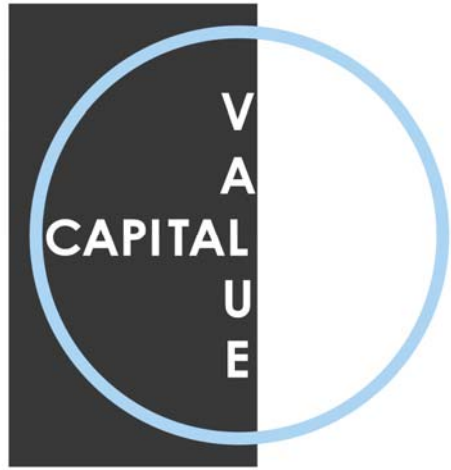


Palisades 2006 User Conference

Use of @Risk in Business Valuations

Michael Churchill
Director
Capital Value Pty Ltd
www.capitalvalue.com.au

Important disclaimer

The examples of the use of @Risk set out in this presentation are for illustrative purposes only and do not represent the view of Capital Value on particular variables or assumptions employed in valuations prepared by Capital Value.

All of the examples in this presentation are drawn from actual valuations performed by Capital Value. However, in order to maintain client confidentiality, figures, names and descriptions have been altered and disguised.

For a more detailed or confidential discussion of particular aspects of this presentation, please contact Michael Churchill via email: m.churchill@capitalvalue.com.au

The use of @Risk in Business Valuations

- Business valuation basics
- How is uncertainty and risk accommodated in the “traditional” valuation?
- Does Monte Carlo simulation help?
- Acceptance of Monte Carlo in the “real world”
- How Monte Carlo simulation can help explore upside/downside risk
- …in a highly risky context e.g. R&D/early stage technology
- …in a mature business context
- Insights from @Risk outputs

Some background and context

Capital Value is a specialist business valuation practice providing business valuation services for:

- Financial reporting requirements (to satisfy A-IFRS – impairment testing, purchase price allocation)
- Tax compliance (valuation of businesses for CGT, tax consolidation, transfer pricing)
- Litigation support
- Strategy formulation – deal pricing, M&A advisory, capital raising

Use of Monte Carlo simulation in business valuation

Monte Carlo analysis is merely a way of modelling the uncertainty of multiple variables simultaneously.

Throughout our valuation practice, Monte Carlo analysis is used to explore the likely impact of future uncertainties and to manage our own risk. There is no limit to the circumstances in which @Risk can be used! Examples of business types where we have employed @Risk include:

- Gold mining
- Coal mining
- Minerals exploration
- Minerals smelting and refining
- Brewing
- Steel manufacture
- Technology commercialisation
- Hardware retailing
- Downstream oil business
- Infrastructure contracting

Business valuation in an uncertain world

The typical business valuation primarily relies on a view of the future as represented by either:

A "take" on the likely possible future profitability, condensed to an annuity ("Future Maintainable Earnings") capitalised using an estimate of the price that the marketplace is prepared to pay for that estimated ongoing profitability

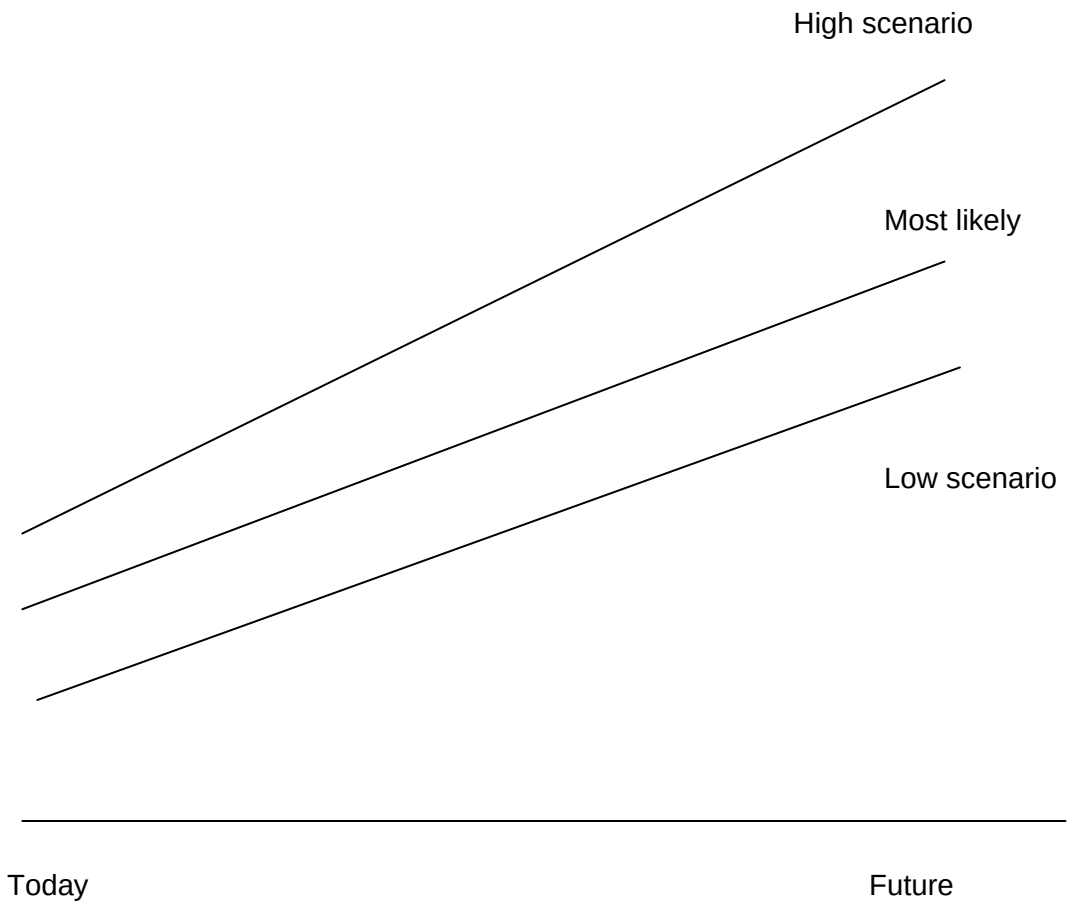
Or

A "best estimate" of likely future cashflows over a period of 5-10+ years, discounted to a present value employing a risk-adjusted discount rate

Risk and uncertainty is rarely explicitly considered. Worse: it is often "hidden" through the use of arbitrary risk-adjustments to discount rates and via the selection of "most likely" cashflow or earnings outcomes

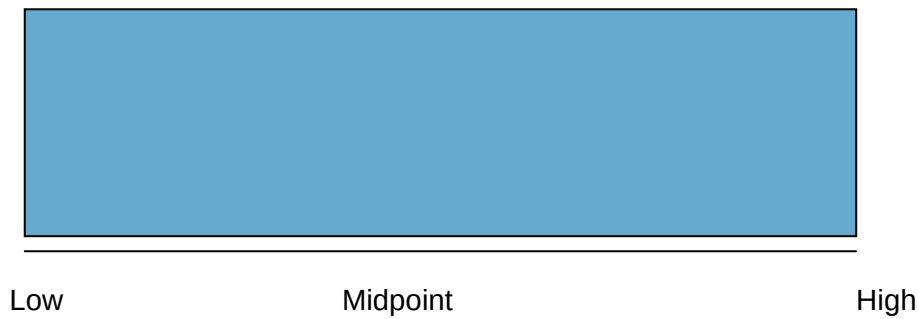
Typical valuation outcomes

Uncertainty is implicitly recognised in most valuations. Typically a range of possible outcomes is presented:

