumptions
- Educate non-finance audience about the effect of assumptions

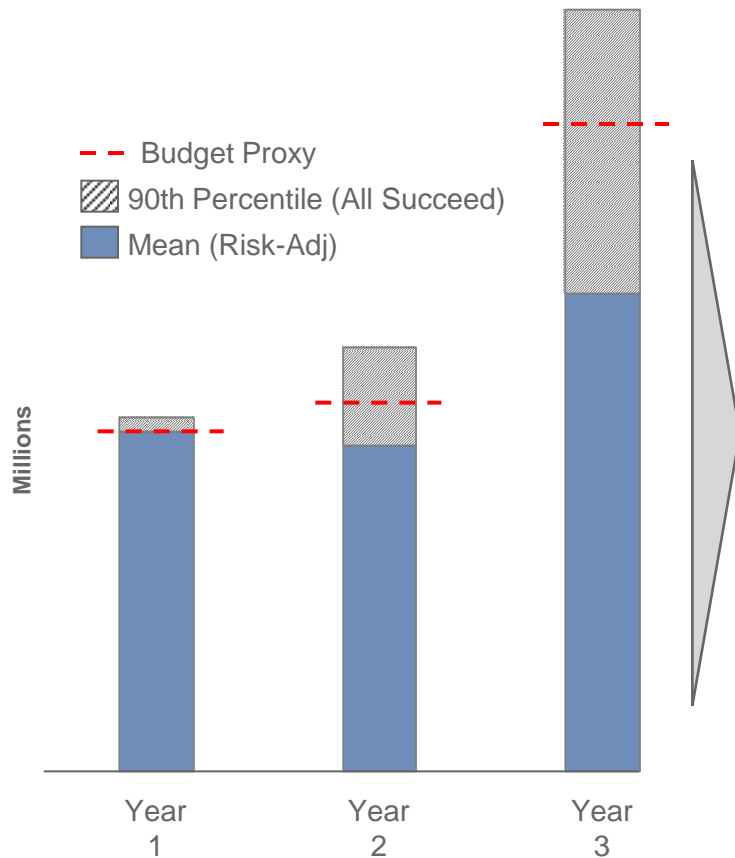
Appendix



Corporate Finance
March 2010



Corporate Budgeting: Sample Output



Accounting for risk, the portfolio investment plan for . . .

- Year 1: Falls right within the budget
- Year 2: Leaves small budget cushion
- Year 3: Opportunity to invest aggressively

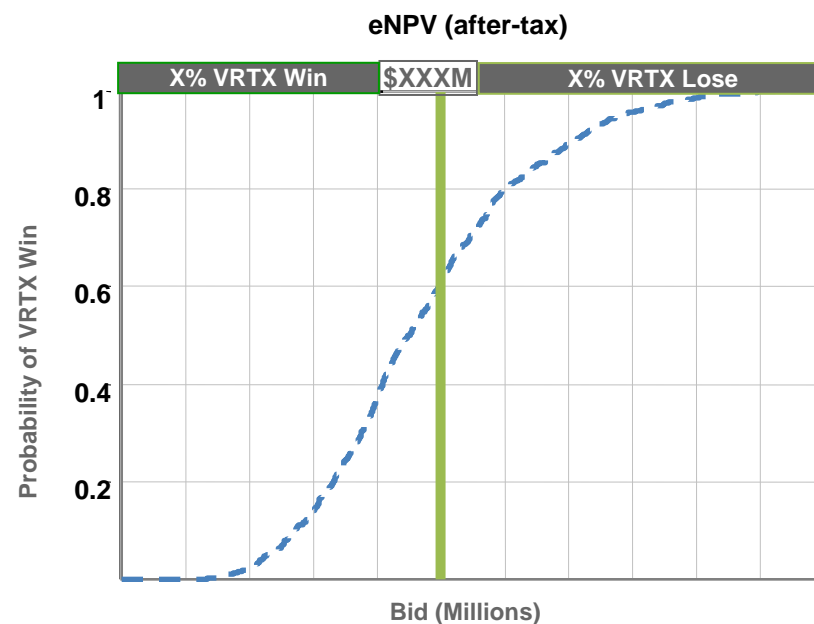
Decision tools help to improve the corporate budgeting processes

