# Strategy@Risk Ltd

**Presentation to:**

*Risk-Opportunity Based Management achieves a sustainable increase in enterprise value over time.*
*It represents an important tool for planning as well as for performance measurement and for controlling purposes*

*"S@R has set out to create models that boost income and save our clients time and money. Our models can give answers to both deterministic and stochastic questions, by linking dedicated ebitda models to holistic balance simulation taking into account all important factors describing the company. The basis is a real balance simulation model – not a simple cash flow forecast model."*

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The purpose of this presentation is not to propose another traffic forecast model but rater to touch upon one issue that affects all forecast models regardless of it's purpose – uncertainty.

Forecast uncertainty can have many sources but two is prominent:
➢ uncertainty in assumptions (exogenous variable) and
➢ uncertainty in the parameter estimation.

Other model and data shortcomings like omitted and extraneous variables and measurement errors etc. will of course also add to possible forecast errors.
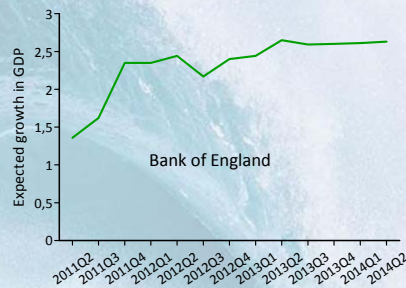
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# Changes in GDP is usually an important factor in traffic forecasts.

Bank of England expects the mean GDP growth rate to develop as in the figure.

o But how much can the growth rate deviate from the mean?

o And what will happen after 2014?
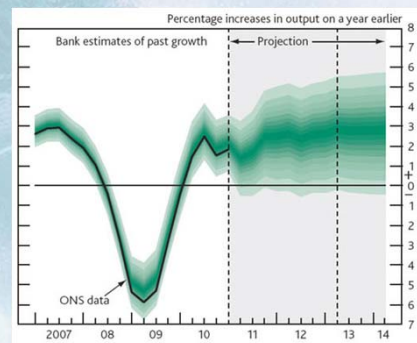


Bank of England

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# Uncertainty in the Assumptions

There is another band on the GDP chart, implied but un-seen, indicating a 10% chance of something unpredictable. The fan chart covers only 90% of the BoE's estimates of the future probabilities.

And what about the changes in:
- Population
- Car ownership
- Infrastructure and transport policy
- Etc.

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## How can you plan for the future when even the past is uncertain?

The uncertainty about the past is a source for measurement errors in the data.

The "Black Swan" will probably only have a small impact on the long term traffic forecasts.

The 'TENconnect' EU project mentions "uncertainty" 12 times and "stochastic" 9 times in their 320 pages report.
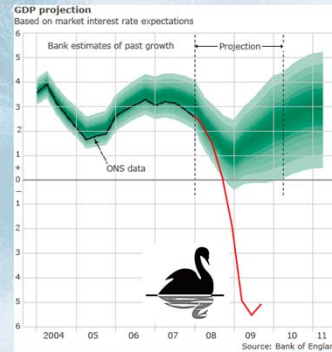
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## Certainty and Uncertainty

*Rather than "Give me a number for my report," what every executive should be saying is "Give me a distribution for my simulation."(Savage, 2002)*
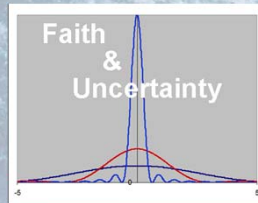
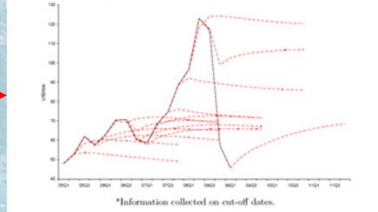Savage, L., S.,(2002). The Flaw of Averages. Harvard Business Review, (November), 20-21

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The Difference between Certainty and Uncertainty
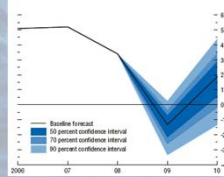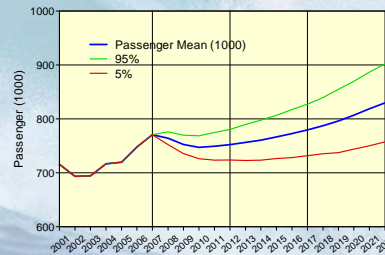
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# But we will use the average values, you say

*The Flaw of Averages states that: Plans based on the assumption that average conditions will occur are usually wrong.* (Savage & Danziger, 2009)

Many economists use what they believe to be most likely or average values as input for the exogenous variables in their spreadsheet calculations.