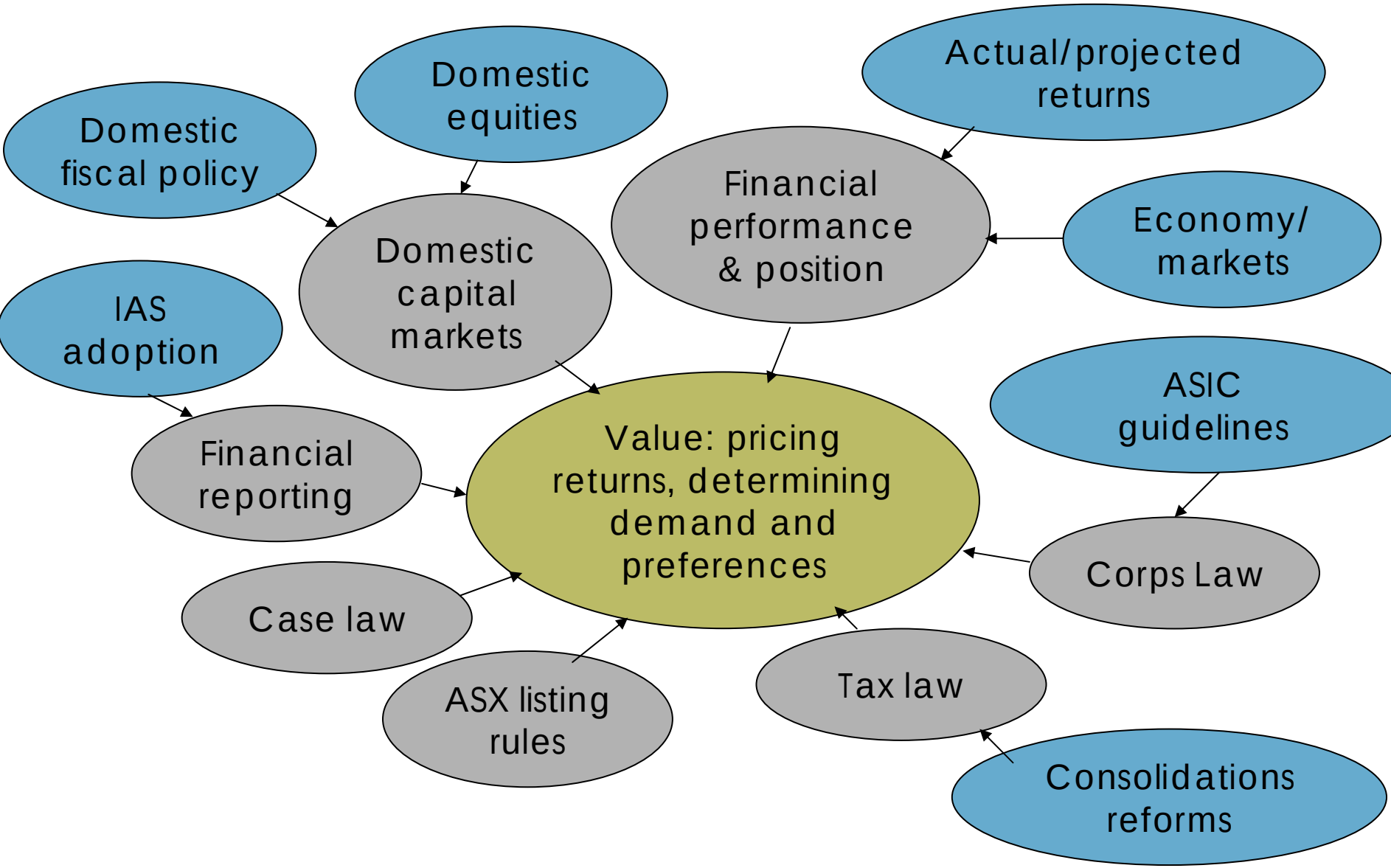


Typical valuation outcomes

- Consequently, most valuation conclusions are presented as being "between x and y, with a midpoint of y"
- It is rare that a valuation will describe whether "x" is the lowest possible outcome or that "y" is the highest possible outcome
- The description of a "midpoint" implies that the range of possible valuation outcomes are symmetrically or normally distributed
- However, most valuations suggest that any outcome within the range is possible, without any indication of probability
- The reader might reasonably assume that all outcomes (within the range described) are equally probable!



The underlying drivers of value are diverse, complex and highly variable



Valuation “science” is improving…

Past	Present	Future
Deterministic	Sensitivities & scenarios	Probabilistic
Opaque	Translucent	Transparent
Subjective basis for assessing capitalisation rates	Modern Portfolio Theory employed to assess discount rates	Modern Portfolio Theory + capital markets reality checks
Tangible assets at book	Tangible assets at WDRC	Tangible assets at market value
Intangible assets=goodwill	Intangibles identified	Specific intangible asset valuations
Backward-looking	Unvalidated management forecasts	Market assessments and probabilistic view of projections

Resistance from some quarters is being overcome by authoritative pronouncements as to use of probabilistic valuations

The US accounting standard FAS 123R relating to valuation of executive compensation prescribes the use of a basic probabilistic approach to valuation. In a recent US article (Curtiss, Institute of Valuation, July 2006) the following comments are made:

Probability Assessments

Fortunately, ***the Practice Guide provides authoritative justification for the use of probabilities. In essence, it validates a paradigm shift from using the most probable outcome as our projection to using multiple projected outcomes weighted by their probability.*** *This is perfectly reasonable in theory, as it explicitly considers risk, but the problem of assessing the probabilities is of huge proportions.*

Another defense of the use of probabilities is that many of the other appraisal methods we use: the Direct Market Data Method (ranking a subject company in a percentile of attractiveness), Ibbotson data (using long-term historical averages), and control and liquidity adjustments (using market study averages) are also somewhat probabilistic.

In 2003 the ATO recognised the need to "lift the bar"

In its second "Large Business Compliance Program" issued in June 2003, ATO flagged its expectations with respect to the quality of business valuations used for tax purposes:

"In cases where market valuations have significant tax impacts and are materially different from the values used for the purposes of the business generally, ***we will check… that the full range of probabilities is properly taken into account****, so that valuations are based on what is more likely to occur (for example, in cases where the asset is unique or there are no recent sales to benchmark against)."*

It is clear that the market place and tax authorities will expect more from our profession and explicit recognition of risk and uncertainty is one of the key areas for improvement.

Monte Carlo simulation in action

Most of the inputs to valuation have three dimensions:

- Price (or rate)
- Volume or quantity
- Time

Each of these inputs have typical characteristics:

- Price is often determined by economic forces – a utility function
- Volume is determined by a demand driver
- Time is either continuous or discrete – for example a project starts this summer or next (modelled as a “switch” with a probability of occurrence)

Example: the cost of capital

The discount rate employed in a discounted cashflow valuation is derived from a set of assumptions which are sometimes difficult to observe and are all variable to a greater or lesser extent, including:

- A measure of the riskless rate of return – typically taken to be the long-run government bond rate
- An estimate of the market risk premium
- An estimate of the covariance risk of the asset against the returns of all risky assets

…and in the case of a weighted average cost of capital:

- A view on the optimal capital structure (i.e. mix of debt and equity) and
- An estimate of the "spot" cost of debt for the various components of the debt funding (short, medium and long-term debt funds)

The estimation of the cost of capital is one of two critical elements of the valuation (the other being the estimation of cashflows)

Key drivers of mature businesses

- Revenue
- Cost of goods sold/gross profit margin
- Operating expenses
- Depreciation
- Specific incremental changes – new products, new geographies, impact of competition
- Capitalisation multiple
- Adjustments to multiple – e.g. control premium
- Growth

Mature business example model...

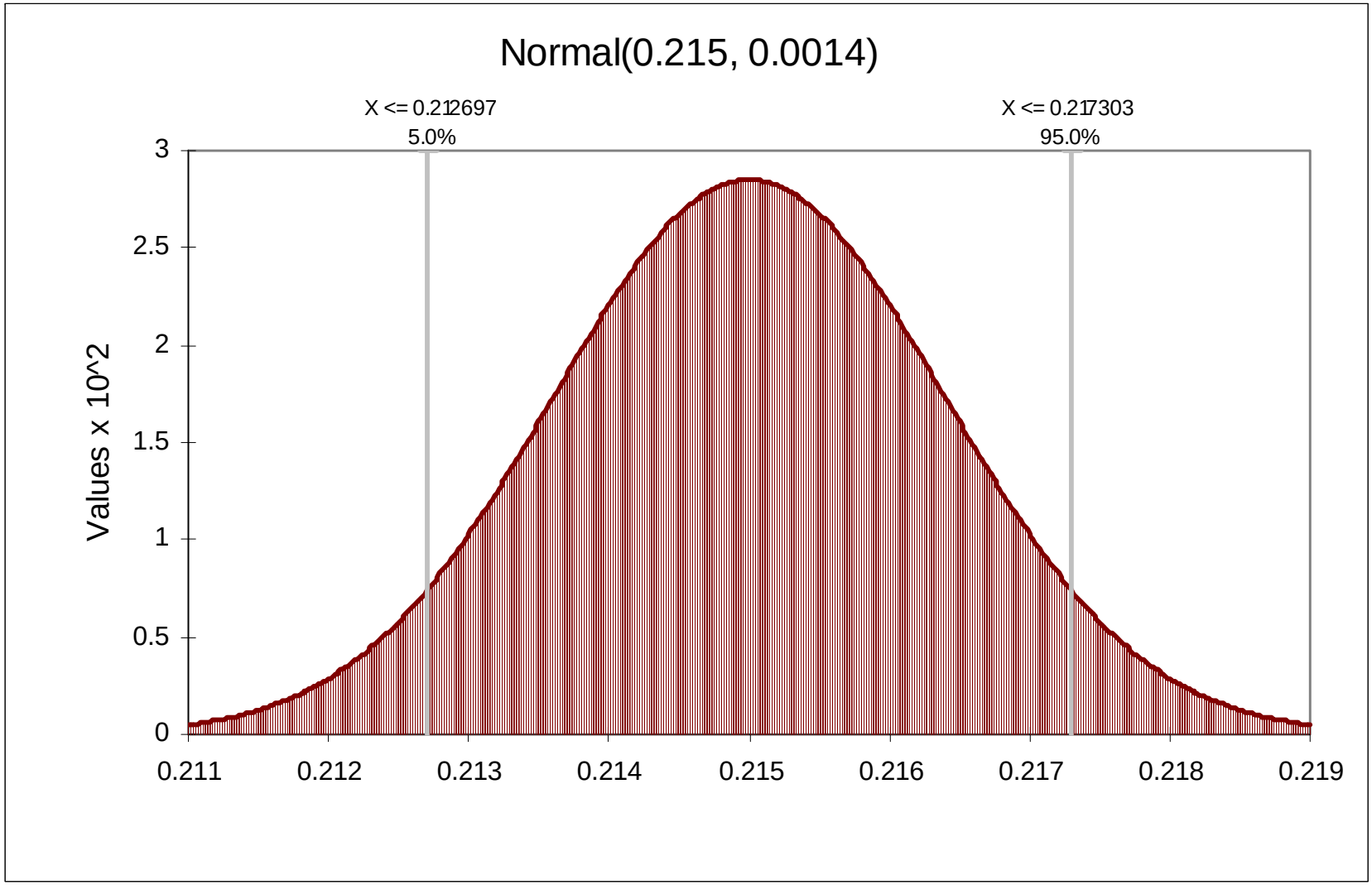
Model	1	RISK MODEL - COMPLETED					
Case	Dinki-Di	*Input variable - not @RISK*			*Input variable - @RISK*	*Output variable - @RISK*	
		Historical				Prospective	**FUTURE**
		Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**MAINTAINABLE**
		($,000)	($,000)	($,000)	($,000)	($,000)	($,000)
Revenues		7,380,877	8,187,049	9,057,228	10,186,683	11,313,533	9,225,000
Cost of Goods Sold		5,503,174	6,087,065	6,697,184	7,548,258	8,397,476	6,844,950
	as % Revenue	74.6%	74.3%	73.9%	74.1%	74.2%	
Gross Profit		1,877,703	2,099,984	2,360,044	2,638,425	2,916,057	2,380,050
Operating expenses		1,581,881	1,741,789	1,952,551	2,204,981	2,427,602	1,983,375
	as % Revenue	21.43%	21.27%	21.56%	21.65%	21.46%	
EBITDA		295,822	358,195	407,493	433,444	488,455	396,675
Depreciation		107,510	122,389	137,160	144,956	156,114	134,000
EBIT		188,312	235,806	270,333	288,488	332,341	262,676

