ICAAP quantitative tools

Pillar 2 risk quantification and capital planning

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AGENDA

1. Global Overview
2. Risk identification
3. Risk quantification
4. Capital planning

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ICAAP QUANTITATIVE TOOLS

Leveraging on its experience and in line with market practices, Avantage Reply has developed several assets for the ICAAP covering risk quantification and capital planning.

Flexible and easy to use, it provides financial institutions with a toolkit which allows them to easily perform internal assessment of the following risks and integrate outcomes into decision-making processes.

This tools are covering the following themes:

1. Risk identification
2. IRRBB
3. Credit Concentration risk
4. Operational risk
5. Capital planning

Risk identification
Self-assessment for
Material risk identification

IRRBB
Sensitivity of EVE and NII

Credit Concentration Risk
HHI Methodology

Operational Risk
Value at Risk calculation

Capital modeling and planning

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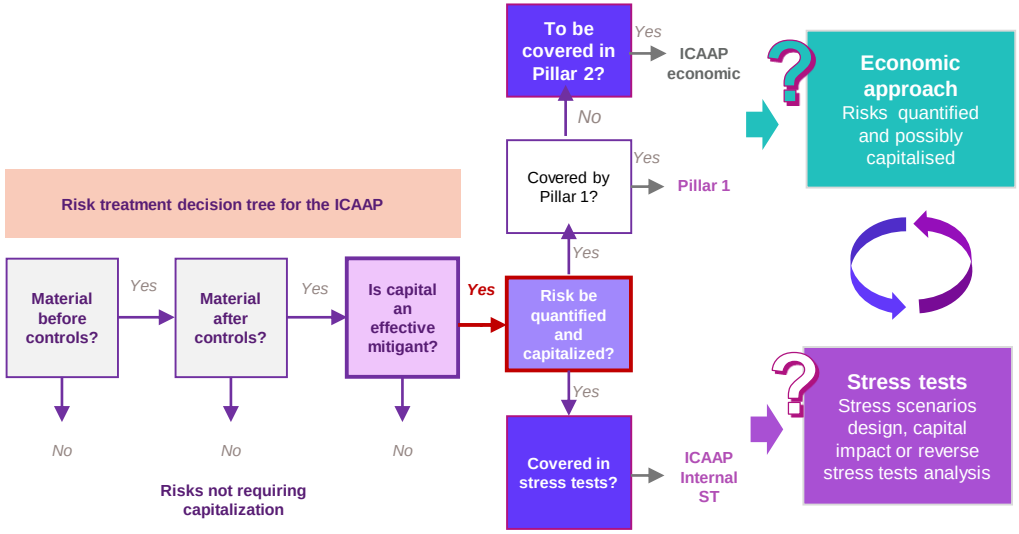
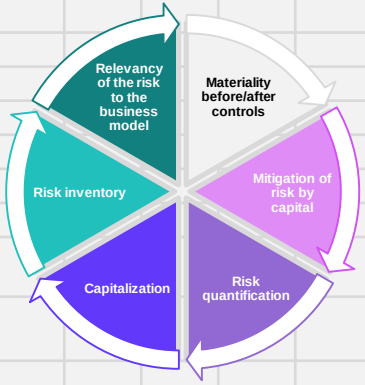
RISK IDENTIFICATION
Practical tool for Material risk identification

Tool 1	**Risk identification**
Tool 2	Risk Quantification
Tool 3	Capital planning

- Based on its experience, Avantage Reply has developed **a self-assessment for the material risk identification processes**.
- It is based on a series of questions to **qualify the risks to which the bank is exposed.** This assessment is based on :



Risk inventory	
Credit risk	Credit default
	Concentration risk (Credit)
	Sovereign risk
	Counterparty credit risk
	….
Market risk	Traded market risk
	IRRBB
	FX risk in the banking book
	Concentration risk (Market)
	….
Op risk	…
ALM risks	…
Strategic risk	…
…	…



RISK QUANTIFICATION UNDER THE PILLAR 2

Practical tool for IRRBB modeling (1/2)

IRRBB[1] refers to the current or prospective risk to the bank's capital and earnings arising from adverse movements in interest rates that affect the bank's banking book positions.

