FAN CHART:

The art and science of communicating uncertainty

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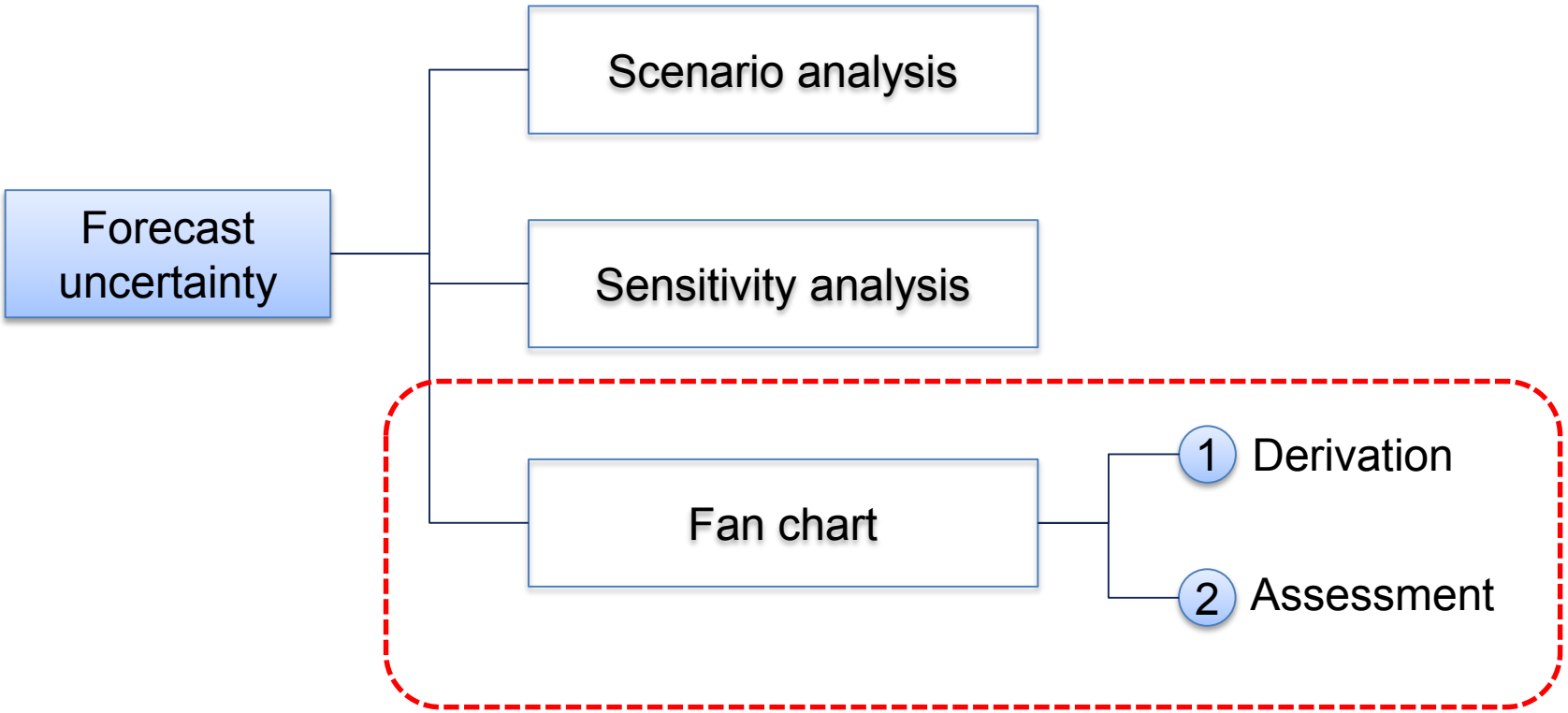
Forecast uncertainty can be assessed in three ways



Constructing the fan chart: Deriving the three key parameters of the fan chart

Parameters	*Derivation method*
1 Central projection	**Baseline forecast** of the variable ie GDP or inflation
2 Uncertainty (Width)	**Historical forecast errors,** adjusted for uncertainty of key assumptions (risks factors) affecting the baseline forecast eg ER, commodity prices, etc.
3 Balance of risks (Skew)	**Linear combination of the skew of risks factors,** obtained from subject matter experts

Historical forecast standard error

$$\sigma_{infl} = \sigma_e \frac{\sum w_i x_i}{\sum w_i \bar{x}_i}$$

Uncertainty of forecast assumptions (now compared to past)