Informing Business Development Process using @Risk

Define Variables for simulation

<u>Base Assumptions</u>	<u>Base</u>	<u>Range</u>
Discount Rate	X%	7% - 10%
POS (Cumulative)	22.5%	15% - 30%
Price	\$XK	-5K / +10K
Market Share	X%	25% - 45%
Prob. of Early Launch *	X%	0% - 2x%

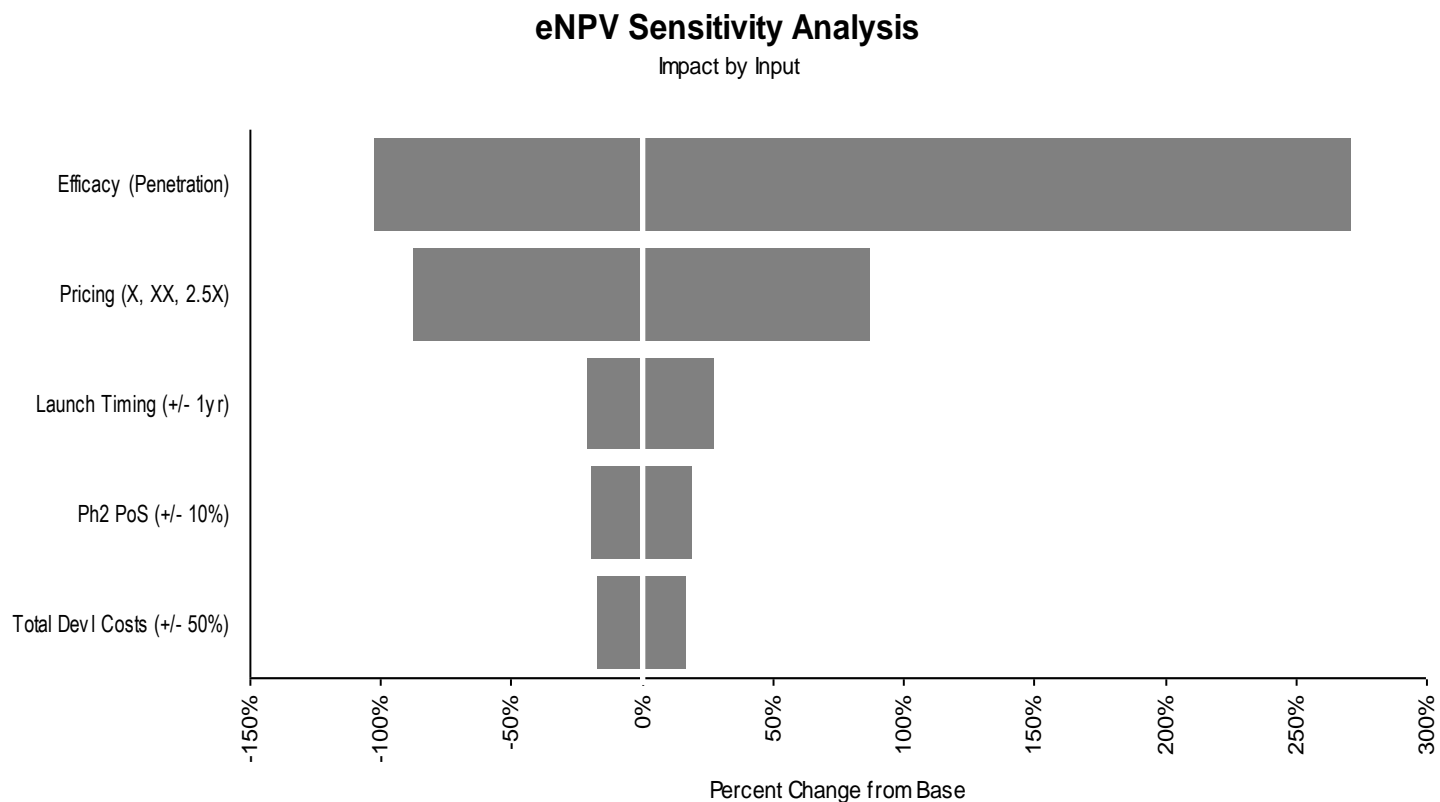
Monte Carlo Analysis Output



Simulation can help to inform the bid strategy



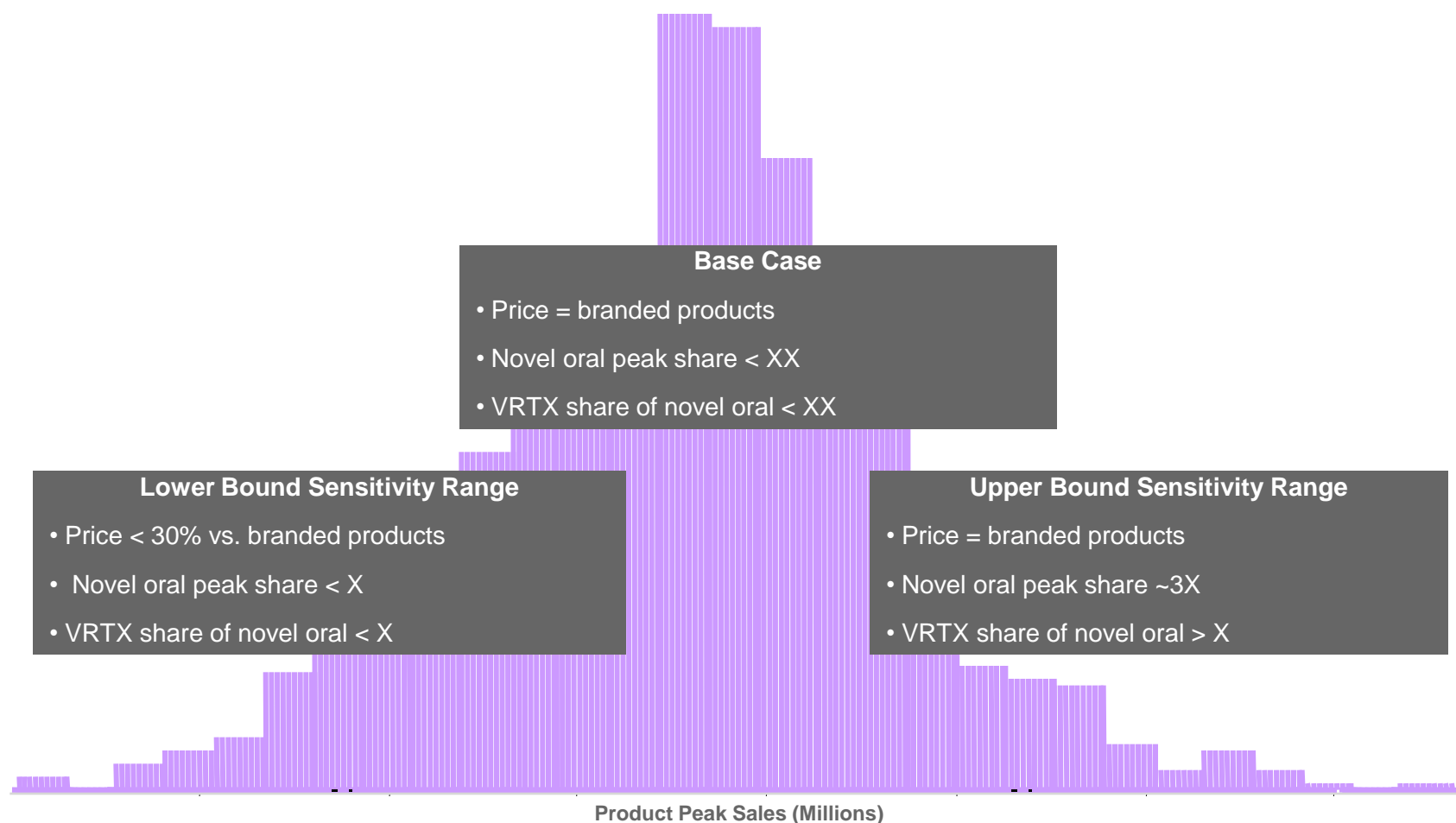
Sensitivity Analysis using Top Rank



Help the team focus on key drivers of the program value.