	Taxpayer's Estimate		
FME	330,000		262,676
Multiple	20	Includes the control premium	14.2
Control Premium	Unknown		28%
Business Value	$ 6,600,000		4,775,587

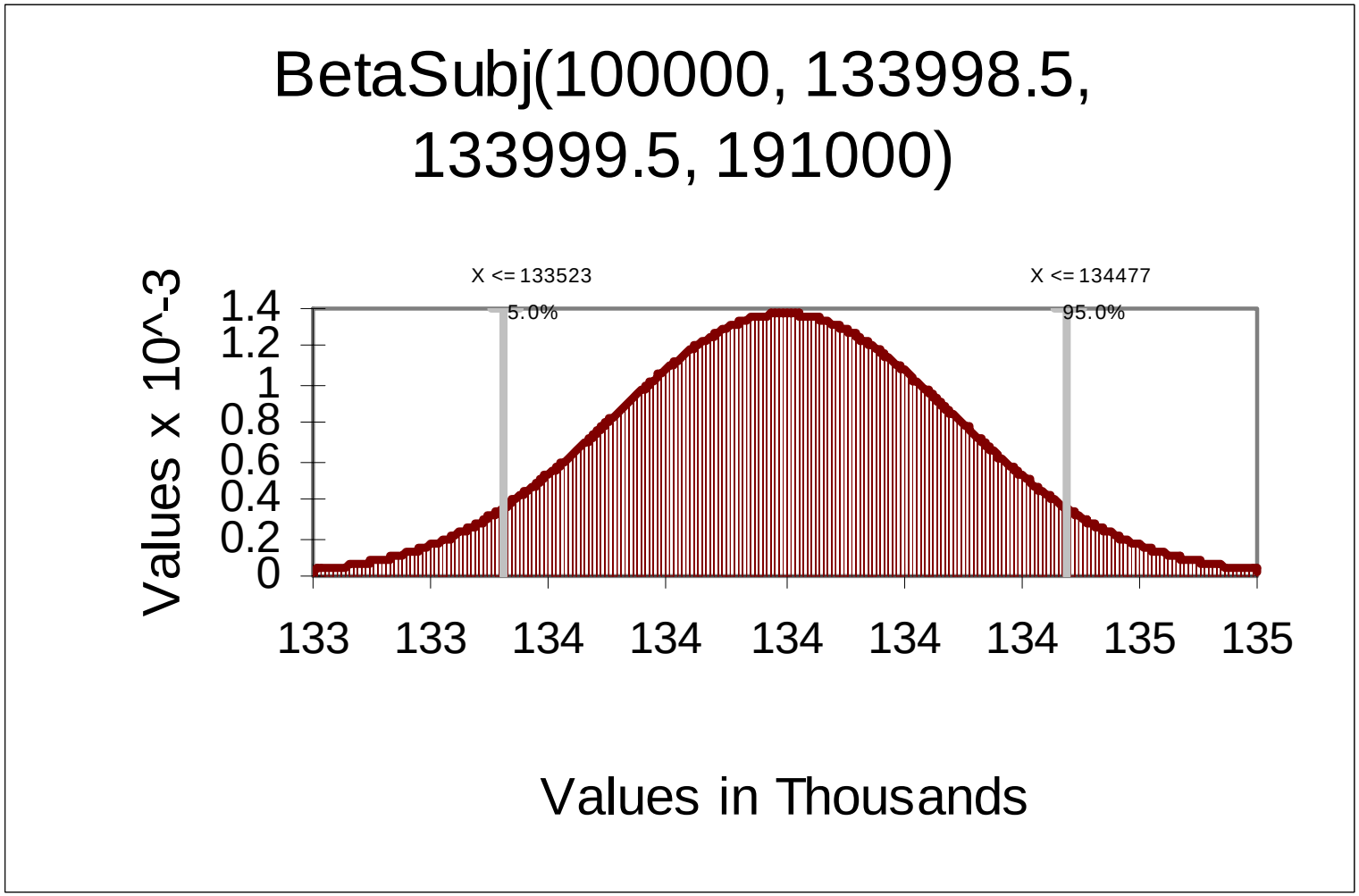
Assumptions:

COGS_%	74.2%
OPEX_%	21.5%

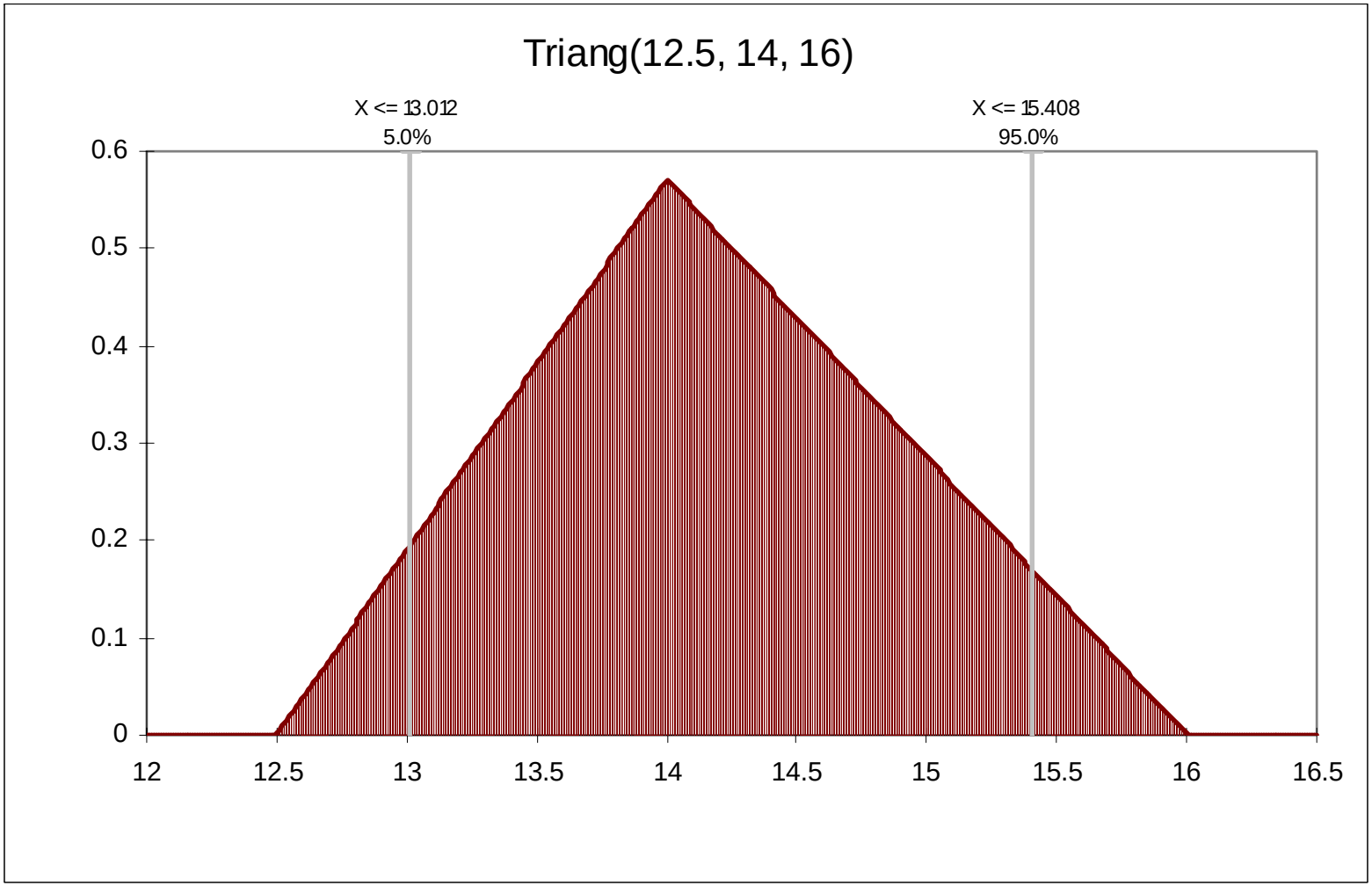
Normal distributions might be used for key variables such as revenue, cost of goods and opex