$w_i = elasticity\ of\ assumptions$

$x_i = current\ volatility\ of\ assumptions$

$\bar{x}_i = historical\ volatility\ of\ assumptions$

$$\gamma_{infl} = \sum w_i \gamma_i \qquad \text{where} \qquad \gamma_i = \sqrt{\frac{2}{\pi}}\,(\sigma_u - \sigma_l)$$

Assumptions: 1. Distribution of variable and risks factors are assumed to be TPN

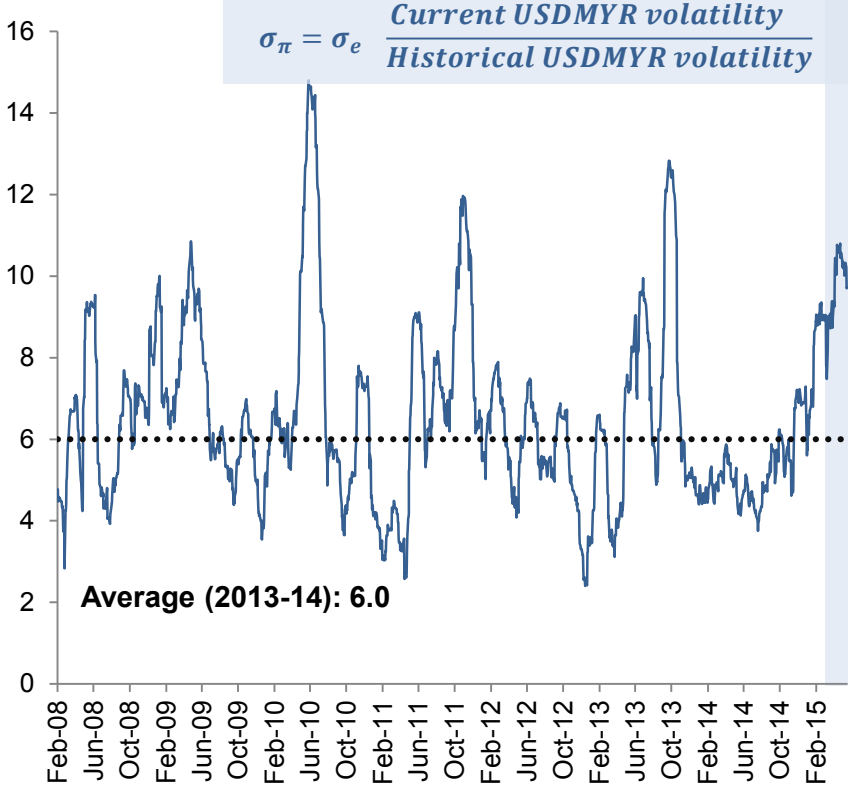
2. Maximum of the analyst forecast represents the upper 90% confidence level and the minimum represent the lower 90%. This is used to compute the upper and lower standard deviation of TPN (σ_u, σ_l respectively)

Width: Forecast uncertainty incorporates the uncertainties of risk factors

- The adjustment to the overall forecast uncertainty is based on the volatility of the assumption relative to the historical value of volatility

USDMYR Volatility
(Standard Deviation of USDMYR)