Two Measured Values

EVE (Economic Value of Equity)

- Represents the valuation of balance sheet and off-balance sheet income and is calculated by discounting future cash flows at a given date.
- Measures the impact of interest rates on the price of balance sheet and off-balance sheet instruments
- Reflects changes in product prices and their sensitivity to interest rates

NII (Net Interest Income)

- Changes in interest income are measured over a short period of time (3 Years according to the EBA guidelines[2]).
- The NII sensitivity measures changes in net interest income over a given period as a result of changes in interest rates.

[1] https://www.bis.org/bcbs/pubd368.pdf
[2] Guidelines on the management of interest rate risk arising from non trading book activities EBA/GL/2018/02

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RISK QUANTIFICATION UNDER THE PILLAR 2

Practical tool for IRRBB modeling (2/2)

Tool 1	Risk identification
Tool 2	**Risk Quantification**
Tool 3	Capital planning

Parameters	
parallel	6.00%
short	2.50%
long	1.00%
Outlier	2.00%

Exchange rate	
GBP	111.00%
USD	85.00%
CHF	93.00%
JPY	0.81%

INPUTS

EUR	
SWAP curve tenors	SWAP rate
0.00	-0.470%
0.08	-0.435%
0.25	-0.396%
0.50	-0.397%
0.75	-0.393%
1.00	-0.384%
2.00	-0.363%
3.00	-0.310%
4.00	-0.268%
5.00	-0.203%
6.00	-0.137%
7.00	-0.059%
8.00	-0.003%
9.00	0.075%
10.00	0.140%
12.00	0.262%
15.00	0.414%
20.00	0.555%
30.00	0.600%

- **Market Parameters** :
  - Rate curves: Index Overnight, 1M, 3M, 6M, 9M, 12M by Currency.
  - Exchange rate
- **Products**
  - Outstanding amounts and average spread by type of rate and currency

1. Parallel shock up
2. Parallel shock down
3. Steepener shock
4. Flattener shock
5. Short rate shock up
6. Short rates shock down
7. Outlier test (+/- 200 bps)

Currency		EVE								
		Base scenario	Parallel Shock Up	Parallel Shock Down	Steepener Shock	Flattener Shock	Short Rate Shock Up	Short Rate Shock Down	Parallel Up - Outlier Test	Parallel Down - Outlier Test
Overnight	0,003	0,007	0,007	0,006	0,006	0,007	0,007	0,006	0,007	0,006
]0, 1M]	0,042	0,181	0,185	0,178	0,179	0,185	0,186	0,177	0,185	0,178
]1, 3M]	0,167	0,384	0,390	0,377	0,378	0,390	0,392	0,376	0,390	0,377
]3M, 6M]	0,375	0,718	0,732	0,705	0,709	0,730	0,734	0,703	0,732	0,705
]6M, 9M]	0,625	0,592	0,606	0,578	0,583	0,603	0,607	0,578	0,606	0,578
]9M, 1Y]	0,875	1,289	1,311	1,267	1,276	1,305	1,311	1,266	1,311	1,267
]1Y, 1,5Y]	1,250	1,226	1,252	1,199	1,213	1,243	1,250	1,202	1,252	1,199
]1,5Y, 2Y]	1,750	1,026	1,056	0,997	1,015	1,042	1,050	1,002	1,056	0,997
]2Y, 3Y]	2,500	2,644	2,707	2,581	2,630	2,670	2,686	2,602	2,707	2,581

