

sas.forum
BELUX 2010

SAS Solution for Solvency II: practical case



**THE
POWER
TO KNOW®**

SAS Solution for Solvency II: practical case

- What is this presentation about?

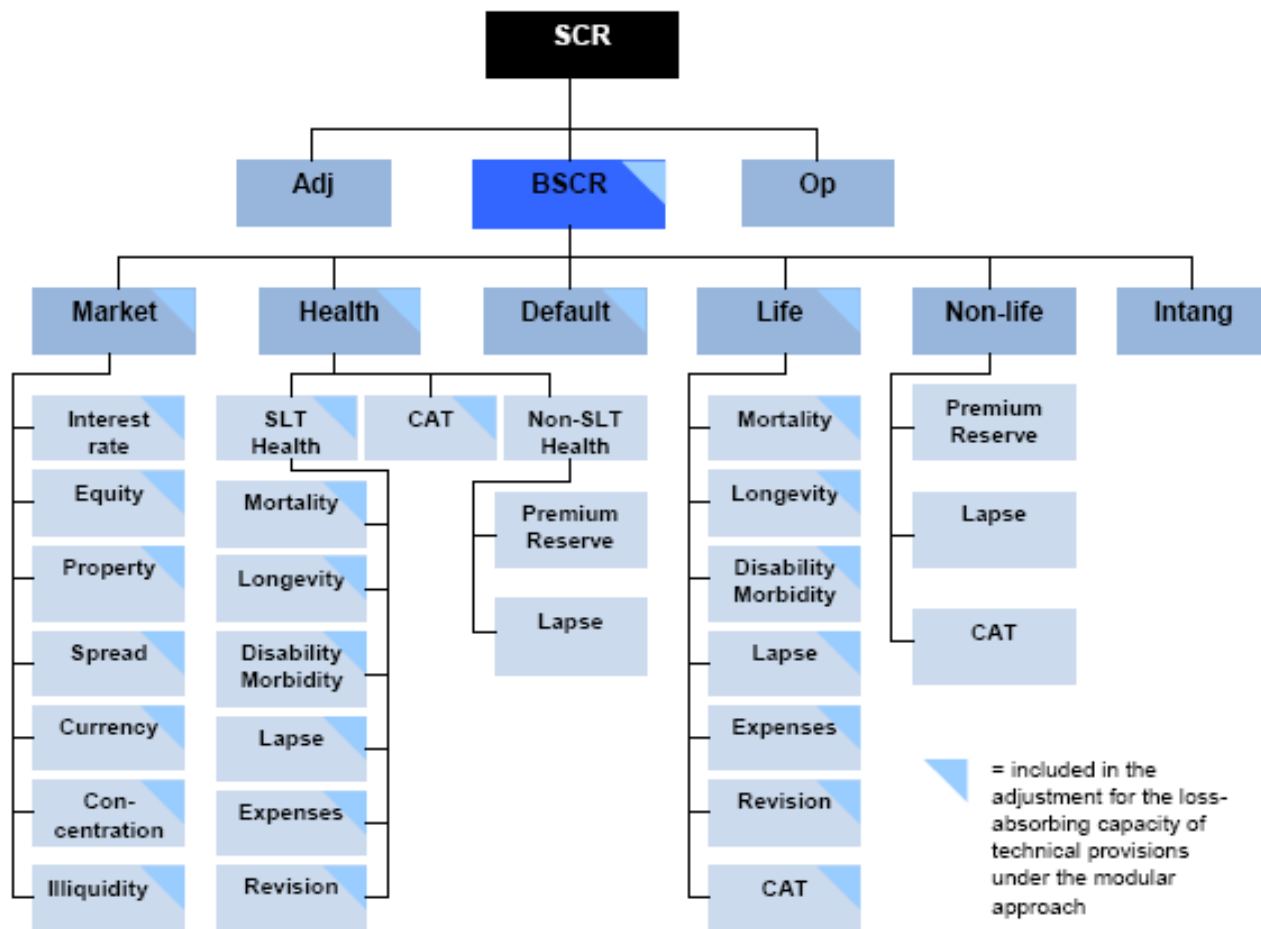


This is what you may desire for your Solvency II solution

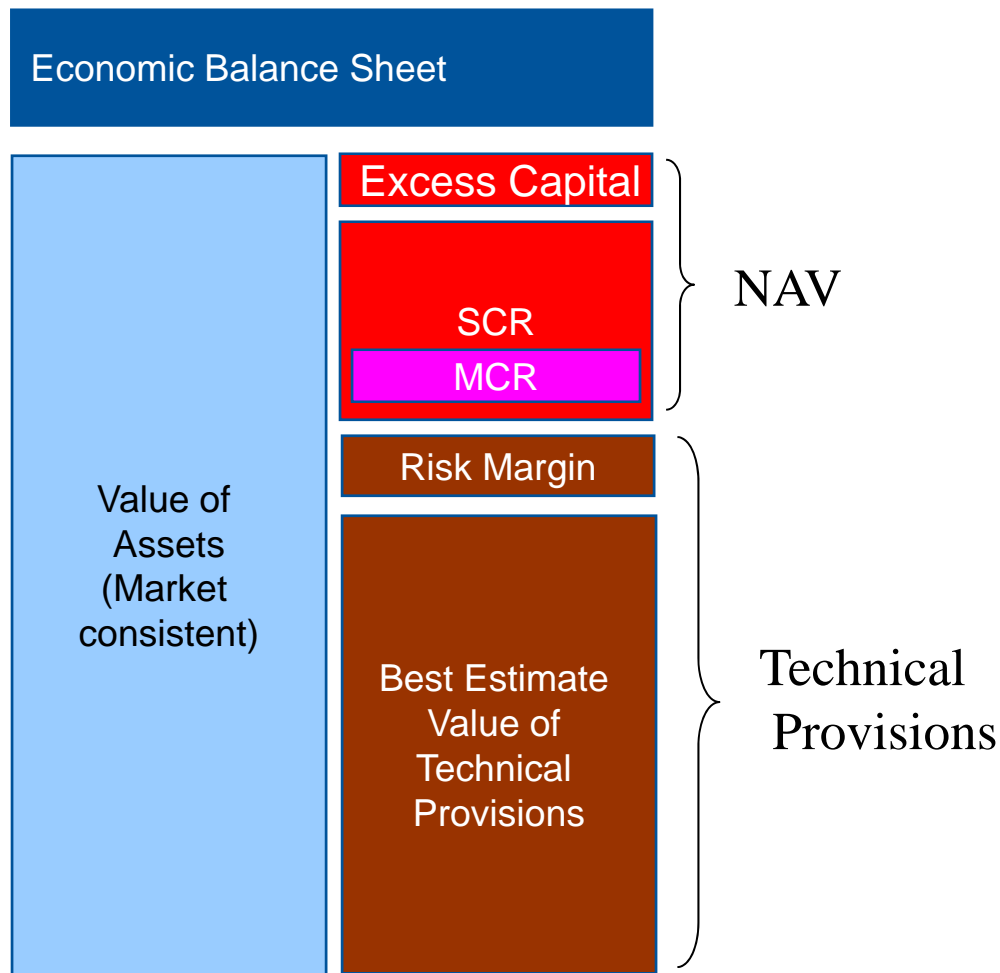


But, what is really in it?