We know however that:

1.  the probability for any variable to have outcomes equal to any of these values is close to zero,
2.  and that the probability of having outcomes for all the (exogenous) variables in the spreadsheet model equal to their average is virtually zero.

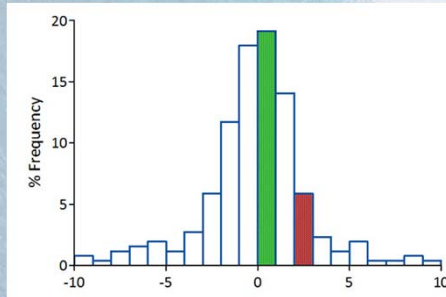Savage, L., S., & Danziger, J. (2009). The Flaw of Averages. New York: Wiley.

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## The Flaw of Averages

But if a small deviation from the most likely value is admissible, how often will the use of a <u>single estimate</u> like the most probable value be 'correct'?



In this case with a Slash distributed variable, using the mean (red bar) would prove you <u>wrong</u> 95 out of 100 times and using the most probable value (green bar) would prove you <u>wrong</u> 80 out of 100 times.

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## The "Flaw of Averages" and Jensen's Inequality

The <u>left</u> side of the inequality: is what we are interested in and what the Monte Carlo model calculates:

The <u>right</u> side of the inequality : is what a projection based model calculates:

$$E[f(X)] \leq f(E[X])$$

E = Expected value, f() = System performance measure (convex), X = Uncertainties that determine the performance

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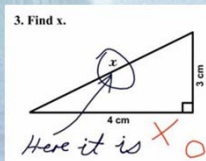
## But we will use Scenario Analysis, you say

You set, each input to its best (or worst) possible outcome and the function is calculated with those values.

The question now is - if this really is the best (or worst) value or if let's say a 95% (5%) percentile is chosen for each input – will that give the 95% (5%) percentile for the resulting function?

From statistics we know that for the joint distribution of (X ± Y) the expected value E(X ± Y) is E(X) ± E(Y) and that Var(X ± Y) is Var(X) + Var(Y) ± 2Cov(X,Y). Already from the expression for the joint variance we can see that this not necessarily will be true.

The Fallacies of Scenario Analysis



Pct. difference in result between the joint distribution and X ± Y for the same standard deviations from mean
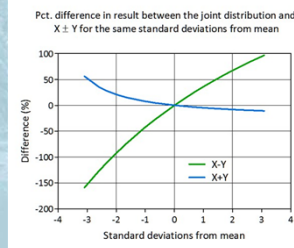
Add to this, an analysis with a large number of correlated stochastic variables, complex calculations, simultaneous equations, and there is no way of finding out where you are on the resulting probability distribution - unless you do a complete Monte Carlo simulation.
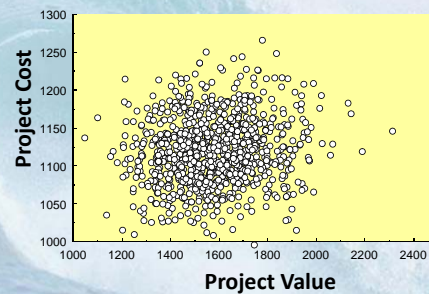
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## The face of uncertainty

Project Cost    (   )                    Project Value    (   )

Uses:
✓ Compare strategic choices
✓ Estimate necessary capital and investment requirements
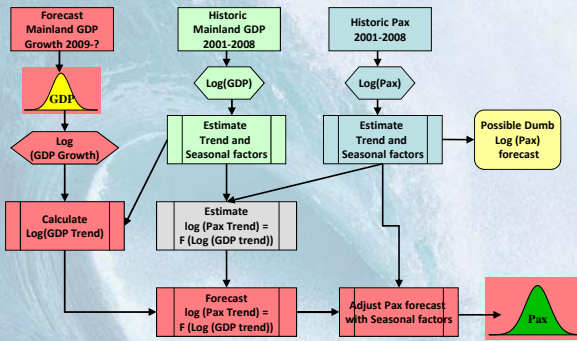✓ Valuations, capital cost and requirements, individually and effect on project



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Forecasting Demand and future variance in Demand

A six step forecast model:
- GDP and fare price development with seasonality will determine the future Pax development
- Income and price elasticity's gives us the possibility to calculate expected change in Pax