Inputs

Shock Scenarios

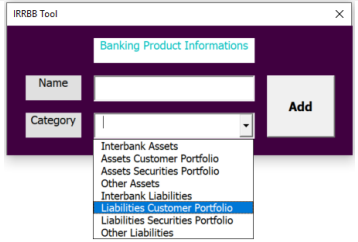
Mapping of each product by category

IRRBB Tool

Currencies

4 Categories of Assets and Liabilities :

- Interbank
- Client portfolio
- Securities portfolio
- Others

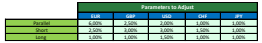


5 Significant currencies for each product :

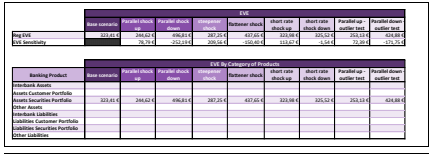
- EUR, GBP, USD, CHF, JPY
- Possibility to add other currencies

Outputs

- Outcome of the EVE and NII computations and their sensitivities to different shocks
- Graphics



Parameters to Adjust					
	EUR	GBP	USD	CHF	JPY
Parallel	6,00%	2,00%	2,00%	1,00%	1,00%
Short	2,50%	1,00%	1,00%	1,00%	1,00%
long	1,00%	1,00%	1,00%	1,00%	1,00%
Outlier	2,00%				

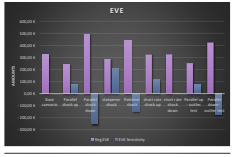


	EVE								
	Base scenario	Parallel shock up	Parallel shock down	Steepener shock	Flattener shock	short rate shock up	short rate shock down	Parallel up - outlier test	Parallel down outlier test
Reg EVE	322,41 €	266,62 €	496,81 €	287,25 €	437,65 €	323,98 €	325,52 €	253,13 €	624,88 €
EVE Sensitivity		78,79 €	-252,19 €	209,54 €	-150,40 €	113,67 €	-1,54 €	72,28 €	-171,75 €

	EVE by Category of Products								
Banking Product	Base scenario	Parallel shock up	Parallel shock down	Steepener shock	Flattener shock	short rate shock up	short rate shock down	Parallel up - outlier test	Parallel down outlier test
Interbank Assets									
Assets Customer Portfolio									
Assets Securities Portfolio	322,41 €	266,62 €	496,81 €	287,25 €	437,65 €	323,98 €	325,52 €	253,13 €	624,88 €
Other Assets									
Interbank Liabilities									
Liabilities Customer Portfolio									
Liabilities Securities Portfolio									
Other Liabilities									

Calculation Update

Unload



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RISK QUANTIFICATION UNDER THE PILLAR 2

Practical tool for Operational risk modeling

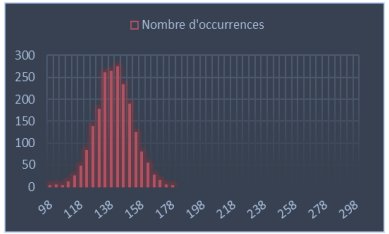
Tool 1	Risk identification
Tool 2	**Risk Quantification**
Tool 3	Capital planning

- The **Loss Distribution Approach** (**LDA**) is an advanced method of calculating operating losses consisting to estimate **severities and occurrences distribution laws of operational risk events in order to determine the economic capital for operational risk.**
- The idea is to consider that bank's total annual loss due to operational risk is assessed in terms of two elements: **occurrence and severity**.
- This method is broken down into 3 steps as follows :

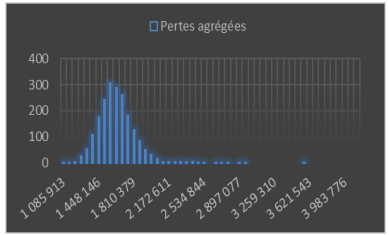
1 Choice and calibration of frequency and severity distribution

Modelling the loss distribution and frequency will be done for each type of Basel event. It consists of adjusting probability laws both on frequency and severity data of operational risk incidents over a given time horizon.

Occurrence distribution



Severity distribution



2 Construction of total loss distribution

Monte-Carlo simulation is used to simulate the different distributions of severity and occurrence of losses.

3 Calculation of Value At Risk (VAR)

The Value At-Risk (VAR) of level α (or equivalently a confidence level of 1-α%) is finally obtained by calculating the quantile of order α of the distribution of the total loss.