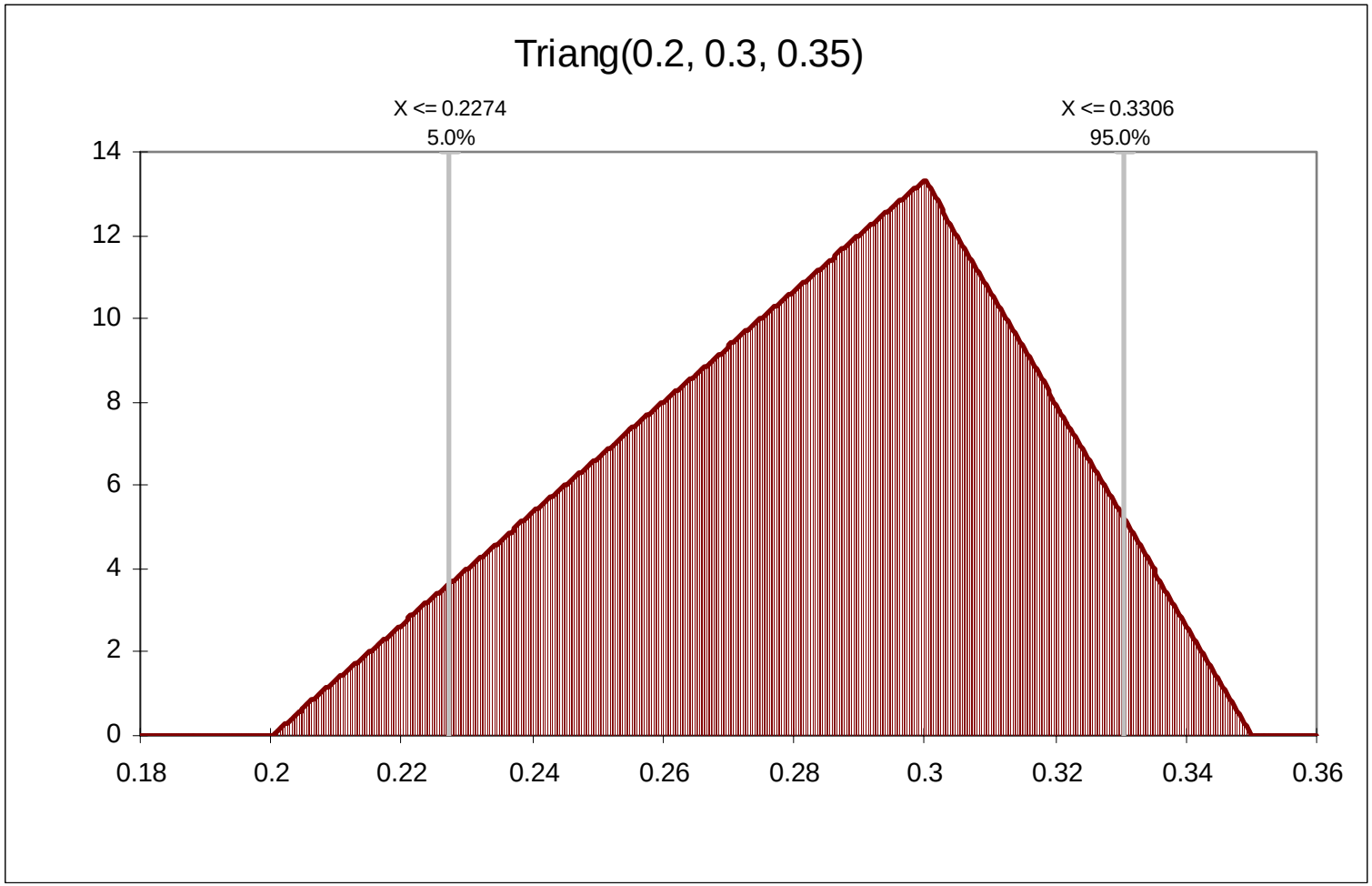
Whilst depreciation might employ an alternative distribution…



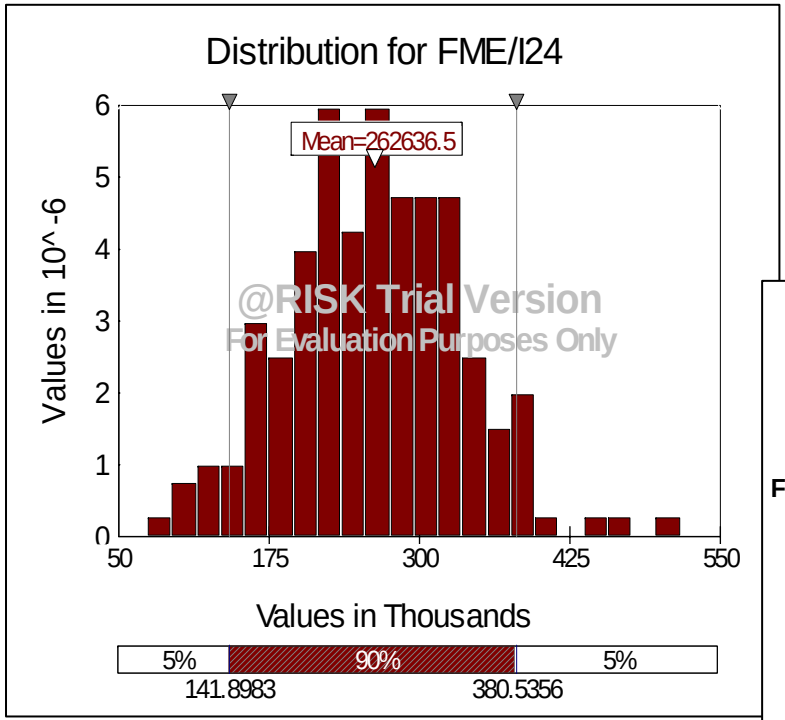
The multiple is assessed from observed data

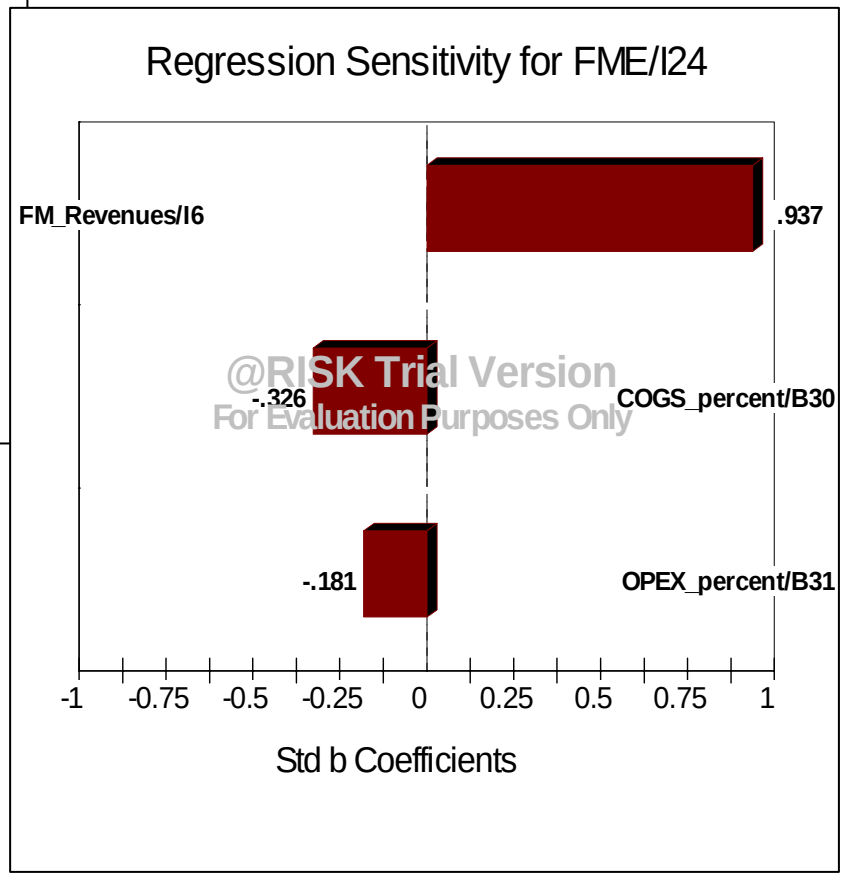


The addition of a control premium to the observed multiple can be tackled probabilistically:

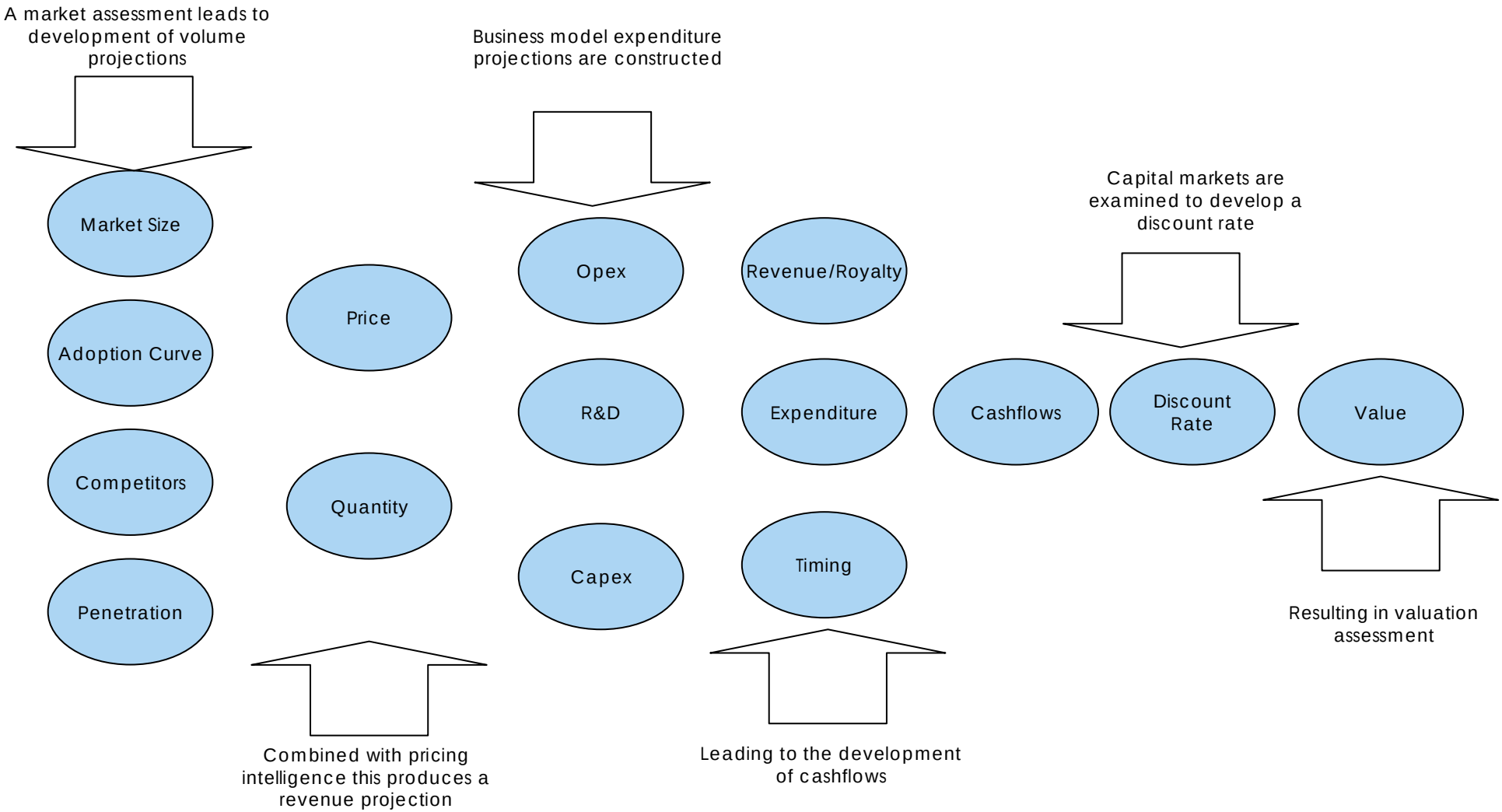


To arrive at outputs and sensitivity…





Typical discounted cashflow model construction



New drug discovery example-simplified

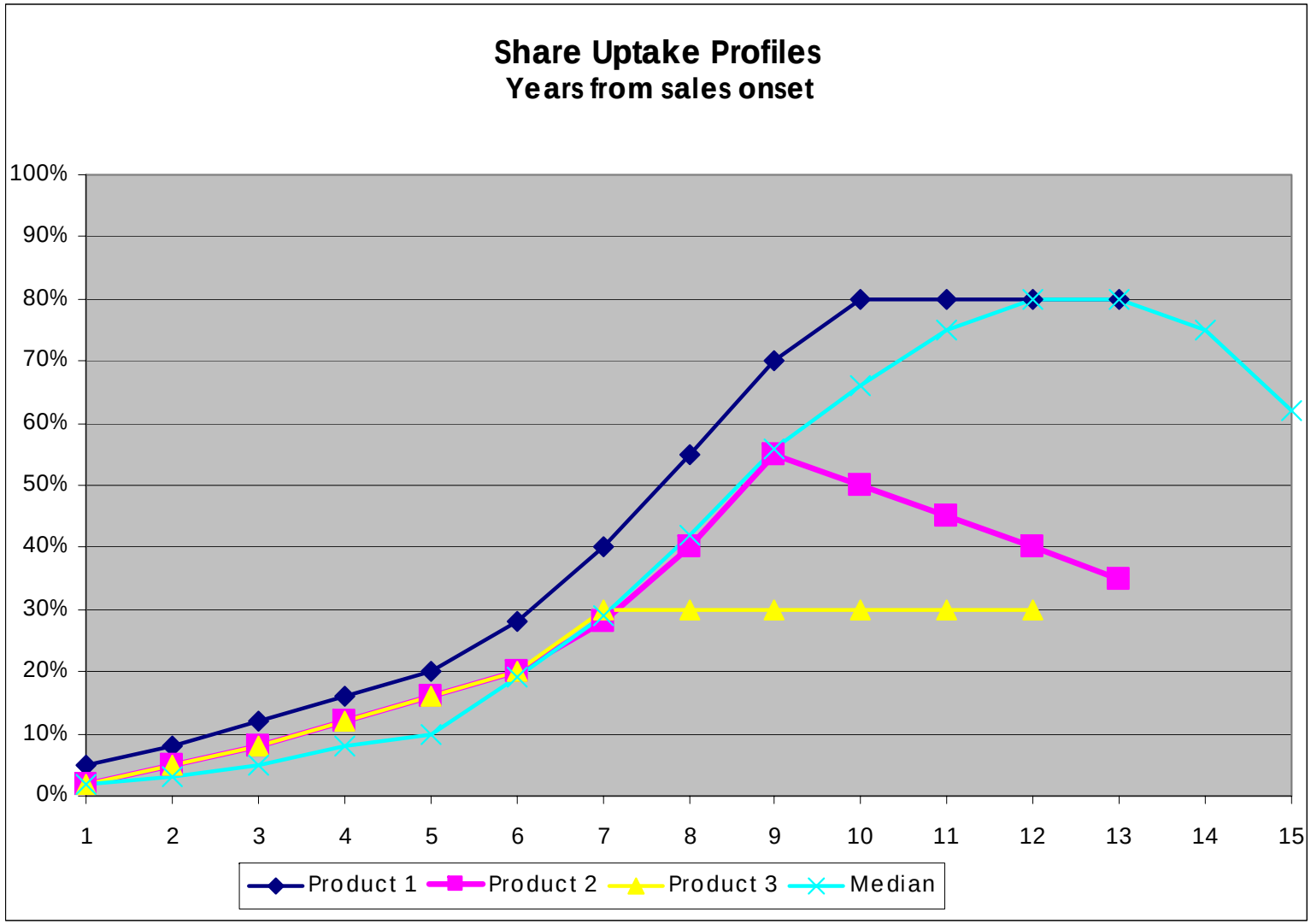
ASSUMPTIONS & SUPPORTING CALCULATIONS:

		Forecast				
	Open/Set Val	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
NPV Discount Factor	10.0%					
Inflation		3.0%	3.0%	3.0%	3.0%	3.0%
Population growth		3.0%	3.0%	3.0%	3.0%	3.0%
R&D spend threshold	$ 320,000	to achieve approval to enter market the next year!				
R&D spend <cum>	$ -	$ 173,333	$ 346,667	$ 420,000	$ 420,000	$ 420,000
# competitors_total	4	4	4	5	5	5
NewDrugCo in mkt		0	0	1	1	1
Other entries		0	0	0	0	0
Other departures		0	0	0	0	0
Other entries/departs <cum>		0	0	0	0	0
Share Capture_max		24.6%	24.6%	19.7%	19.7%	19.7%
Share Capture_trend	Year	SCR1	SCR2	SCR3	SCR4	SCR5
	% of max	5.0%	30.0%	60.0%	85.0%	95.0%
Years in market		0	0	1	2	3
SG&A_variable_%	35.0%	% of gross sales				
% discount	5.0%	per entry				
% premium	-2.5%	per departure				
Drought Reduction Factor		1	1	1	1	1