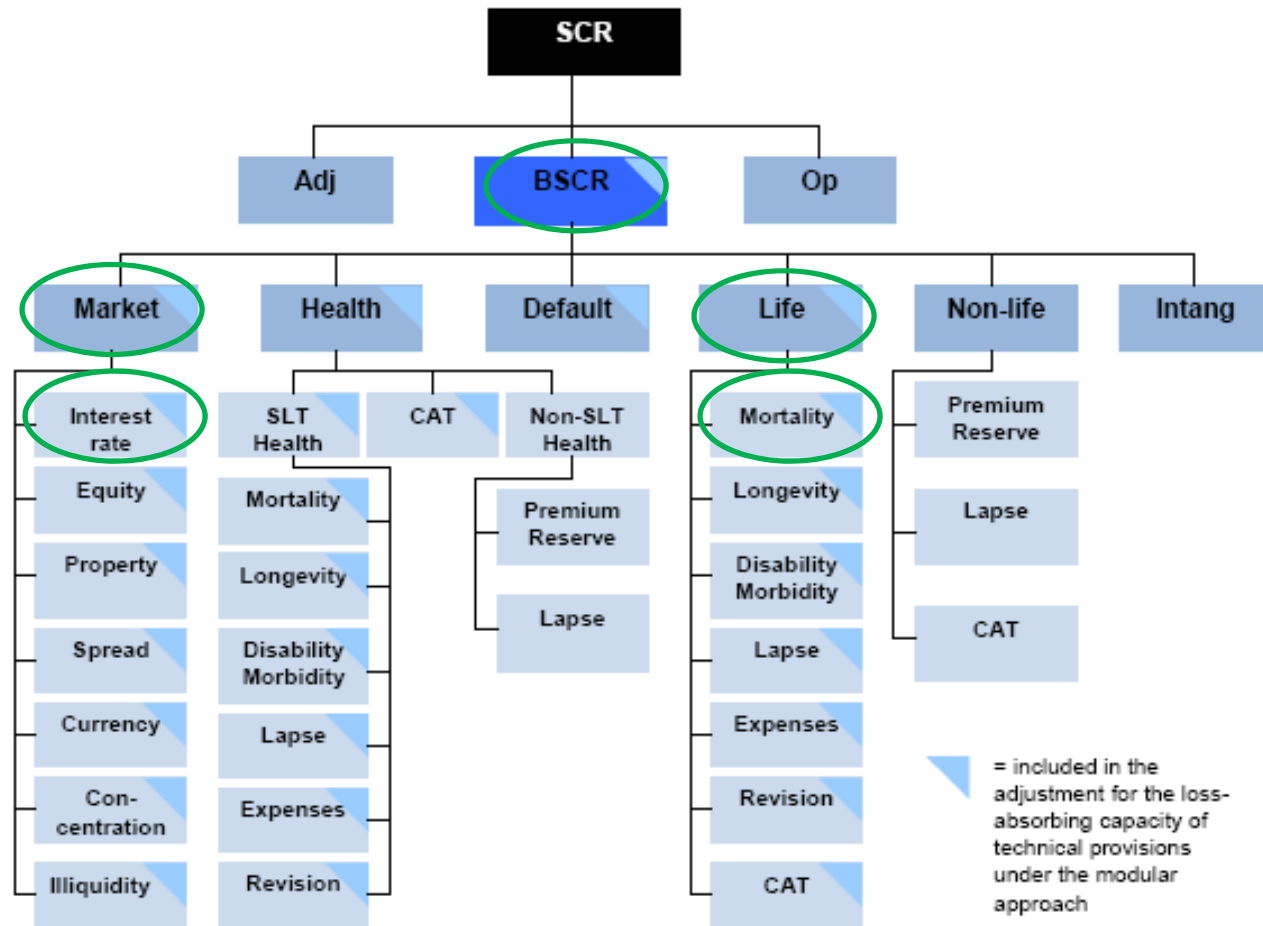
Scope of the exercise (I): which risks?



Solvency II : Pillar 1 – Economic balance sheet



Scope of the exercise (I): which risks?