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RISK QUANTIFICATION UNDER THE PILLAR 2

Practical tool for Operational risk modeling

The tool makes possible to calculate **the VaR using different distribution laws** allows to choose the probability distribution that fit to financial institution data. Results are presented by Basel category with different distribution :

1. **Frequency** distribution : Poisson.
2. **Severity** Distribution : Log-normal, Gamma, Weibull, Exponential.

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Simulations of pairs (occurrences / losses)

Reply France	Number of occurrences (Poisson distribution)	Aggregate losses (Lognormal)	Aggregate losses (Loi Gamma)	Aggregate losses (Loi Weibull)	Aggregate losses (Loi Exponentiel
	22	538,248	1,145,505	1,143,604	1,130,277
	24	737,026	1,230,347	1,265,567	1,265,385
	20	581,306	1,070,059	1,044,354	1,008,135
	26	840,426	1,335,675	1,355,028	1,450,805
	21	736,031	1,076,326	1,111,902	1,053,405
	17	428,867	886,348	891,501	885,861
	24	675,777	1,246,357	1,263,166	1,224,233
	21	676,754	1,076,316	1,082,217	1,085,863
	19	1,400,714	1,012,813	981,434	969,237
	20	533,867	1,028,630	1,059,355	1,017,488
	18	563,728	927,056	835,582	912,662
	20	543,064	1,039,201	1,043,593	1,067,623
	18	478,037	932,555	962,836	932,370
	22	584,444	1,136,366	1,138,142	1,119,522
	13	336,715	713,054	688,615	680,925
	24	714,604	1,283,019	1,243,225	1,263,946
	23	662,710	1,188,630	1,191,005	1,231,489
	29	761,246	1,547,556	1,521,023	1,432,380
	26	643,308	1,361,231	1,371,039	1,334,849
	15	467,544	777,240	760,400	810,605
	17	382,715	897,822	883,206	854,343
	16	408,217	818,805	830,118	803,651
	22	1,353,345	1,132,293	1,138,630	1,250,714
	23	916,522	1,177,161	1,206,463	1,137,421
	20	526,236	1,042,008	1,050,905	1,132,173
	24	701,219	1,236,534	1,260,104	1,223,333
	24	665,031	1,239,796	1,257,386	1,294,469
	16	425,639	827,807	837,549	843,353
	24	633,720	1,246,423	1,278,480	1,213,161
	23	616,619	1,209,639	1,196,882	1,252,717
	23	859,652	1,184,981	1,212,428	1,228,361
	16	388,608	817,350	824,811	875,685
	23	864,745	1,193,366	1,198,286	1,203,394
	23	668,831	1,205,417	1,186,538	1,132,153
	23	617,371	1,211,078	1,214,514	1,292,509
	24	701,748	1,249,544	1,246,093	1,331,246