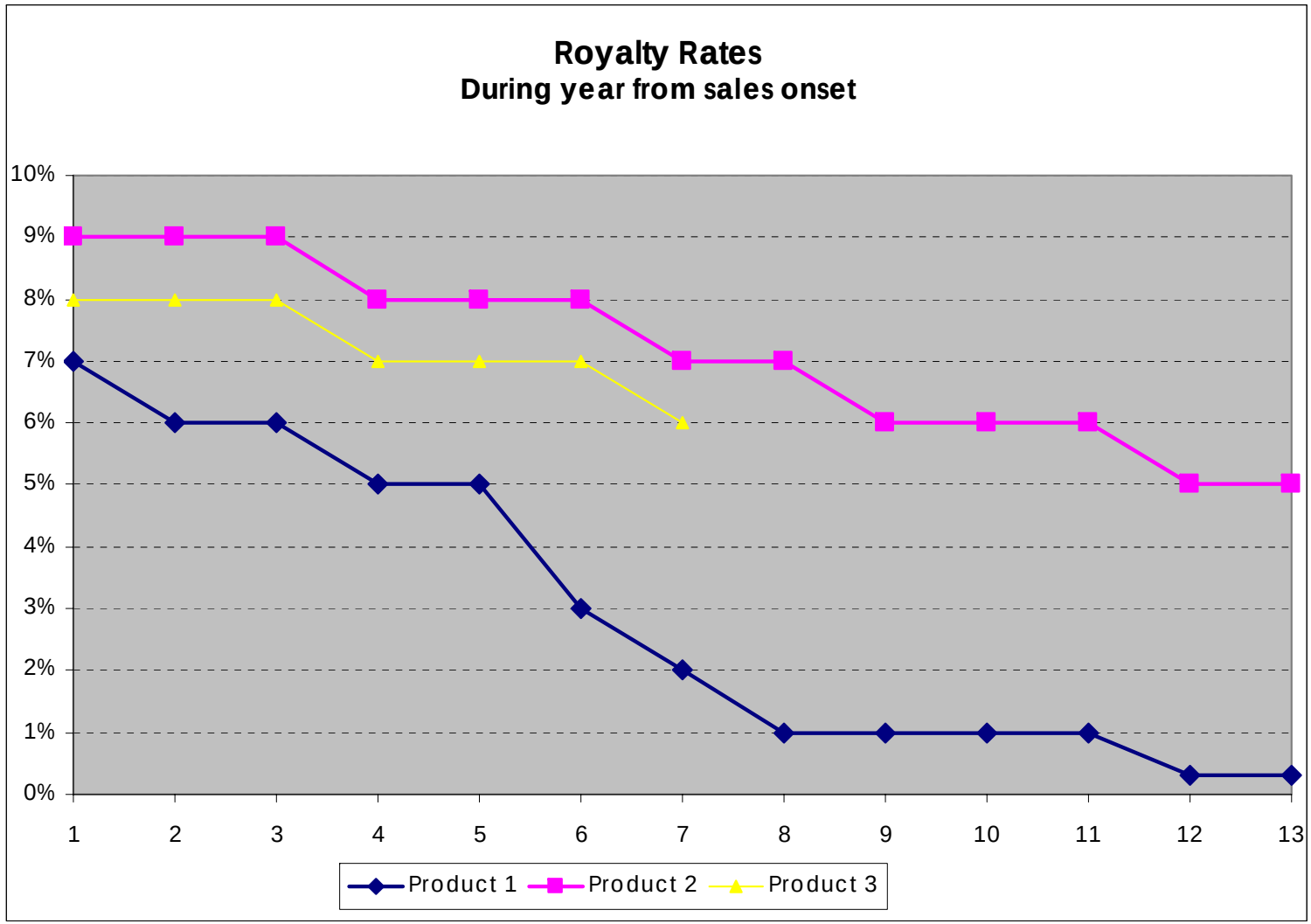
Key assumptions which have been included in the @Risk modelling

- Market sizing – population growth and competitive forces
- Inflation (effectively used to "deflate" nominal data)
- R&D spend
- Market share
- Adoption curve (or market share "trend") – modelled using probabilities around different shaped curves (employing a Bass model)
- Product price
- Selling, general and admin expenses

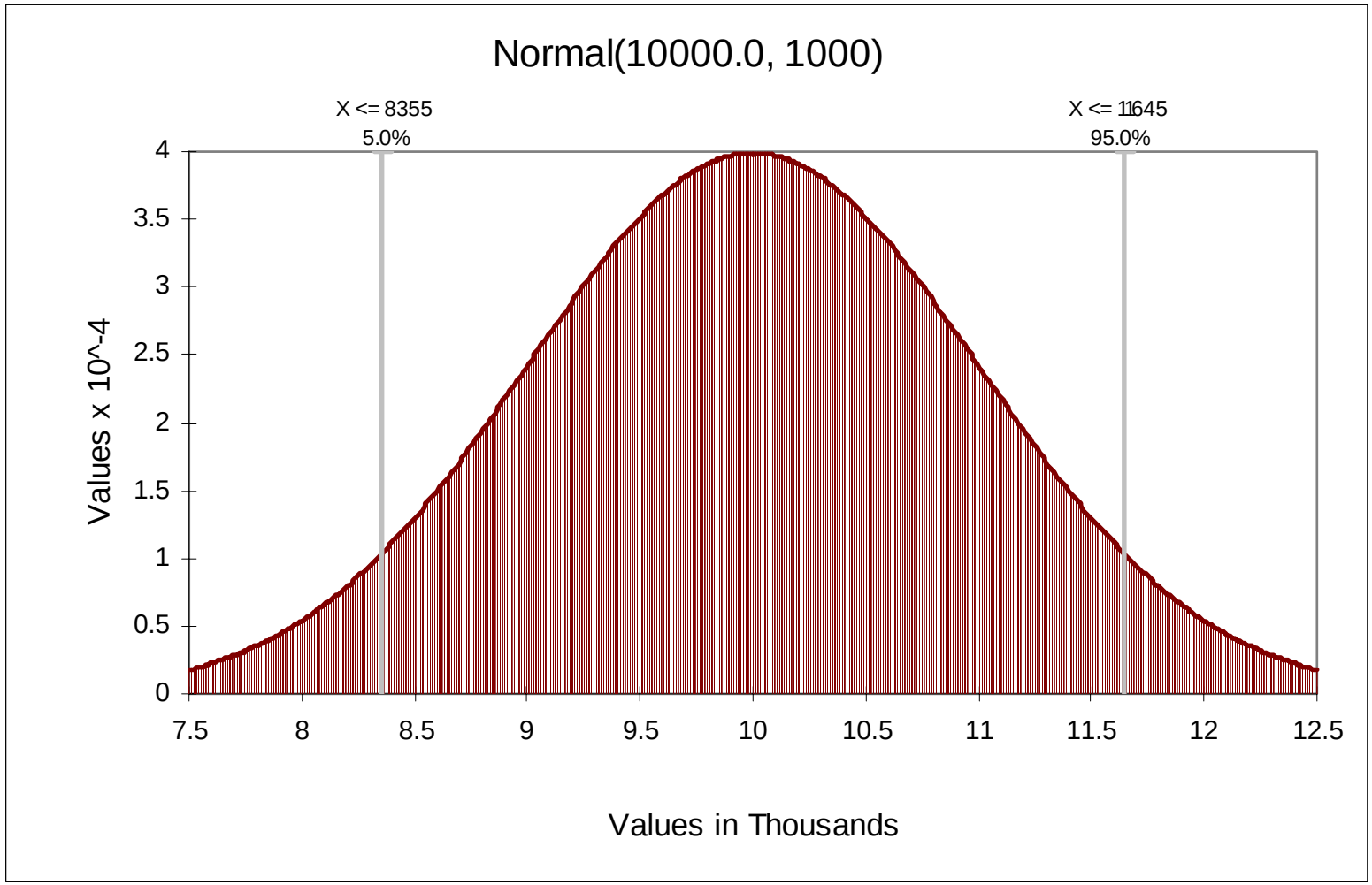
Adoption/share curve may anticipate new entrants…