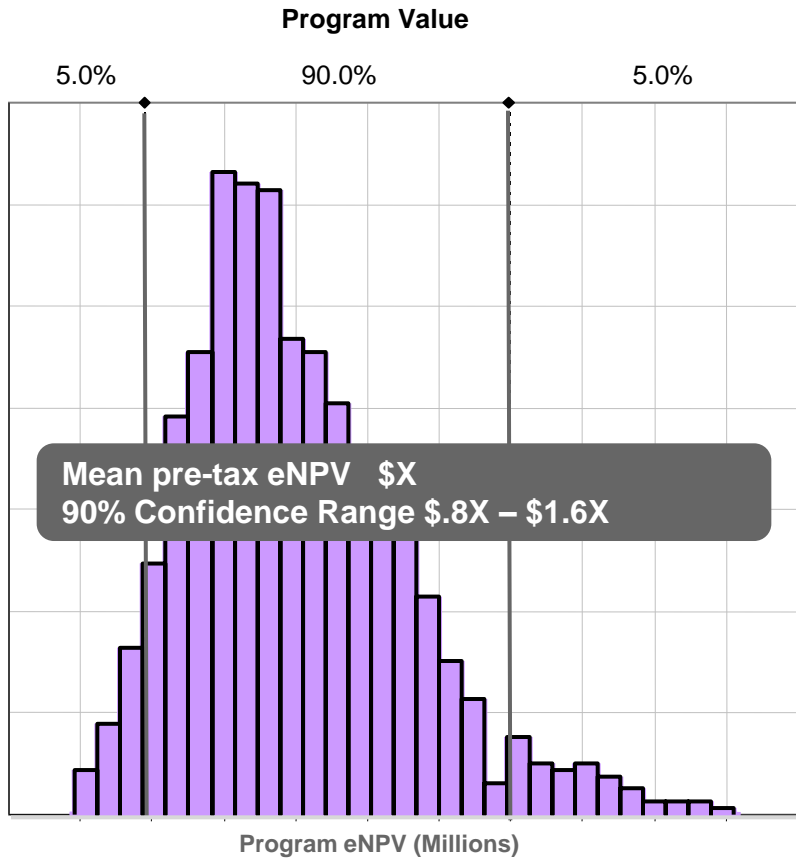
Creating “weighted” Commercial Forecast with @Risk



Sensitivity ranges reflect risk and opportunities in the commercial profile of the program

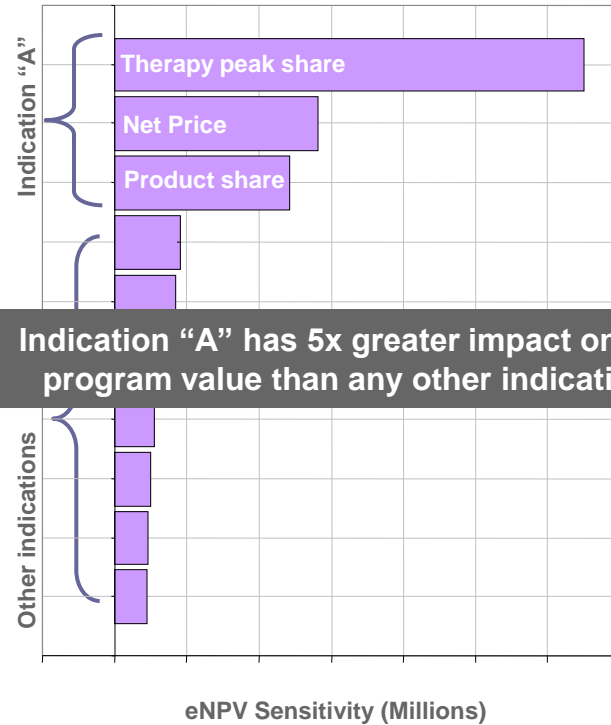


Program Valuation using @Risk



Longer right tale indicates the upside potential outweighs the downside risks

Program Value
Regression - Mapped Values



No commercial assumptions outside of indication "A", can move value by greater than 10M



Traditional eNPV Calculation Method

Traditional P&L

(\$M)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Product Revenue	-	-	-	-	-	-	64	432	506	818	677	571	478	404	353	321	91	44	15	14	14	
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Introducing Decision Tools into Corporate Strategic Planning

2005

- Basic LRP Model: compounds “on” or “off”
- Specific development plans were not available

2006

- Scenario based planning with expected values / probabilization
- First use of activity sheets
- First portfolio valuations
- Enhanced scenarios: from 5 to 5,000 possibilities

2008

- Introduce decision tools concepts & outputs to existing scenario based planning
- Indication & lifecycle valuations
- LRP simulations
- Enhanced probabilities: dependent POS

2009

- Efficient frontier
- Forecast simulations

2010

- Utilize decision tools & process to better test key drivers & assumptions
- Use tools more broadly