Losses and occurrences frequency

Aggregate losses	Frequency	Occurrences number	Freque ncy

Confidence level	Simulation number
99	100

Aggregate losses	Occurrences number

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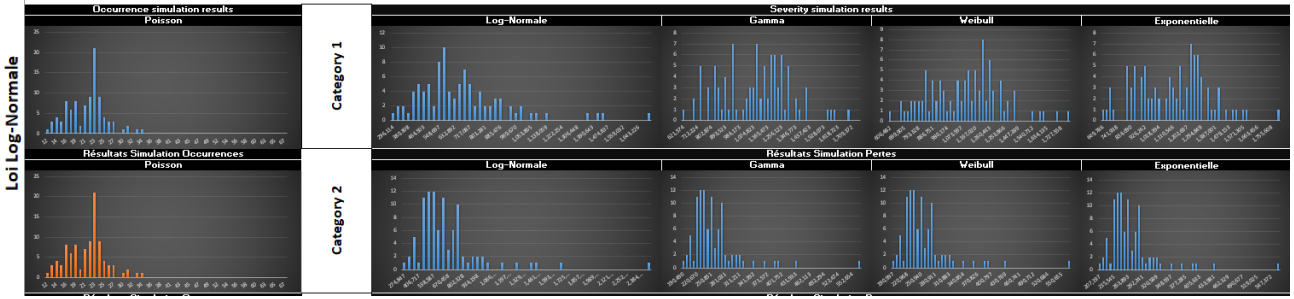
Basel Categories1	Probability distribution	Log-normal	Gamma	Weibull	Exponential
Category 1	Internal Fraud	1,424,726.46	1,668,339.54	1,634,987.30	1,780,625.10
Category 2	External Fraud	1,670,132.66	543,615.06	558,974.87	547,027.65
Category 3	Employment Practices and Workplace Safety	1,358,831.95	6,080,201.14	6,649,828.39	5,715,886.66
Category 4	Clients, Products, and Business Practice	1,333,766.25	1,668,352.17	1,678,685.07	1,706,987.24
Category 5	Damage to Physical Assets	2,389,174.48	645,268.17	646,327.32	627,068.24
Category 6	Business Disruption and Systems Failures	2,004,131.76	826,014.20	828,602.55	830,282.85
Category 7	Execution, Delivery, and Process Management	1,424,726.46	1,341,528.53	1,333,534.01	1,354,928.26
		11,605,490.02	12,775,918.83	13,393,140.10	12,562,816.00



Data for illustrative purposes

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RISK QUANTIFICATION UNDER THE PILLAR 2

Practical tool for Concentration credit risk modeling

- The PRA, UK supervisory authority, recommend the Herfindahl-Hirschman Index (HHI) method to assess the credit concentration under Pillar 2. The HHI allows to evaluate the margin of conservatism in basis point that a financial institution for sector or geography or single name credit concentration.
- The HHI method is a three time process :

1 Data collection and mapping

Sector

RWA par Secteur
Agriculture, forestry and fishing
Construction
Financial industry (bank and non-bank)
.....
Wholesale and retail trade
Services and other
Transport, storage and utilities

Geography

RWA by geographie
North America
South/Latin America and Caribbean
Europe (west) area
.....
Sub-Saharan Africa
Supranational

Single name

RWA by single name
Contrepartie 1
Contrepartie 2
...
Contrepartie X

2 HHI calculus

The HHI is the sum of the squares of the portfolio shares of all exposures. These shares are measured using RWAs:

$$HHI = \sum_{j=1}^{N} \left(\frac{\sum_i RWA_i}{\sum RWA} \right)$$

$$avec\ i \in sector, geographie\ or\ single\ name\ j$$

3 Evaluation of the margin of conservatism in basis points

Sector

HHI RWA	Capital add-on (% of portfolio RWA)
0,00%	0,00%
11,10%	0,00%
20,30%	0,20%
25,60%	0,50%
41,70%	0,80%
67,40%	1,25%
100,00%	1,40%

Geography

HHI RWA	Capital add-on (% of portfolio RWA)
0,00%	0,00%
11,10%	0,00%
24,90%	0,20%
34,50%	0,50%
47,80%	0,80%
77,90%	1,25%
100,00%	1,40%

Single name

HHI RWA	Capital add-on (% of portfolio RWA)
0,00%	0,00%
0,29%	0,50%
0,59%	1,00%
1,15%	2,00%
1,65%	3,00%