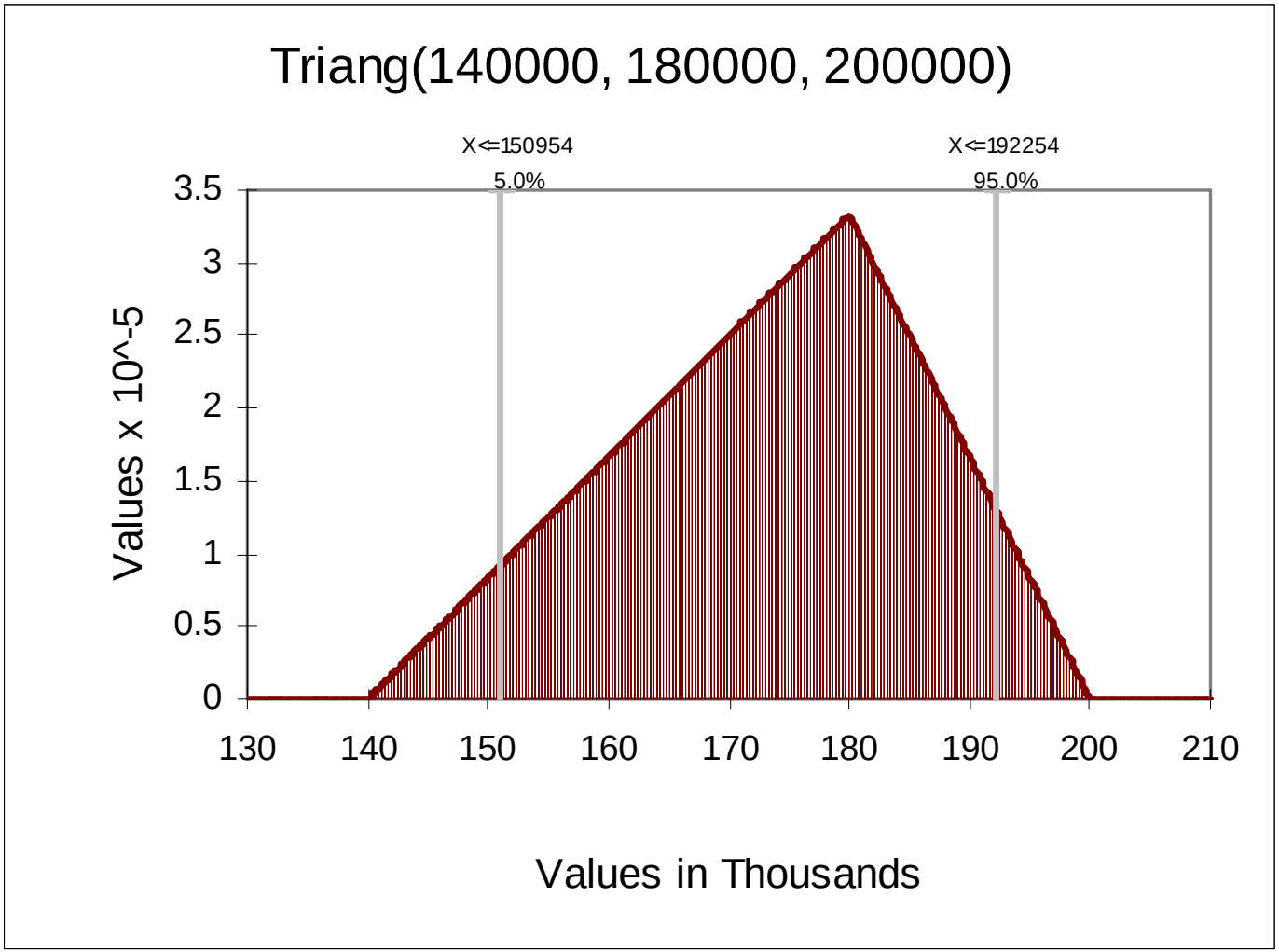
...and Royalty Rates may follow a similar trend:



Product pricing has been determined from a wide range of observations



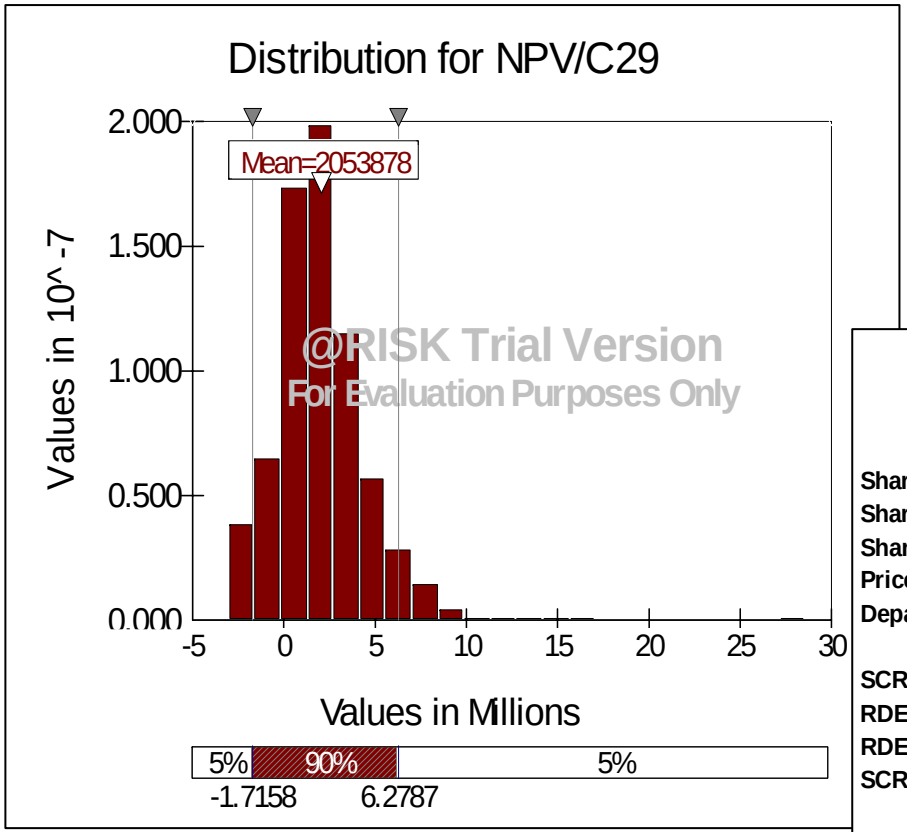
R&D spend is likely to present significant risk of over-run…

