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Session 9
Economic Scenario Generators and Model Risk

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Waves of Reforms…Oceans of Opportunities

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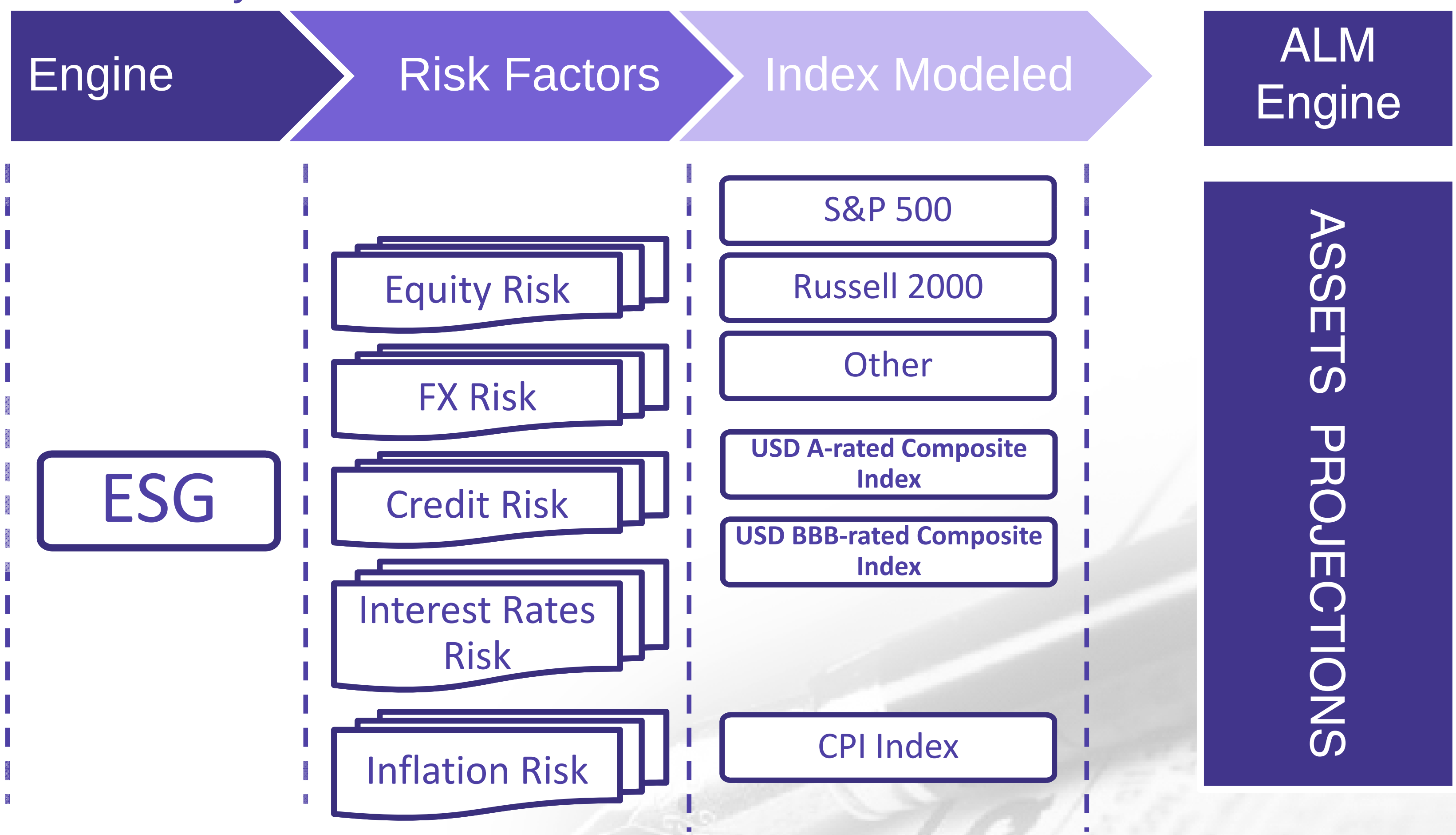
Economic Scenario generators and Model risk

- An ESG will generate multiple scenarios reflecting the risk factors tight to a Currency.