→ **Conservatism margin for concentration risk**

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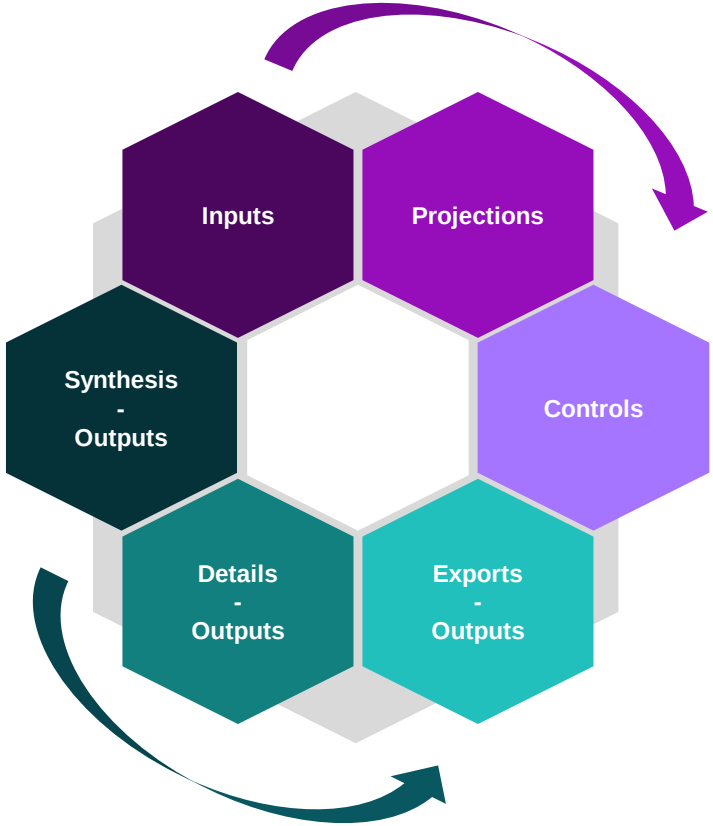
CAPITAL PLANNING
Practical tool for capital modeling and planning

Tool 1	Risk identification
Tool 2	Risk Quantification
Tool 3	**Capital planning**



Regulatory reports: COREP, FINREP

Internal reports: Internal data extracts for the projection of RWA, CCF, Provi, CRM, …

Numerator: One form used to define the assumptions of the projected values according to 7 levers to CET1. It also allows to integrate a lever to the global capital amount.

Denominator: Two dedicated forms including one to select projection levers (8 in total) with the type of projection to be associated. The 2nd form used to enter the forecast values.

Operational risk controls and global consistency checks related to the use of capital planning tool.

Solvency ratios medium term projections (CET1 ratio, Global solvency ratios…)
Graphic presentations in normal and stressed situations (including the potential activation of management buffer)

Calculations and outcomes of numerator projections
Calculations and outcomes of denominator projections

Data backup and backtesting on historical windows
(also include reports for internal or external purposes)

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AVANTAGE REPLY FRANCE
Our service offering

Expert and methodological support in ALM, Finance and Risk around strategic risk management and management processes, governance of Finance and Risk functions, risk modeling and scarce resources (capital, liquidity) and stress tests

ALM

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Finance Risk

- Our teams support CROs and CFOs from the design of target systems to operational implementation at Group or entity level.
- Our missions last from 1 month to 1 year. On average, they last 6 months.

	Strategy and governance	Steering	Modeling	Regulatory (transversal offer)
Finance	Business model assessment	ICAAP	P&L Modeling and Stress tests	▪ Regulatory watch ▪ Regulatory strategy ▪ Remediation ▪ Project management
	Capital management governance	Capital allocation policy	Business / Capital modeling	
	Solvency stress testing governance	TLAC/MREL	Resolution modeling	
Risk	Risk governance	Material risk assessment	Pillar 1Risk models design and validation	SREP/TRIM
	Model risk management	Risk appetite	Model risk tiering and scoring	
	Regulatory strategy	Recovery plan	Pillar 2 models and risk stress tests	
ALM	ALM governance	ILAAP	ALM risk metrics	BRRD
	ALM strategy (including hedging)	IRRBB	ALM models	
	Fund transfer pricing	Contingency plan	Liquidity stress tests	
Trading Activities	Desk strategy	P&L attribution	Pricing models	CRR/CRD 4
	Desk hedging strategy	Market risk policy	Valuation/PVA	
	Model risk management	Limit framework	Risk models/Stress tests	CRR2/CRD 5
				Guidelines EBA/BCE…

- Strategic diagnosis, gap analysis and benchmarking
- Definition and design of steering processes and dashboard
- Organizational and governance redesign
- Deployment and operational implementation
- Modeling and Quantitative studies
- Subject matter expert support

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