Air Travel Demand

What is the effect on Pax of changes in income and price?:

Income and price elasticities gives us the possibility to calculate expected change in Pax:
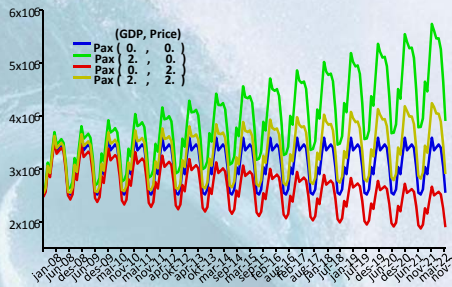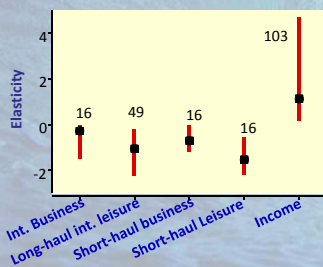
## Total PAX 2001-2006 and Forecast 2008-2022

**Planning and uncertainty:**

- Planning for an uncertain future is a hard task, but preparing for it by adapting to the uncertainties and risk uncovered is well within our abilities

- Not all uncertainty represents risk of loss, but manifestations of opportunities given the right strategy, the means and will of implementation

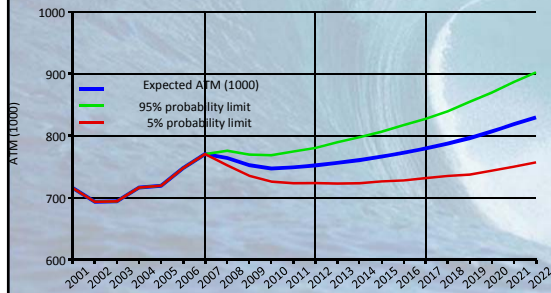http://www.strategy-at-risk.com/2008/09/01/the-advantages-of-simulation-modelling/
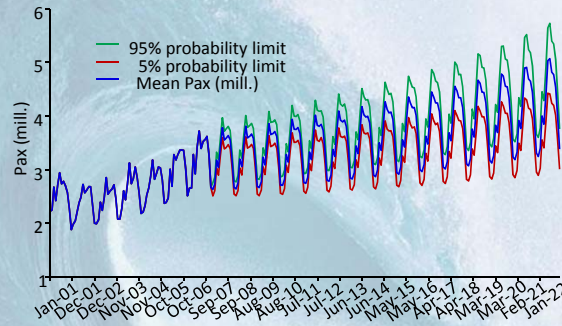
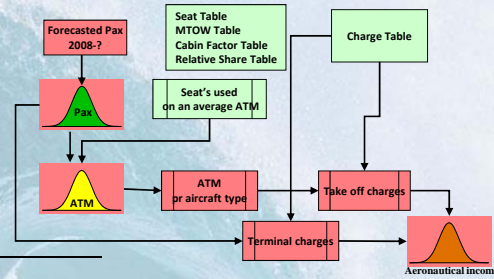15

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## The ATM forecast process
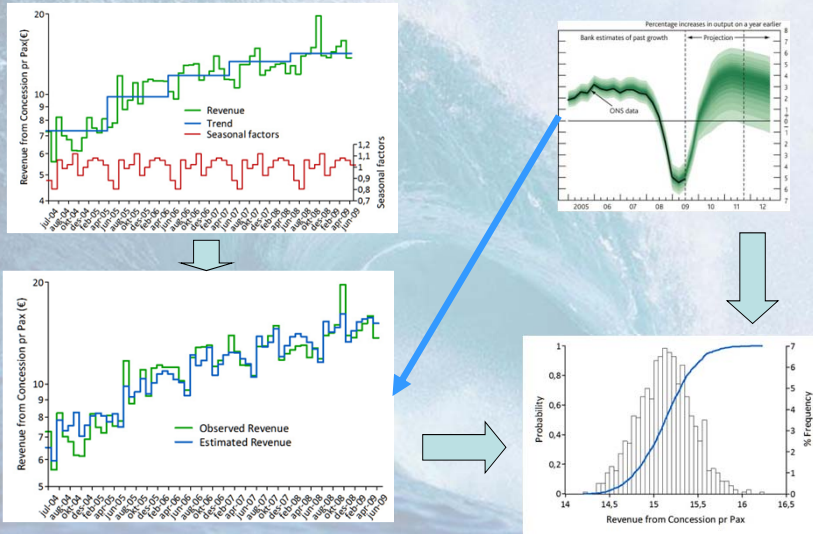### Domestic and International Pax and Cargo

Having forecasted Pax and Cargo the ATM's can be calculated given expected seat factors and airplane types:

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Concessions Revenue Forecast



Having Pax and Cargo, Concessions etc.
we can forecast the yearly EBITDA:

Pax and Freight are main airport income and cost drivers.