Plan

- An Insurance Company
- Loading the datamart
- Mortality Risk SCR

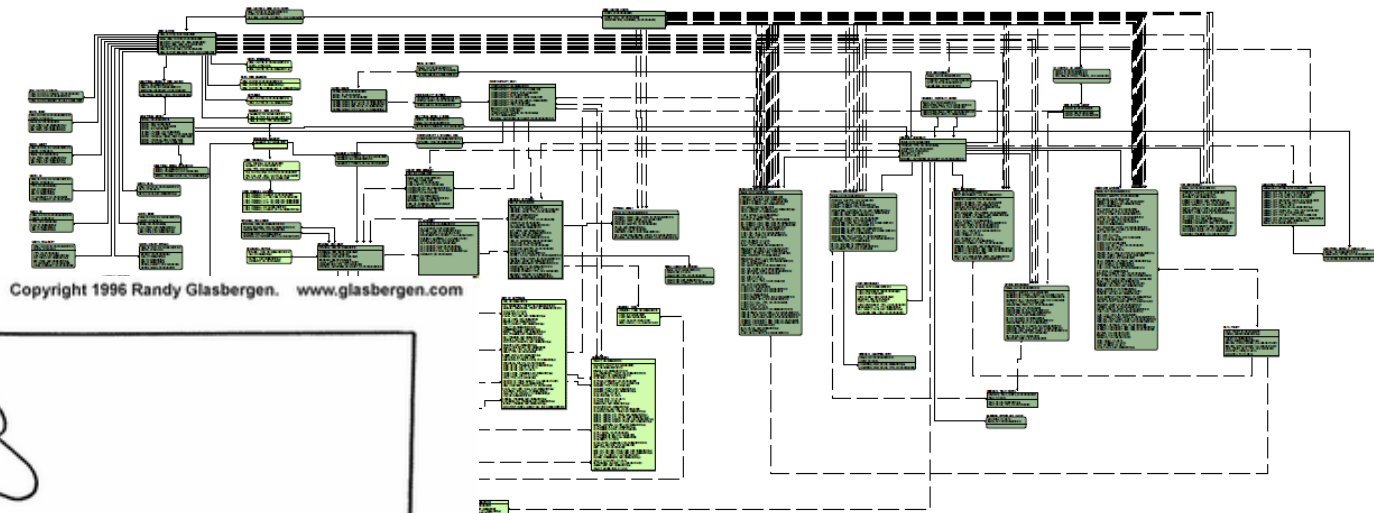
An Insurance Company

- A dummy portfolio has been set up:
 - Asset: 5 bonds
 - Liabilities: 50 Whole Life contracts

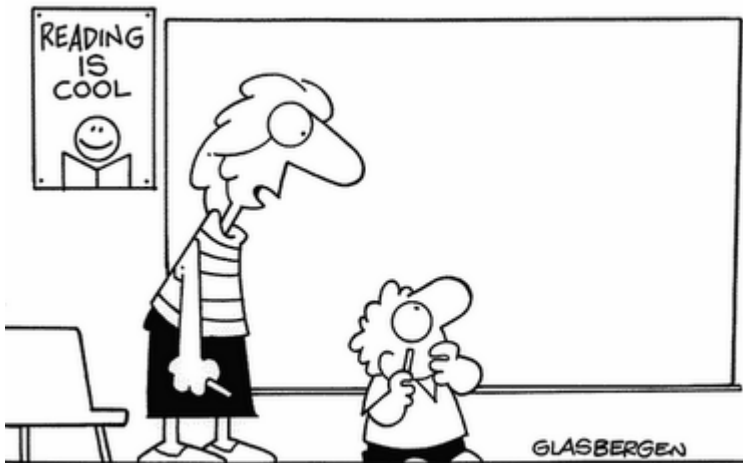
- Market Value of the asset: € 3.282.741
- Best Estimate Value of the liabilities: € 2.855.252

Loading the datamart

- What the real complexity of loading our portfolio and parameters in the data model?



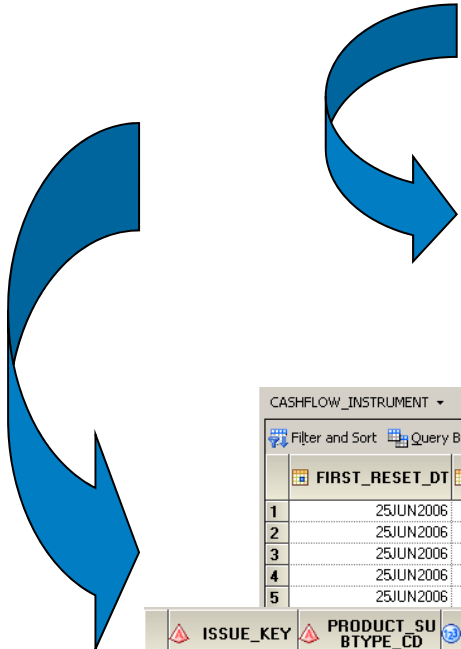
Copyright 1996 Randy Glasbergen. www.glasbergen.com



“There aren’t any icons to click. It’s a chalk board.”