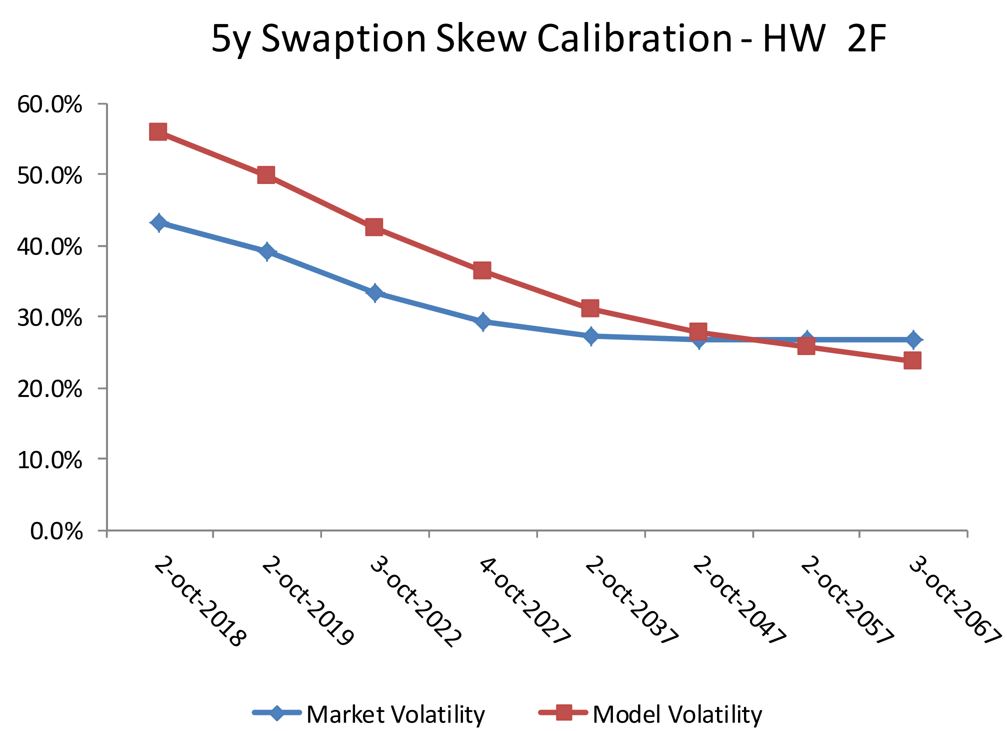
Economic Scenario generators and Model risk

- The modeled indices are used as proxies to model the assets backing the liabilities or backing the free surplus;
- The ALM Engine can go from a simple spreadsheet to an full actuarial projection software;
- In most cases Interest Rate Risk requires to model the full Yield Curve at future time steps in order to reflect liability values in each future date.

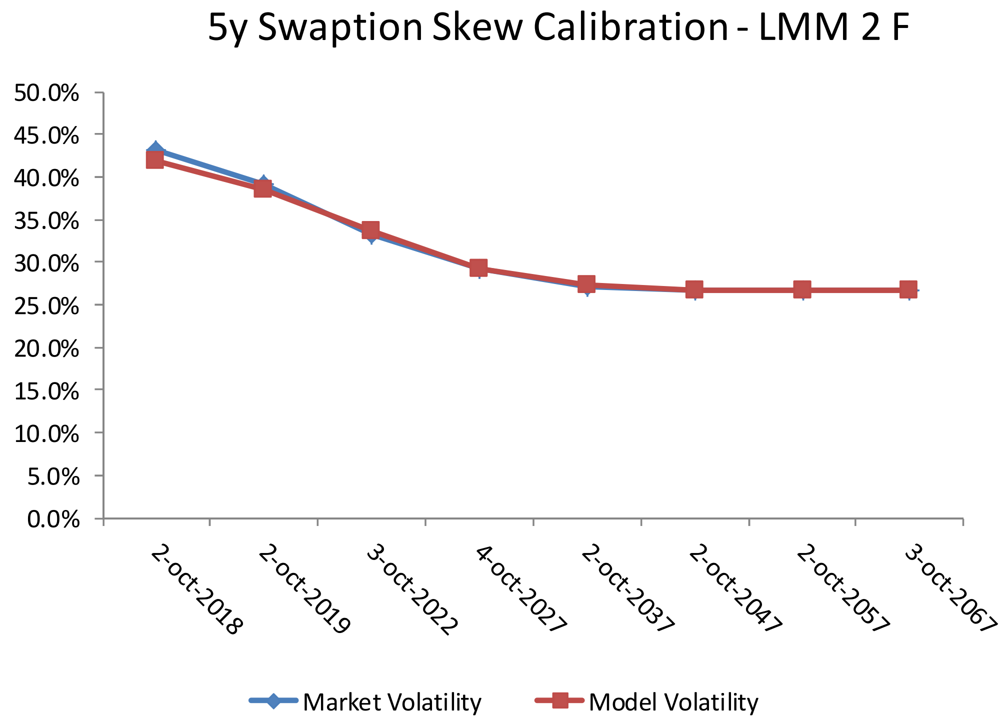
Scenarios	t=	0	1	2	...	48	49	50
Scenario 1	ZCB 1	0.999297	0.999297	0.999297	...	0.998509	0.998728	0.998661
	ZCB 2	0.999252	0.999222	0.999277	...	0.998423	0.998748	0.998567
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	ZCB 600	0.103746	0.151337	0.166203	...	0.129762	0.15942	0.135007
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
Scenario 1000	ZCB 1	0.998612	0.998549	0.998633	...	0.998875	0.998875	0.998875
	ZCB 2	0.998434	0.998553	0.998615	...	0.998684	0.998899	0.998835
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	ZCB 600	0.103746	0.151337	0.166203	...	0.129762	0.15942	0.135007

