New SAG format and approach

Ref	Risks	Control description	Test of Design / Test of Effectiveness	Applicable policies
Volatility data	**Equity asset class**			
	Wrong local volatility construction/interpolation lead wrong Price	The interpolation of volatility surface should be offer the calendar arbitrage.	Fit a C12 function with respect to time to maturity for each strike for the bid and ask quotes of the volatility surface and find the statistical distribution of the error function.	
	Wrong local volatility surface construction/interpolation lead wrong Price	The interpolation of volatility surface should be offer the butterfly arbitrage .	Fit a C12 function with respect to strike as variable for each time to maturity for the bid and ask quotes of the volatility surface and find the statistical distribution of the error function.	
	Dynamic arbitrage free local volatility interpolation lead wrong Price	The interpolation of volatility surface should be dynamically arbitrage free.	Use the Fenglar~\cite{Feng2012} method draw the arbitrage free interpolation which gave the dynamic arbitrage free price and hence the implied volatility. Compare these volatilities with the given volatility surface and find the statistical distribution of the error function.	

Technical Annex of Pricing Model Validation

Ref	Risks	Control description	Test of Design / Test of Effectiveness	Applicable policies
	Wrong Stochastic volatility surface calibration lead wrong Price	Check the if the pure SVI parameterization is used to build the stochastic volatility surface, which is may not be smooth and should be restricted to near ATM volatility.	Perform the check of the SVI time dependent parameter calibration with given closed form solution against the SVI time independent parameters and check the error in volatiltiy surface.	
	Wrong Local Stochastic volatility surface calibration lead wrong Price	Check the if local stochastic volatility surface is built converges to local volatiltiy and pure volatility.	By Switching off the vola vol parameter the volatility surface should converge to local volatility surface and by using the mixing factor one the volatility surface should converge to the pure stochastic volatiltiy surface.	
	FX asset class			
	Wrong local volatility construction due to prime currency convention lead wrong Price	Check the market convention for the prime currency	Find the G10 new market convention to decide the which currency should be prime currency for the volatility construction.	
	Wrong local volatility construction due to delta included quotes lead wrong Price	Check the market convention for the Delta included in the premium convention for the volatility surface construction	Find the new market convention to decide if the delta included premium are quoted or not and if it is included in calculating the implied volatility surface.	
	Wrong local volatility construction of	Check the market convention for	Find the if the sticky delta surface or	

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	volatility convention lead wrong Price	the volatility surface type is used in the given currency pair.	sticky strike surface is used for the given currency pair.	
	Wrong local volatility surface interpolation for sticky delta lead wrong Price	The interpolation of sticky delta volatiltiy surface should be offer the calendar arbitrage.	Fit a C12 function with respect to time to maturity for each delta for the bid and ask quotes of the volatility surface and find the statistical distribution of the error function.	
	Wrong local volatility surface interpolation sticky delta lead wrong Price	The interpolation of volatiltiy surface should be offer the butterfly arbitrage .	Fit a C12 function with respect to delta as variable for each time to maturity for the bid and ask quotes of the volatility surface and find the statistical distribution of the error function.	
	Wrong volatility interpolation for sticky strike lead wrong Price	The interpolation of sticky delta volatiltiy surface should be offer the calendar arbitrage.	Fit a C12 function with respect to time to maturity for each strike for the bid and ask quotes of the volatility surface and find the statistical distribution of the error function.	
	Wrong volatility interpolation sticky strike lead wrong Price	The interpolation of volatiltiy surface should be offer the butterfly arbitrage .	Fit a C12 function with respect to strike as variable for each time to maturity for the bid and ask quotes of the volatility surface and find the statistical distribution of the error	

