Défis actuels de la finance : nouvelles approches théoriques et gestion des risques bancaires et financiers

CEPN – LAGA Université Paris 13

Quelques réflexions sur le risque de modèle

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AGENDA

A. Modeling within financial institutions
B. Selected topics
C. Model risk drivers
D. Internal governance and risk model management
E. Challenges
F. References

MODELING AS PART OF DIFFERENT DECISION MAKING PROCESSES (1)

MARKET TRANSACTIONS AND DERIVATIVES PRICING & HEDGING

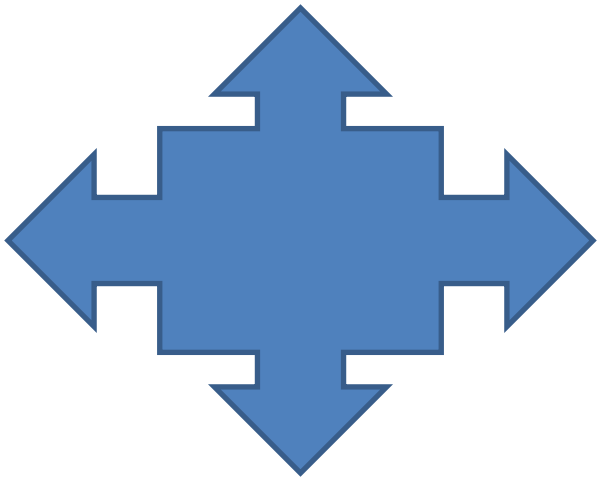
ASSET MANAGEMENT

CREDIT SUPPLY

SAVING AND DEPOSIT BEHAVIOR

CASH FLOW & PROFITABILITY

RISK REWARD MEASUREMENT



COUNTERPARTY AND TRANSACTIONS RATINGS MODELES

FIRM WIDE & PORTFOLIO BASED RISK MEASURES :

- Credit risk
- Market risk
- Operational risk
- IRBB
- Liquidity
- Other risks

RISK MANAGEMENT SYSTEMS AND GOVERNANCE

CAPITAL AT RISK MEASURES : REGULATORY AND ECONOMIC CAPITAL

FIRM WIDE STRESS TESTING

CAPITAL RATIO DEFINITION & CAPITAL ALLOCATION

REGULATORY CONSTRAINT ACCORDING TO SCAP / PILLAR 2

MODELING AS PART OF DIFFERENT DECISION MAKING PROCESSES (2)

- SHORT TIME TO LONG TERM HORIZON :
  - Real time pricing and hedging
  - Long term credit financing
  - ALM models and Balance sheet for long term financing strategies
- FINANCIAL INNOVATIONS
  - Product complexity
  - Market interaction and growth
  - Increasing competition
- STRATEGIC DECISIONS IMPACTS
  - Financial markets : Pricing ,mark to market and hedging / P&L strategies
  - Regulatory capital : RWA and Regulatory Capital / Leverage and deleveraging
- COMPLEXITY
  - Mathematical
  - Data intensive
  - Subjectivity
  - Comprehensiveness
  - Limitations
- MODELS INTRINSIC FRAGILITY
  - Over engineering
  - Data complexity
  - Non stability
  - Major assumptions (Efficient Markets, ../..) breakdown within crisis
  - Capability to model

Example # 1 / Credit and market risks frontiers for derivatives exposure measurement

❑ Key issues :

- Stochastic Potential Future Exposures measurement for OTC derivatives
- Asset and liquidity assumptions for risk horizon and delay to replace defaulted transactions
- Default risk measures through market based prices , spreads, equity
- Integration of risk capital in economic capital measurement and stress testing : proxys and correlation assumptions

❑ Selected assumptions review :

- Correlation between default and exposure value (« Wrong way exposures »)
- Correlation between market risk drivers and credit risk drivers for joint loss distribution
- Risk Neutral versus Real Risk models :
  - Multifactor Stochastic diffusion model "trends" (real world versus neutral risk) is highly sensitive for potential future exposure levels (upwards or downwards shifts);
  - Valuation models assumptions;
- Liquidity assumptions

❑Transaction credit terms and portfolio devices :

- Risk mitigation contract terms integration leading to collateral valuation margin calls and deposits
- Implied options within derivatives contracts (see portfolio break clauses embedded within bilateral agreements,..)