- Model risk in the Risk Neutral World:
  - Risk Neutral is the measure that captures optionality in the Assets and Liabilities;
  - The model should be set to be market consistent, this is achieved through model “Calibration”;
  - The closer we get to market prices, the **more** market consistent our scenarios are and the **more** market consistent our results are;
  - Model Risk appears when the model is not adequate or calibration not performed adequately

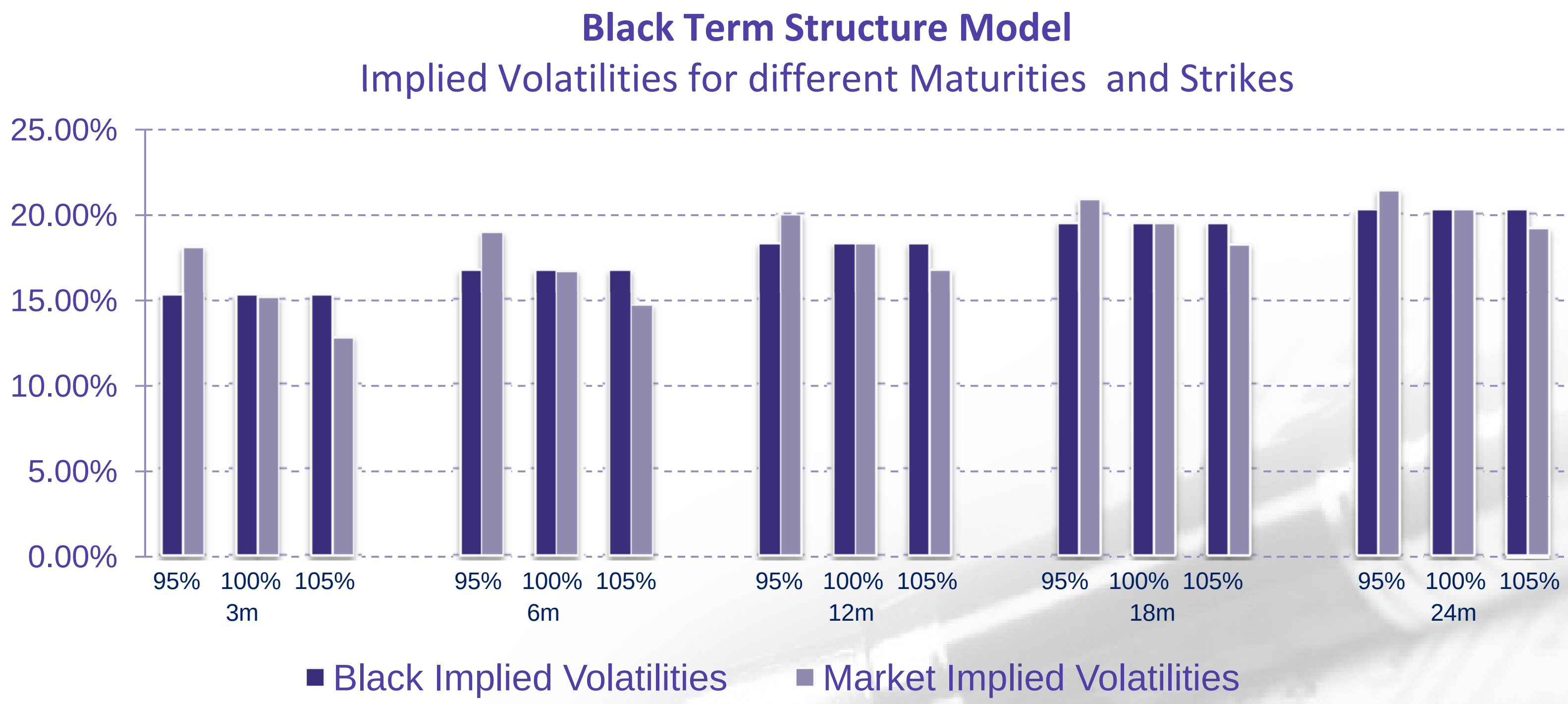
Example 3: Market Consistency for a Single IR Model, the Hull and White 2 factors;