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			function.	
	Dynamic arbitrage free local sticky strike volatility interpolation lead wrong Price	The interpolation of volatility surface should be dynamically arbitrage free.	Use the Fenglar~\cite{Feng2013} method for the sticky delta draw the arbitrage free interpolation which gave the dynamic arbitrage free price and hence the implied volatility. Compare these volatilities with the given volatility surface and find the statistical distribution of the error function. **Note:** Sticky strike is the less or more same algorithm as of Fenglar 2012. But keep in mind to include the extra correct drift term (Domerefrate-forRefrate).	
	Wrong sticky delta Stochastic volatility surface calibration lead wrong Price	Check the if the pure ASVI parameterization is used to build the stochastic volatility surface, which is may not be smooth and should be restricted to near ATM volatility.	Perform the check of the ASVI time dependent parameter calibration with given closed form solution against the SVI time independent parameters and check the error in volatiltiy surface.	
	Wrong Local Stochastic volatility	Check the if local stochastic volatility surface is built converges to local volatiltiy and	By Switching off the vola vol parameter the volatility surface should converge to local volatility surface and	

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	surface calibration lead wrong Price	pure volatility.	by using the mixing factor one the volatility surface should converge to the pure stochastic volatiltiy surface.	
	Wrong Local Stochastic volatility surface **short dated** derivatives could be wrong.	Check the if local stochastic volatility surface has the flying skews at short maturity (below 7 days).	Check if the flying skew are captured by the jump diffusion process..	
	Fixed income derivative			
	Wrong volatility conventions lead wrong Price	Check the volatility convention of the fixed income market based on diffusion process	For the negative rate underlying the diffusion should be normally distributed or shifted lognormal distributed.	
	Wrong volatility transformations lead wrong Price	Check the volatility transformations from different underlying process and their limitations.	Perform the transformation of the volatility surface based with unique density function approach. The change in retrieved density function error function should be reflected in price change and model reserves.	
	Wrong volatility transformations to avoid basis spread lead wrong Price	Check the volatility transformations from different underlying process (e.g. CAP below 1 year quoted with 3 months FWD rate and above with	Perform the transformation of the volatility surface based with approximating the functional form of the density function . The scalability	

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		6M FWD rate) is in place.	of the functional form should be challenged in given market scenarios.	
	Wrong volatility stripping lead wrong Price	Check the volatility stripping for the CAPs is done properly.	Perform the additive stripping algorithm with correct discount factors with closed form solution for only plain vanilla quotes.	
	Wrong volatility interpolation lead wrong Price	Check the volatility interpolation for Swaption and CAPs is done properly.	Perform the SABR interpolation only for lognormal case. In normal volatility case the interpolation method should be based on advanced mapping solution of SABR with correlation = 0 case.	
	Wrong volatility extrapolation lead wrong Price	Check the volatility extrapolation for Swaption and CAPs is done properly.	Perform the SABR extrapolation only for lognormal case with not low strikes and long maturity. For the two special cases Use the shifted ZABR (Hunt's approximation with shifts) in case of normal volatility extrapolation and perform the check against that method with given volatility.	
	Market Conventions			
	Wrong market conventions for day count convention lead	Check the day count conventions used for the time to maturity	The day count convention for time to maturity is according to ISDA rules.	

Technical Annex of Pricing Model Validation

Ref	Risks	Control description	Test of Design / Test of Effectiveness	Applicable policies
	wrong price, wrong VAR and wrong Economic capital requirement (FRTB)			
	Wrong market conventions for the discounting convention lead wrong price, wrong VAR and wrong Economic capital requirement (FRTB)	Check the discounting is done as per new CSA agreements	: If the counter party has the CSA agreement signed with bank or not will lead the different discounting convention.	
	Wrong conventions for the cash settlement price could lead the wrong discounting convention lead wrong price, wrong VAR and wrong Economic capital requirement (FRTB)	Check the deal priced has the cheapest to deliver option.(mostly with Fixed income deals and equity structured deals)	: If the counter party has the cheapest the deliver the deal should be using the discounting of the that currency/curve stripping from bond price od that entity.	
	Wrong strike conventions could lead the wrong price, wrong VAR and wrong	Check the strike is relative, absolute or moneyness convention	The strike convention is taken into properly into the pricing formula and also in risk factor calculation	