Loading the datamart (2): asset portfolio

	A	B	C	D	E	F	L	M	N	O	P	Q
1	COUNTERPARTY_	COUNTERPARTY_	RATING_AGENCY_				PRINCIPAL_BALANCE	BASE_CONTRACT_	FLOAT_REF_			
2	TYPE_CD	TYPE	CD	RATING_GRADE	INST_ID	ISSUE_KEY	_AMT	RT	RATE_ID	FIRST_PAYMENT_DT	LAST_PAYMENT_DT	COUNTERPARTY_RK
2	001	CORPORATE	FIT	AA+	BD_BOND_001	BD_001	1,000,000,00	4,00%	EUR6M	25/06/2006	25/06/2016	1 00
3	001	CORPORATE	S_P	BBB+	BD_BOND_002	BD_002	525,000,00	5,00%	EUR6M	25/06/2006	25/06/2014	1 00
4	004	GOVT	MDY	A2	BD_BOND_003	BD_003	180,000,00	4,50%	EUR6M	25/06/2006	25/06/2011	1 00
5	004	GOVT	FIT	AA-	BD_BOND_004	BD_004	654,000,00	3,00%	EUR6M	25/06/2006	25/06/2013	1 00
6	004	GOVT	S_P	AA	BD_BOND_005	BD_005	1,020,000,00	2,50%	EUR6M	25/06/2006	25/06/2021	1 00



FINANCIAL_CONTRACT

Filter and Sort Query Builder Data Describe Graph Analyze Export Send To

	ISSUE_KEY	PRODUCT_TYPE_CD	CURRENCY_CD	ISSUE_CD	MATURITY_DT	START_DT
1	BD_001	034	EUR		25JUN2016	25JUN2006
2	BD_002	034	EUR		25JUN2014	25JUN2006
3	BD_003	034	EUR		25JUN2011	25JUN2006
4	BD_004	034	EUR		25JUN2013	25JUN2006
5	BD_005	034	EUR		25JUN2021	25JUN2006

CASHFLOW_INSTRUMENT

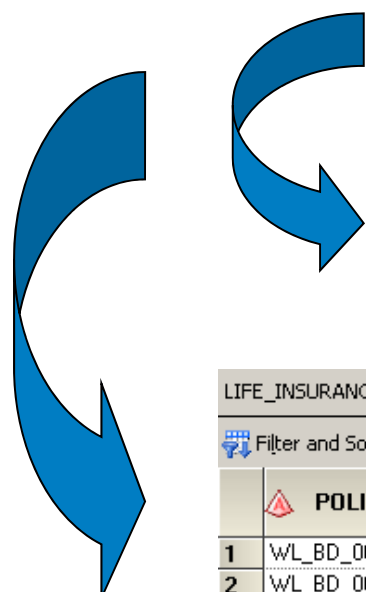
Filter and Sort Query Builder Data Describe Graph Analyze Export Segd To

	FIRST_RESET_DT	FIRST_PAYMENT_DT	LAST_PAYMENT_DT	PRINCIPAL_BALANCE_AMT	PRINCIPAL_PAYMENT_TYPE_CD	BASE_CONTRACT_RT	IRI
1	25JUN2006	25JUN2006	25JUN2016	1,000,000,00000	001		0.0400 N
2	25JUN2006	25JUN2006	25JUN2014	525,000,00000	001		0.0500 N
3	25JUN2006	25JUN2006	25JUN2011	180,000,00000	001		0.0450 N
4	25JUN2006	25JUN2006	25JUN2013	654,000,00000	001		0.0300 N
5	25JUN2006	25JUN2006	25JUN2021	1,020,000,00000	001		0.0250 N

	ISSUE_KEY	PRODUCT_SU	FTP_BASE_RT	INTEREST PAYM	INT_PAYMENT FR	DISCOUNT_CURVE_ID	FUNDING_CURVE_ID	FLOAT_RI
		BTYPE_CD		ENT_TYPE_CD	EQ_TIME_UOM_CD			
1	BD_001	036	0.0400	001	008	INTERBANK_ZERO_EUR_CURVE	INTERBANK_ZERO_EUR...	EUR6M
2	BD_002	036	0.0500	001	008	INTERBANK_ZERO_EUR_CURVE	INTERBANK_ZERO_EUR...	EUR6M
3	BD_003	036	0.0450	001	008	INTERBANK_ZERO_EUR_CURVE	INTERBANK_ZERO_EUR...	EUR6M
4	BD_004	036	0.0300	001	008	INTERBANK_ZERO_EUR_CURVE	INTERBANK_ZERO_EUR...	EUR6M
5	BD_005	036	0.0250	001	008	INTERBANK_ZERO_EUR_CURVE	INTERBANK_ZERO_EUR...	EUR6M