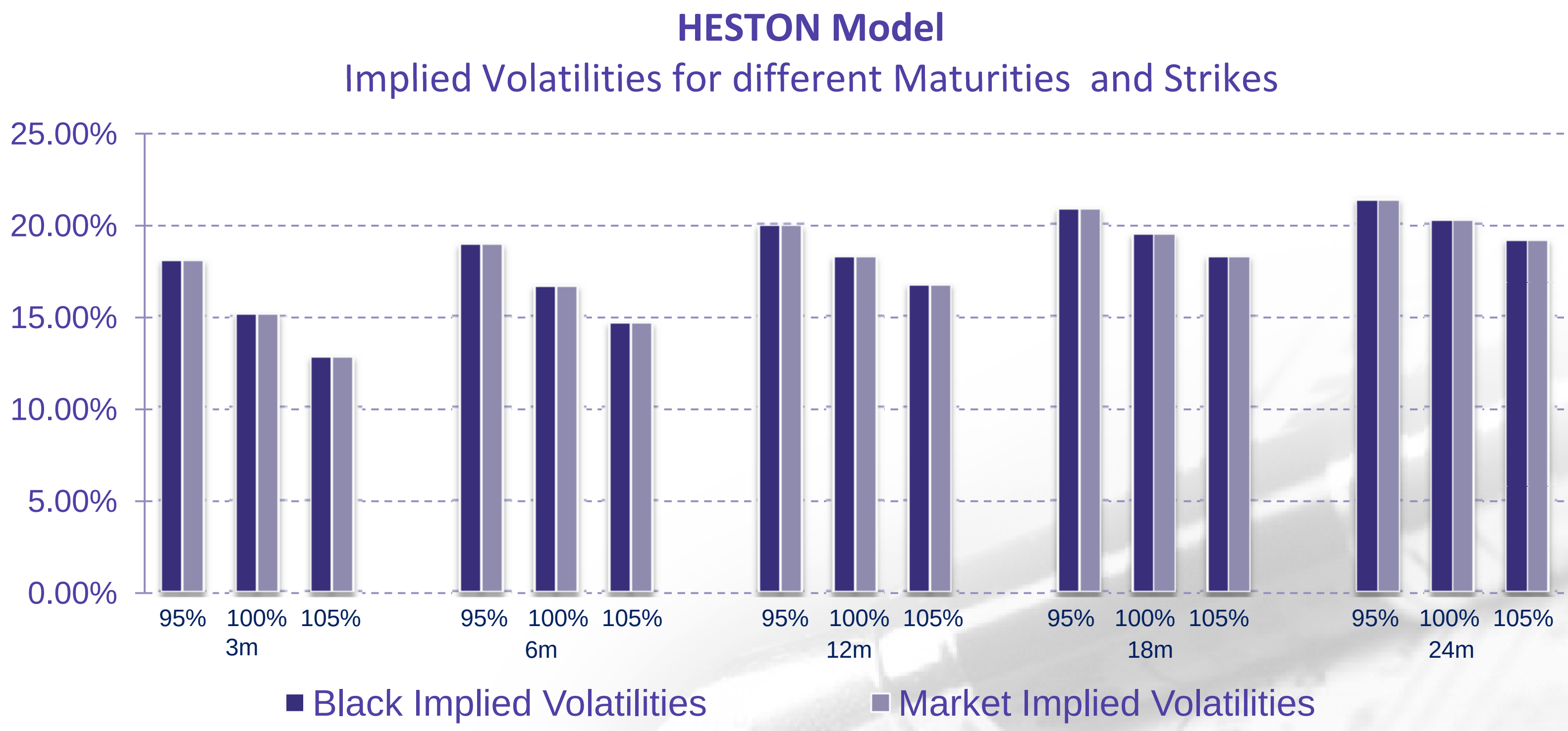
Example 3: Market Consistency for a Single IR Model, the Libor Market Model 2 Factors;



Example 1: Market Consistency for a Single Equity Model, the Black Scholes Term Structure Case.



Example 2: Market Consistency for a Single Equity Model, the Heston Stochastic Volatility Case.



Example 5: What about combining IR model and Equity Model?

Volatility of rates bleeds in the option prices, therefore joint calibration becomes necessary to **perform Joint Calibration**.

Other Issues to consider:

- Does my actuarial model accept negative rates?
- What maximum rate does my model accept?
- My guarantees are sensitive to both rates and equities, they are sensitive to the Rate Equity correlation;

Model Risk in the Context of Economic Scenarios:

- Risk of using a model that is poorly calibrated to market data: Leads to miss-calculated market consistent value;

- Risk of combining multiple stochastic models without joint calibration;

- Risk of using scenarios that are not Risk Neutral “enough” (cf, martingale tests);

- Risk of modifying the structural integrity of economic scenarios to contain the restrictions of an actuarial model;

Thank you

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