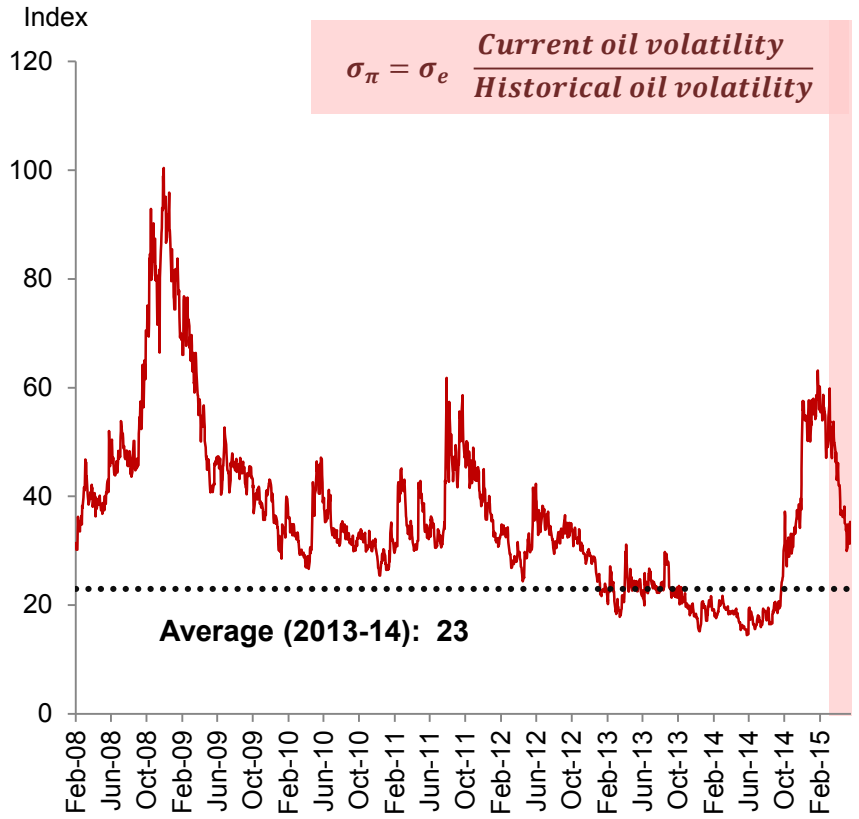
$$\sigma_\pi = \sigma_e \frac{Current\ USDMYR\ volatility}{Historical\ USDMYR\ volatility}$$



Source: Bloomberg

CBOE Oil Volatility Index

$$\sigma_\pi = \sigma_e \frac{Current\ oil\ volatility}{Historical\ oil\ volatility}$$