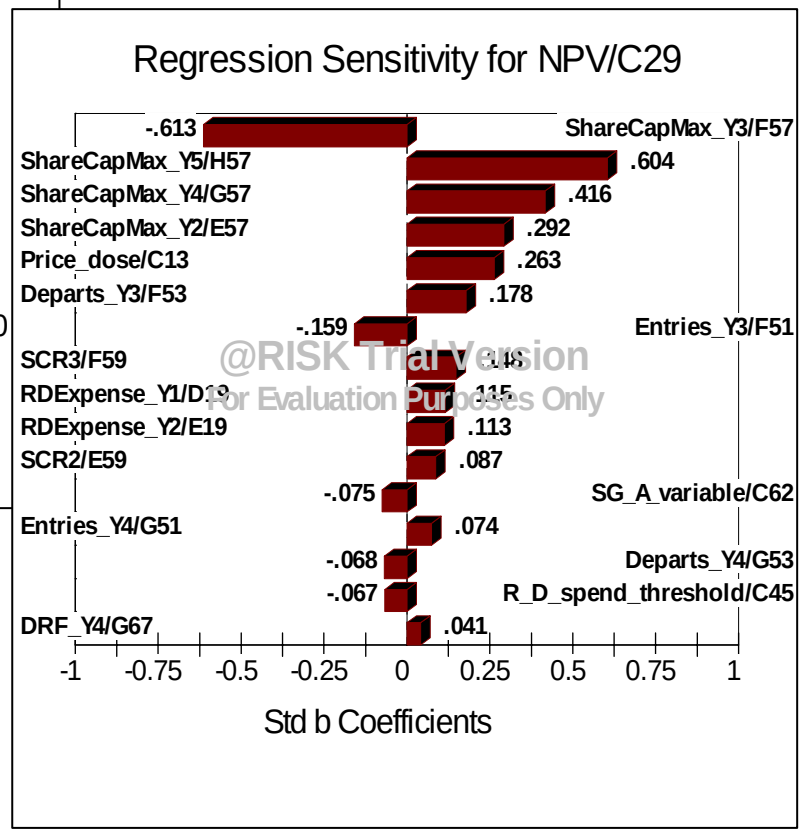


Outcomes are presented in a familiar format and structure…

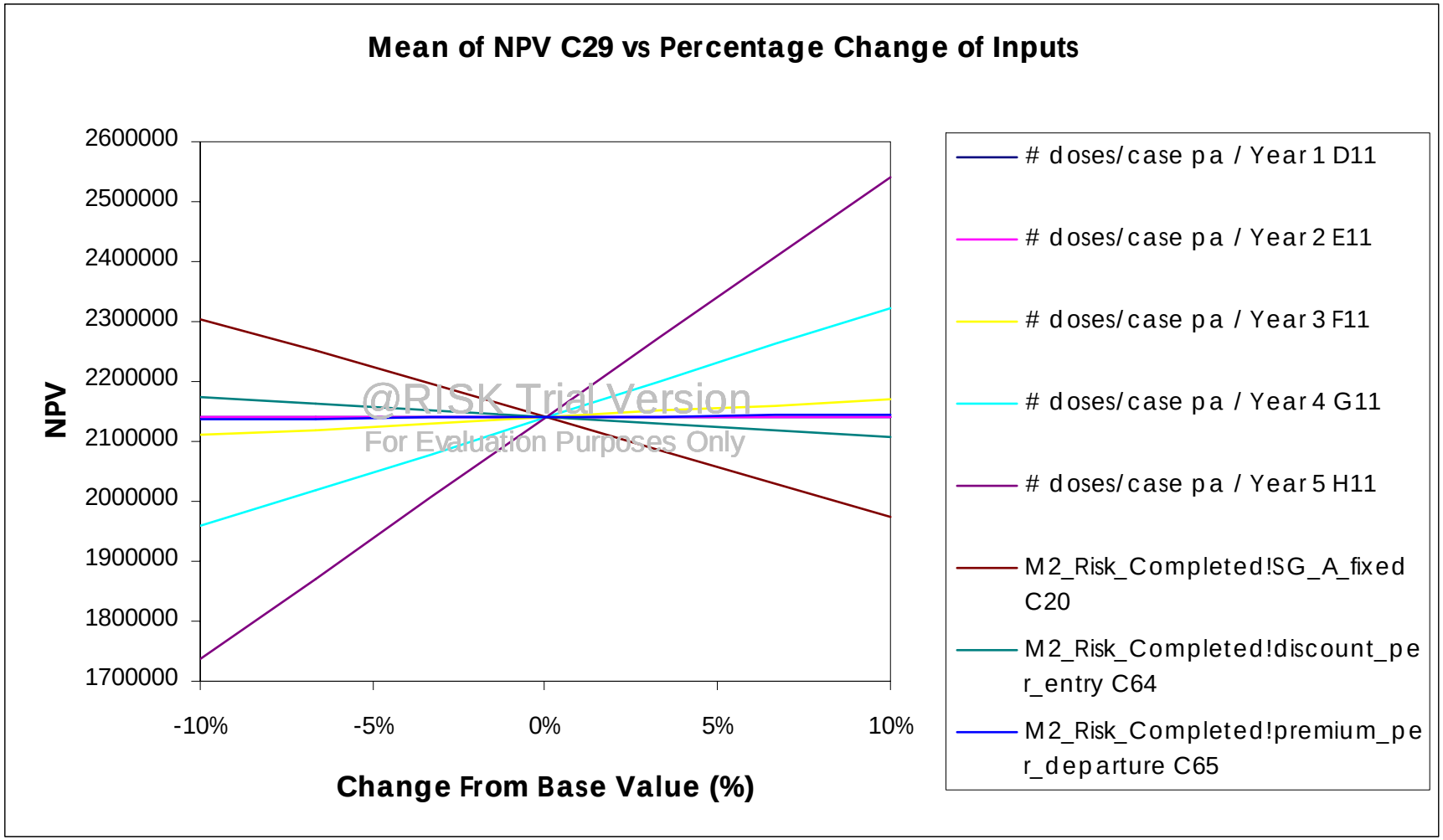
Model	2	RISK MODEL - COMPLETED					
Case	NewDrugCo	***Input variable - not @RISK***		***Input variable - @RISK***		***Output variable - @RISK***	
			Forecast				
		Open/Set Val	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
INCOME							
	# New cases	10,000	10,300	10,609	10,927	11,255	11,593
	# Existing cases	100,000	100,000	110,300	120,909	131,836	143,091
	# Total cases		110,300	120,909	131,836	143,091	154,684
	Market share		0.0%	0.0%	1.0%	5.9%	11.8%
	# cases treated		0	0	1,296	8,442	18,253
	# doses/case pa		10	10	10	10	10
	# doses sold		0	0	12,964	84,424	182,527
	Price/dose	$ 50	$ 52	$ 53	$ 55	$ 57	$ 58
	% discount	0.0%	0.0%	0.0%	5.0%	5.0%	5.0%
	Gross sales		**$ -**	**$ -**	**$ 677,608**	**$ 4,545,119**	**$ 10,121,497**
EXPENSES							
	R&D expense	$ 420,000	$ 173,333	$ 173,333	$ 73,333		
	SG&A_fixed	$ 400,000	$ 412,000	$ 424,360	$ 437,091	$ 450,204	$ 463,710
	SG&A_variable		$ -	$ -	$ 237,163	$ 1,590,792	$ 3,542,524
	Total Expenses		**$ 585,333**	**$ 597,693**	**$ 747,587**	**$ 2,040,995**	**$ 4,006,233**
INVESTMENT SUMMARY							
	Initial investment	$ 2,000,000					
	EBITDA	**-$ 2,000,000**	**-$ 585,333**	**-$ 597,693**	**-$ 69,979**	**$ 2,504,124**	**$ 6,115,263**
	NPV	**$ 2,428,788**					
	IRR	**26%**					

Simple report from @Risk shows most of what we need…



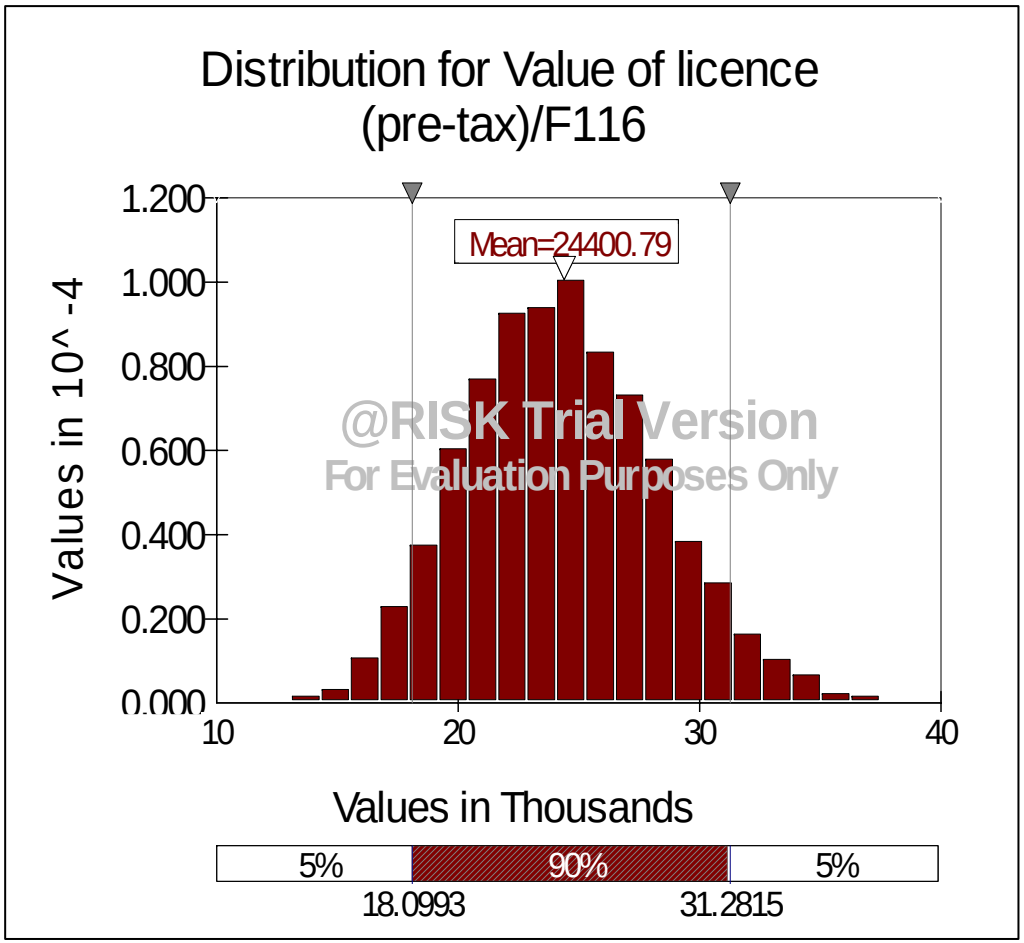


We might wish to show a sensitivity analysis around some key variables



Sometimes there will be unexpected outcomes

The following distribution arose from a technology commercialisation valuation where there were significant milestone payments in the early years:



Selection of distributions

Common sense applies!

Use relationships which are observable, evident from past outcomes and combine with view of how relationships might change in the future

In many cases, getting the distribution absolutely "right" is not super-critical – the overall range of the variables acting in combination is the important part

Examples of relationships/distributions we have observed and used include:

- Product price in a highly competitive market: normal distribution around a "mean" which has been observed over the last three years
- R&D expenditure: budget is likely to be a minimum with the possibility of over-run on cost and time
- Control premium: fairly tightly bounded around 20-30% but recognising that studies show that the observed range is extremely wide – from nil to 80%
- Terminal value in DCF: often relies on renewal of a key agreement (e.g. licence to operate) – modelled as a "switch" with a triangular distribution around the probability of renewal in substitution for an arbitrarily determined terminal value multiple

Some commonly-used @Risk distributions

RiskTriang – triangular distribution

This function can be used for almost all distributions if a "simple" exploration of possible outcomes is required and there is either no reliable data as to distribution "fits"

Triangular distributions might be used for exploring:

Volumes sold

Prices

Discount rates

RiskDiscrete – single-point outcomes

This function is often used for determining the time period in which events or cashflows occur – e.g. year 2, 3 or 4. A probability is associated with each year in this example. It might be 50% chance that the cashflow will commence in Year 2, 40% in year 3 and 10% in year 5.

Conclusions/Summary

- Managers and investors deal with risk and uncertainty on a daily basis
- Rarely is the impact of uncertainty explicitly recognised other than in simple sensitivity analyses
- Traditional business valuations deal with uncertainty in an implicit, "opaque" manner
- Most valuation disputes arise due to the valuers holding different views about the future and the likelihood of different futures emerging
- Whilst the use of @Risk does not completely eliminate the risk of dispute, it is very helpful in explicitly presenting the impact of alternative outcomes
- ASIC and the ATO have recognised the need for probabilistic valuations
- Selection of @Risk distributions is important – but not as critical as taking that first step towards explicitly recognising the power and insight

Capital Value Pty Ltd

www.capitalvalue.com.au

Level 50
101 Collins St
Melbourne Vic 3000
Phone: 03 9653 9388

Level 2
99 Frome St
Adelaide SA 5000
Phone: 08 8111 4035

Michael Churchill
Director
0412 066 019
m.churchill@capitalvalue.com.au