Technical Annex of Pricing Model Validation

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	Economic capital requirement (FRTB)			
	Wrong rolling convention could lead the wrong price, wrong VAR and wrong Economic capital requirement (FRTB)	Check the rolling convention is in place.	The rolling convention is in place, the discount factor and forward rate convention should be changed accordingly.	
	Wrong retesting date convention could lead the wrong price, wrong VAR and wrong Economic capital requirement (FRTB)	Check the rolling convention is in place.	The differ resetting date convention should not be included in pricing as the basis spread risk.	
	Wrong cut off day convention could lead the wrong price, wrong VAR and wrong Economic capital requirement (FRTB)	Check the cut off day convention in place.	The cut-off day convention should be as per trade sheet which is driven by ISDA agreement.	
	Pricing Methods			
	The model assumptions are not	Model assumptions are challenged and controls are in	Assess the assumptions used for the , underlying , volatility and discount . Verify	

Technical Annex of Pricing Model Validation

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	correct leading to the underperformance of the model.	place to ensure that the assumption are clearly stated.	that the correct process (stochastic or deterministic) is used for the: Underlying, Volatility and Discount factor.	
	The Payoff function and boundary condition are not adequately defined. Risk of wrong price, VAR CVA etc.	The payoff function and boundary conditions are verified..	Assess if the payoff reflects the product. Assess the boundary conditions. Verify if the payoff function is in line with described product. Verify if the boundary conditions are properly taken.	
	Calibration instruments (trade sample) are not chosen to reflect all the market scenarios..	FI/FM ensures that the calibration instrument has enough ITM and OTM derivatives with short and long time to maturity	Verify if the ITM market instrument with short maturity and long maturity are chosen. Verify if the OTM market instrument with short maturity and long maturity are chosen. Check whether the calibration results for ITM for maturity varying from short dated to long dated. Check if the calibration results for OTM for maturity varying from varying from short dated to long dated	
	Risk of unstable numerical solutions leads wrong price and risk parameters.	The stability of numerical solutions is controlled.	Verify if the test on numerical stability of the Solutions are done. Verify if the analytical or numerical convergence of solutions has been	

Technical Annex of Pricing Model Validation

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			proved. Check the Numerical stability results (with the same scheme or w.r.t. to another method) Verify the convergence test results.	
	Risk of Unstable Greeks would lead to wrong hedges.	Check if the Greeks are stable and reflect the market movement.	Verify if checks of the stability of Greeks are done. Verify if the Greeks capture the market movement. Check if the test for first and second order Greeks parameters are stable. Check if the market movement is reflected by Greeks parameters. (Hedge is correct or Not).	
	Risk that the limitations of the Model are not identified.	Check if the limitations of the model are specified clearly.	Verify if the limitations of the model are specified w.r.t. the strike and maturity. Check if the model priced for various strikes and maturities matrix is within the error range.	
	PD Test			
	Wrong PD leads wrong XVA,FRTB and Economic capital cost	Check If the PD is drawn from statistical model has finite first order and 2^{nd} order moments.	Find the first order and 2^{nd} order moments.	

Technical Annex of Pricing Model Validation

Ref	Risks	Control description	Test of Design / Test of Effectiveness	Applicable policies
	Wrong marginal of the process leads wrong PD and hence XVA,FRTB and Economic capital cost	Check if marginal of the process for the PD has the distribution based of Moments .	Verify if the distribution is based of marginal's.	
	Single movement for the PD leads wrong XVA	Check if the Joint distribution of probability of default is asymmetrical or symmetrical.	Based on joint pdf , the combined probability of default follows the necessary statistical rules.	
	Wrong PD correlation leads wrong XVA,FRTB and Economic capital cost	Check the if the covariance matrix of joint probability of default is relevant.	Verify the positive semi definite test of co variance matrix.	
	Wrong choice of indicator for the PD leads wrong results for XVA,FRTB and Economic capital cost.	Check if the indicator for the PD (time series for the entity) not part of only credit trading market.	Verify the liquidity of the PD indicator and the if it is independent of actively traded instrument or not.	
	The time series dominated by noise leads to wrong PD and hence XVA,FRTB and Economic capital cost.	Check the residual noise of the time series.	Verify the noise limits are identified and clearly sets in.	