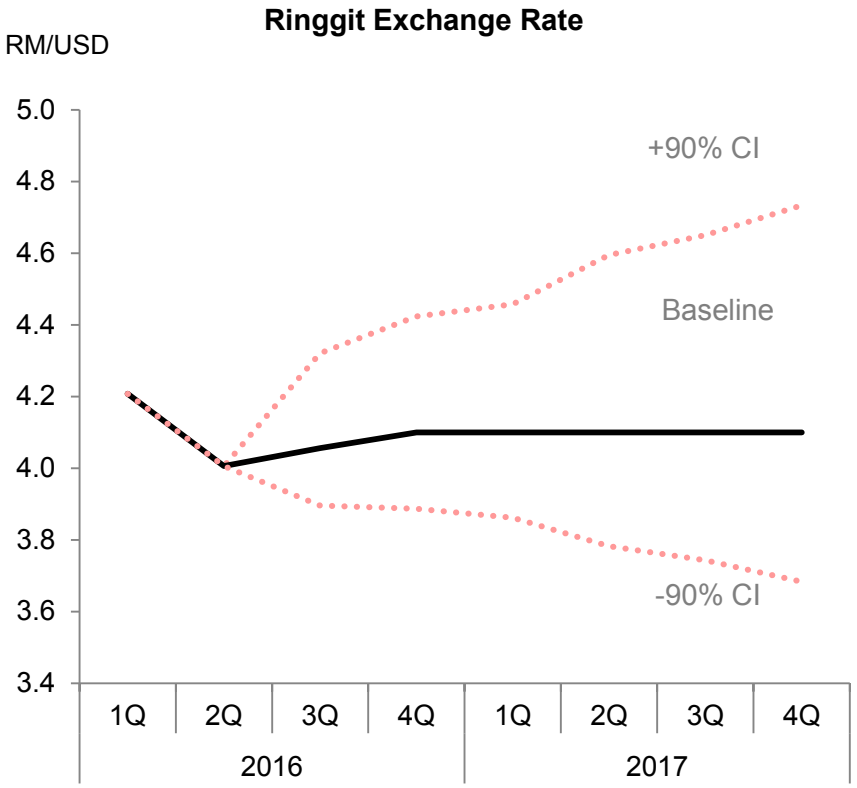
Source: Bloomberg

Main

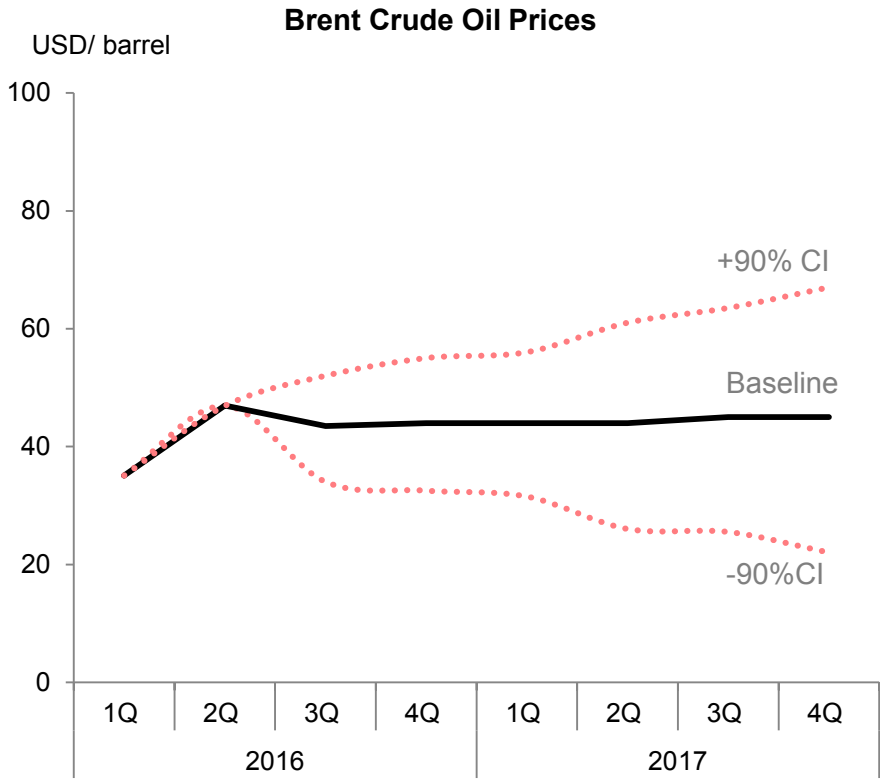
Skew: Overall balance of risk also incorporates the skew of each risk factors

- Balance of risks of each risk factors are obtained from the respective subject matter specialists

Depreciation risks to the ringgit exchange rate



Downside risks to global oil prices

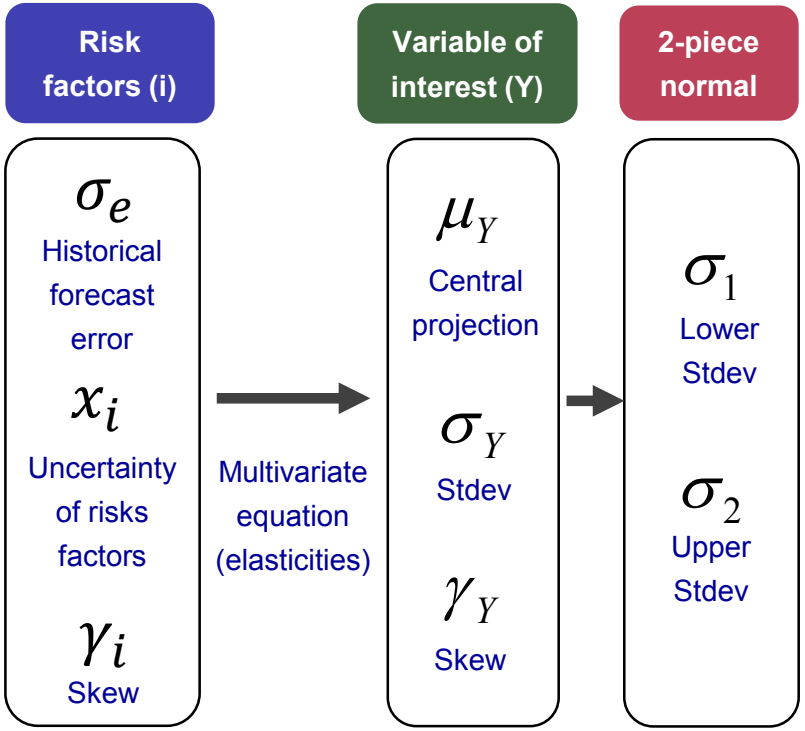


Main

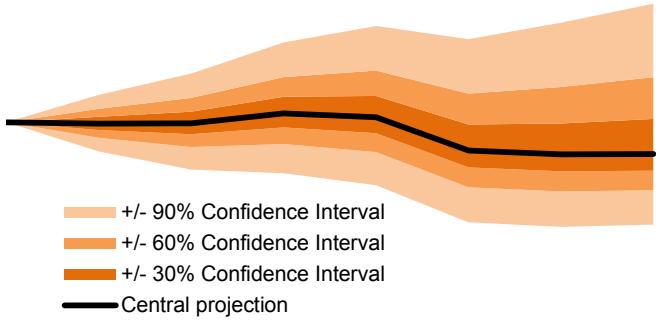
Information of risk factors are incorporated to compute the probability distribution