Example # 2 / Portfolio credit models

- Issue : credit losses measurement for large scale portfolio of assets and credits
- "Convergence" of market standards hence most of the "devil" lies in assumptions
- Assumptions leading to key choices :
  - Losses measurement and valuation :
    - Mark to loss
    - Mark to market
    - Mark to model
  - Risk horizon and asset liquidity
  - « Through the Cycle » or « Point in Time » for credit ratings and default probabilities (see consequences for pro cyclicality)

- Risk drivers modeling assumptions
  - Default model and rating transitions
  - Correlation model choice and calibration
  - Other dependencies
    - Default risk and exposure at default
    - Recovery rates and default risk (« Downturn LGD »)
    - Contingent risk model for credit guarantees, CDS, etc

- Transaction specificities integration (classical financing loans, complex structures, retail pools, derivatives

- Portfolio dynamics integration over long time period horizon

Example # 3/ Data modeling issues

- Diversity of data :
  - Market data
  - Benchmark
  - Internal collection – see Basel 2 Pillar 1 - , ../..
- Distribution law models :
  - EVT / Non Normal “Extreme” laws may bring “solutions” to the limits of standard assumptions (normal, log normal, etc), several difficulties :
    - Limited size of samples for correct fitting; non capability to perform validation tests
    - Robustness through time of models
  - Complexity for correlations
  - Adoption by Competitive & complete market
- Past and future :
  - Model capability to reflect the past and reflect the potential futures outcomes
  - Implied probabilities for model results
  - Major breakdowns and rupture integration in models
- Non observable factors

Example #4 / Metrics, probabilities and scenario based approaches/practices(1)

❑ **Probability/distribution based approaches leads to different metrics** :

- "Body based" distribution indicators : standard deviation and average
- Tail indicators : VAR, Conditional Tail VAR / Expected Shortfall

❑ They are key to understand/capture the patterns of the risk providing the fact that the input are correctly modeled

❑ Multi criteria analysis is necessary but may be considered as "too complex", ***but*** "unique" sets of indicators is generally not sufficient to summarize complete information

❑ Probabilistic approaches & metrics properties :

- Normative due to standardization of metrics ***for identical*** confidence interval level
- Coherent should they satisfy coherent risk measure axiomatic

❑ Risk allocation remains a complex issue :

- Correlation and interdependencies effect across sub portfolio / business unit
- Accuracy of measures at granular levels
- Consistency between global metrics and metrics displayed at sub portfolio/business unit
- Additivity
- Incentives and criteria to adopt between :
  - Variance based allocation to reflect "specific" firm risk
  - Tail based allocation to reflect "systemic risk"

Example # 4 / Metrics, probabilities and scenario based approaches (2)

❑ **Scenario based approaches / stress testing *are complementary* to full probabilistic modeling**

❑ Range of practices covers

- Different set of scenarios (Historical, Hypothetical, Adverse)
- Potentially larger integration of experts (scenario definition,
- More complex are "reverse back" stress test (identify the scenario leading to a XX M EUR Loss ? or finding set of parameters maximizing portfolio loss) due to the large number of risk/business drivers

❑ Consistency with probabilistic methodologies :

- Stress test measurement could either focuses on P&L volatilities or "extreme events"
- Since "Extreme events" are captured by capital models at high level of confidence, consistency needs to be achieved between capital models and stress tests severity
- Stress test severity measurement needs to be discussed together with the corresponding "frequency" rate (see economic based hypothetical scenario or aggregation of stress losses for different scenarios)

❑ "Buy In" Issues

- Comprehensive approaches
- Credibility could be an issue ("unrealistic" assumptions, amounts of losses, discussion points concerning the subjective perception of assumptions and results)
- Needs to be integrated into Risk/Business lines decision management schemes

❑ Both practices needs to be used :