Loading the datamart (3): liability portfolio

	A	B	C	D	E	F	G	H	I	M	Q	S	T	U
1	Risk_Location_Co	CURRENCY				Product	Death_Benefit	Modal_Premium			Next_Premium			
2	untry_CD	_CD	Policy_id	Gender_CD	Birth_dt	Product_ID	_Amt	_AMT	Technical_Rate		Payment_DT	Prem_Duration_DT	EFFECTIVE_DT	Expiration_DT
2	BE	EUR	WL_BD_007	MAN	01-Mar-78	WHOLE_LIFE	1000000,00	4.000,00	4,00%		15/10/2009	15/10/2042	15/10/2001	15/10/2087
3	BE	EUR	WL_BD_008	MAN	01-Mar-78	WHOLE_LIFE	1000000,00	4.000,00	4,00%		15/10/2009	15/10/2042	15/10/2001	15/10/2087
4	BE	EUR	WL_BD_009	MAN	01-Sep-77	WHOLE_LIFE	857.800,00	4.424,59	4,10%		15/10/2009	15/04/2042	15/04/2001	15/04/2086
5	BE	EUR	WL_BD_010	MAN	01-Mar-77	WHOLE_LIFE	861.100,00	4.553,92	5,00%		15/10/2009	15/10/2041	15/10/2000	15/10/2086
6	BE	EUR	WL_BD_011	MAN	01-Sep-76	WHOLE_LIFE	962.200,00	5.115,21	4,20%		15/10/2009	15/04/2041	15/04/2000	15/04/2085
7	BE	EUR	WL_BD_012	MAN	01-Mar-76	WHOLE_LIFE	863.500,00	5.999,74	4,80%		15/10/2009	15/10/2040	15/10/1999	15/10/2085



LIFE_DETAILS ▾

Filter and Sort Query Builder Data Describe Graph Analyze

	LIFE_INSURANCE_POLICY_RK	DEATH_BENEFIT_AMT	PREM_DURATION_DT
1	1000001	1.000.000.00000	15OCT2042
2	1000002	1.000.000.00000	15OCT2042
3	1000003	857.800.00000	15APR2042
4	1000004	861.100.00000	15OCT2041
5	1000005	962.200.00000	15APR2041

INSURED_DETAILS ▾

Filter and Sort Query Builder Data Describe Graph Analyze Export Send To

	INSURED_RK	UOE_RK	GENDER_CD	BIRTH_DT	TOBACCO_I
1	3000001	2000001	MAN	01MAR1978	N
2	3000002	2000002	MAN	01MAR1978	N
3	3000003	2000003	MAN	01SEP1977	N
4	3000004	2000004	MAN	01MAR1977	N
5	3000005	2000005	MAN	01SEP1976	N

LIFE_INSURANCE_POLICY ▾

Filter and Sort Query Builder Data Describe Graph Analyze Export Send To

	POLICY_ID	INSURANCE_PRODUCT_ID	GUARANTEED_INT_RT	CURRENCY_CD	PREMIUM_TYPE_CD	GUARANTEED_LIFETIME_INT_RT	NEXT_PREMIUM_PAYMENT_DT
1	WL_BD_007	WHOLE_LIFE	0.0400	EUR	FIX	0.0400	15OCT2009
2	WL_BD_008	WHOLE_LIFE	0.0400	EUR	FIX	0.0400	15OCT2009
3	WL_BD_009	WHOLE_LIFE	0.0410	EUR	FIX	0.0410	15OCT2009
4	WL_BD_010	WHOLE_LIFE	0.0500	EUR	FIX	0.0500	15OCT2009
5	WL_BD_011	WHOLE_LIFE	0.0420	EUR	FIX	0.0420	15OCT2009

Loading the datamart (4): load amortality table

Country	Gender	x	qx
BE	F	0	0,03359%
BE	F	1	0,03366%
BE	F	2	0,03373%
BE	F	3	0,03382%
BE	F	4	0,03391%
BE	F	5	0,03401%
BE	F	6	0,03413%
BE	F	7	0,03426%
BE	F	8	0,03440%
BE	F	9	0,03456%
BE	F	10	0,03474%
BE	F	11	0,03494%
BE	F	12	0,03516%
BE	F	13	0,03541%
BE	F	14	0,03569%
BE	F	15	0,03600%
BE	F	16	0,03635%
BE	F	17	0,03673%
BE	F	18	0,03717%
BE	F	19	0,03765%
BE	F	20	0,03819%
BE	F	21	0,03879%
BE	F	22	0,03947%
BE	F	23	0,04022%
BE	F	24	0,04106%
BE	F	25	0,04200%
BE	F	26	0,04305%
BE	F	27	0,04422%
BE	F	28	0,04552%
BE	F	29	0,04698%