To construct the fan chart:

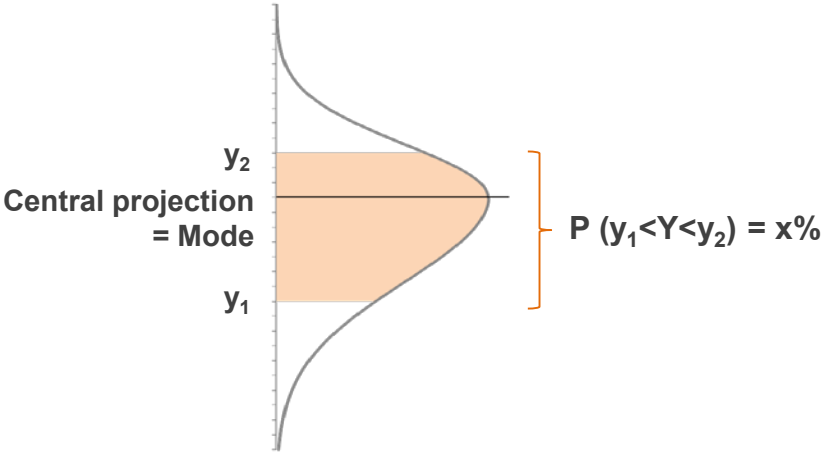
Combine three key parameters using the two-piece normal distribution



A. Deriving upper and lower bands of a fan chart

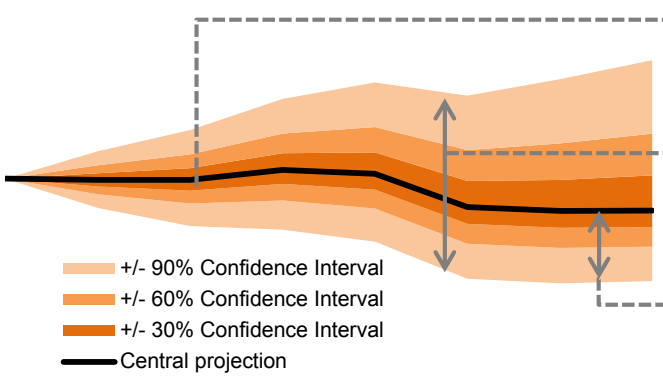


B. Computing probability of a given forecast range



Fan chart enables probabilistic analysis of risks surrounding the forecasts

A. Fan chart provides the balance of risks of the forecasts

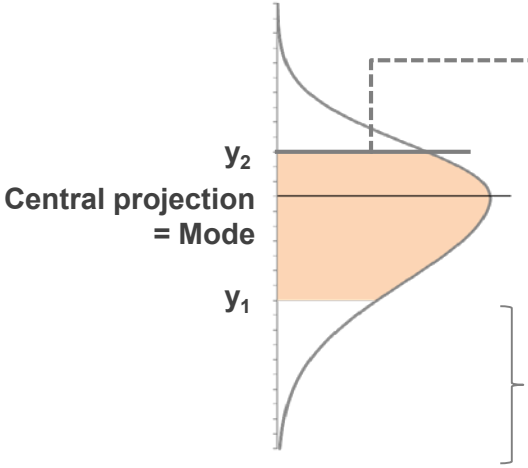


1 Central projection: Baseline forecast
- *Represents the most probable outcome (mode)*

2 **Width**: Level of uncertainty
- *The wider the fan chart, the more uncertain is the forecast*

3 **Skew:** Balance of risks
- *Larger width below baseline indicate downward bias and larger probability of below baseline*

B. Splicing the fan chart provides the probability distribution at any point in time



4 Level at each confidence intervals
- *Eg. Level of inflation at 60% confidence intervals*
- *Help to form forecast range*

5 Probability being within a certain range
- *To determine the downside risks/ upside risks to variable eg probability of inflation falling above a certain threshold*

It contains abundant of information to support policy making

1. ***What level of uncertainty surrounding the forecasts?***

2. ***Where does the balance of risks lie?***

3. ***What contributes to the balance of risks?***

4. ***What is the probability of being within(outside) the forecast range?***

5. ***How has the balance of risks surrounding the forecast have evolved?***

Thank you