- Consistency is necessary
- Conditional loss stress testing as a further step

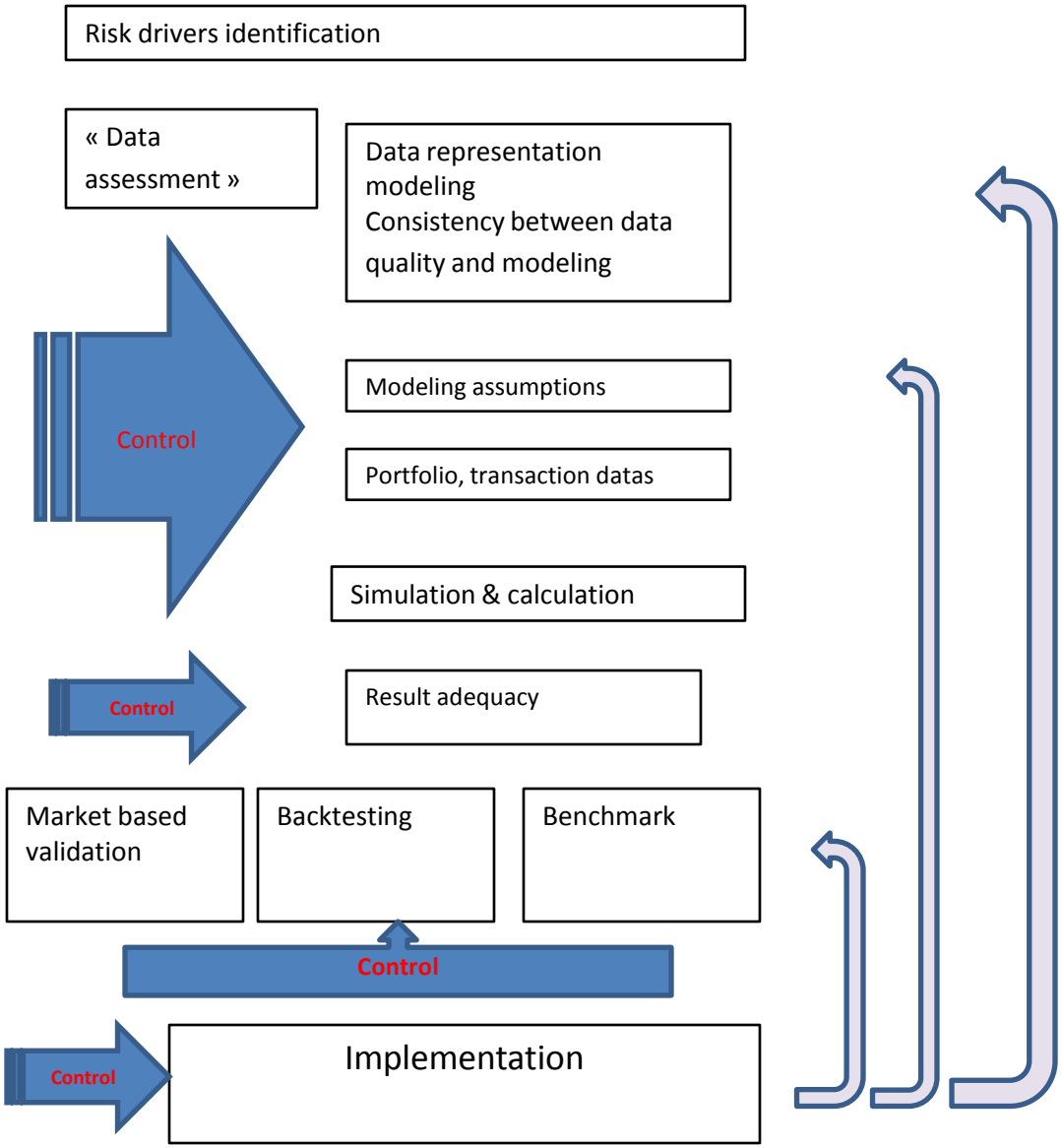
MODEL RISK HAS SEVERAL DIMENSIONS

- ❑ MODEL CAPABILITY TO REPRESENT COMPLEXITY
- ❑MODEL THEORETICAL FRAMEWORK RELEVANCE
- ❑MODEL MISSPECIFICATION
- ❑INADEQUATE ASSUMPTIONS
- ❑ MODEL PARAMETER ERROR CALIBRATION
- ❑ DISCREPANCY BETWEEN PRICING AND HEDGING
- ❑ MODEL OVERALL RESULTS INADEQUACY
- ❑ERROR IN IMPLEMENTATION
- ❑UNABILITY TO BACKTEST
- ❑../..

MODEL RISK MANAGEMENT PRACTICES AND MITIGATION

- Validation assumptions
- Measuring model risk :
  - Back testing
  - Sensitivity analysis
  - Measure of parameters errors
  - Measure of models errors
  - Measure of non appropriateness of values and results
- Internal governance
  - implement permanent supervisory for control and validation
  - Independence from developing entities
  - Integration of different know how (“quants”, operational experts, and senior management,)
  - Decision tracking process
  - Senior management buy in
- Risk model « hedging » and pricing
  - Price integration
  - P&L reserves
  - Capital charge (Add on ; example of EL vs Provisions for regulatory credit risk)
- Regulatory intervention
  - Model review and validation
  - Pillar 2 review of non regulatory Pillar 1 models
  - Capital charge

MODELING « CYCLE » SHOULD INTEGRATE VALIDATION STEPS AND "BACKTEST" LOOPS



- Set up controls and key stages / steps
- Model & Performance Indicators
- Set up parallel chains of controls and validation (Ex = default probability and recovery events versus models predictions. Ex = P&L market transactions moves explanation/ VAR Back test)
- Building parallel infrastructures and data collection
- Feed back loops on business patterns changes

DISCUSSION TOPICS AND CHALLENGES

❑ Internal practices issues

- Recognize “ex ante” and identify model limitations and range of result validity with confidence interval assessement
- Managing complexity and model limitations through multiple expertise
- Implementation of model validation governance
- Maintain in long term strong expertise
- Pay attention to “over engineering” consequences
- Focus on key assumptions consequences
- Develop Senior Management Buy In
- ../..

❑ Financial and banking systems issues

- Pooling of interest versus competition
- Transparency versus competition
- Diversity versus standardization
- Endogenous risk transmission
- “Market” capability to integrate alternative framework for pricing models
- “Systemic risk “amplifications (ex pro cyclicality and Point In Time versus Through The Cycle assumptions, ..)

❑ Modeling challenges

- Tractability of complexity in modeling
- Alternative models to standard assumptions framework
- Error measurement modeling
- Risk perception of extreme events and subjectivity
- Other risk “areas” for modeling

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