All upside and downside (risk) is determined by short- and long-term variation in Pax and Freight.

All future capital costs are determined by current level of investment and future capacity increase induced by Pax/Freight development.

Forecasted Pax and Cargo will also give future minimum investments in air - and land side infrastructure.

EBITDA 2009
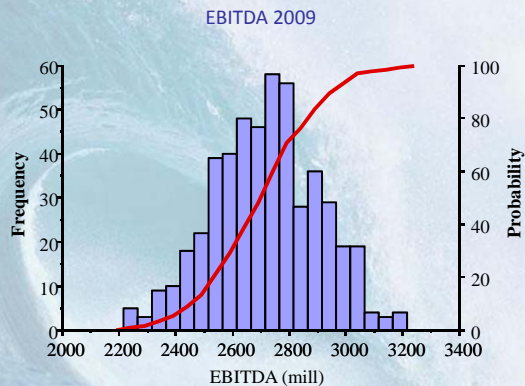
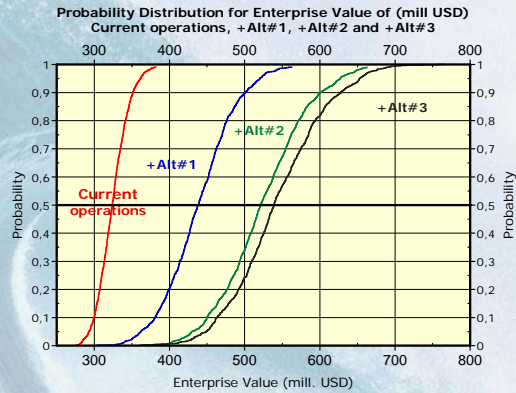## Analyze and compare strategic Investments

If you are looking at investing alternatives or Contemplating possible M&A, the Equity Value distribution's:

1. Location will give an absolute ranking of alternatives
2. Shape will give important information on risk and opportunities
3. Together the give all necessary information for selecting the dominant alternative

**Probability Distribution for Enterprise Value of (mill USD)**
**Current operations, +Alt#1, +Alt#2 and +Alt#3**

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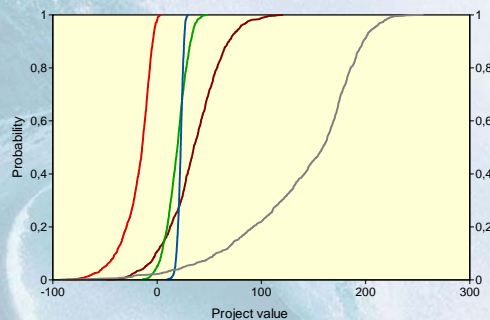## Easy you say, but it could have been like this

Which project should be selected?

? Do you want high value and high risk or
? lower value and less risk?



But, there are methods that can support decision making in situations like this – using stochastic dominance.

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## The Machiavellian formulae

**Costs[1]:**

In 9 out of 10 transportation infrastructure projects, costs are underestimated:

- For a randomly selected project the probability of actual costs being <u>larger</u> than estimated costs is 0.86.
- The probability of actual costs being <u>lower</u> than or equal to estimated costs is only 0.14.

**Demand[2]:**

Forecast inaccuracy is constant for the 30-year period covered: no improvement over time:

- 84 % of rail passenger forecasts are <u>wrong</u> by more than 20 %.
- 50 % of road traffic forecasts are <u>wrong</u> by more than 20 %.

Overestimated revenues
+ Overvalued development effects
– Underestimated cost
– Undervalued environmental impact
= Project Approval

[1]Flyvbjerg Bent, Mette K. Skamris Holm, and Søren L. Buhl (2002), "Underestimating Costs in Public Works Projects: Error or Lie?" Journal of the American Planning Association, vol. 68, no. 3, 279-295.
[2] Flyvbjerg Bent, Mette K. Skamris Holm, and Søren L. Buhl (2005), "How (In)accurate Are Demand Forecasts in Public Works Projects?" Journal of the American Planning Association, vol. 71, no. 2, 131-146.

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# Thank you for listening



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