SAS Information Delivery Portal

Portal Page Search

Load Mortality Table

Bookmark Publish E-mail

General

Specify a file containing a Mortality Table

Please enter the list of tabs containing the tables

Please enter the mortality table category

Please enter the dimensions corresponding to the table

The dimensions of a mortality table are typically the country and gender

Run

QUOTE_INSURANCE

Filter and Sort Query Builder Data Describe Graph

	RISK_FACTOR_ID	RISK_FACTOR_VALUE
28160	STA_LONG_GB_M_111	0.650997
28161	STA_LONG_GB_M_112	0.725632
28162	STA_LONG_GB_M_113	0.808326
28163	STA_LONG_GB_M_114	0.899643
28164	STA_LONG_GB_M_115	0.999990
28165	PAUL_LONG_BE_F_0	0.000336
28166	PAUL_LONG_BE_F_1	0.000337
28167	PAUL_LONG_BE_F_2	0.000337
28168	PAUL_LONG_BE_F_3	0.000338
28169	PAUL_LONG_BE_F_4	0.000339
28170	PAUL_LONG_BE_F_5	0.000340
28171	PAUL_LONG_BE_F_6	0.000341
28172	PAUL_LONG_BE_F_7	0.000343
28173	PAUL_LONG_BE_F_8	0.000344
28174	PAUL_LONG_BE_F_9	0.000346
28175	PAUL_LONG_BE_F_10	0.000347
28176	PAUL_LONG_BE_F_11	0.000349
28177	PAUL_LONG_BE_F_12	0.000352
28178	PAUL_LONG_BE_F_13	0.000354
28179	PAUL_LONG_BE_F_14	0.000357
28180	PAUL_LONG_BE_F_15	0.000360

Mortality Risk SCR (1): context

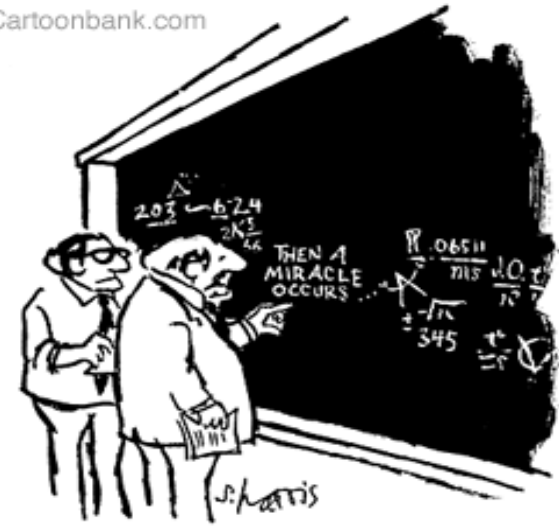
- Are we sure we understand what happens?

CASHFLOW

Filter and Sort Query Builder Data Describe Graph Analyze Export Send To

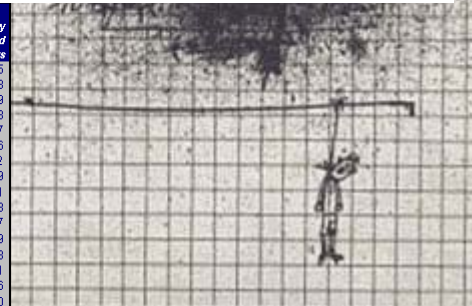
	InstID	Mat_Date	CF01_Date	CF01_Amt	CF01_Note
1	POLICY_WL_BD...	October 15, 2009	October 15, 2009	-3,838.07	CF01 Premium Income
2	POLICY_WL_BD...	October 15, 2010	October 15, 2010	-3,680.40	CF01 Premium Income
3	POLICY_WL_BD...	October 15, 2011	October 15, 2011	-3,529.05	CF01 Premium Income
4	POLICY_WL_BD...	October 15, 2012	October 15, 2012	-3,383.75	CF01 Premium Income
5	POLICY_WL_BD...	October 15, 2013	October 15, 2013	-3,244.25	CF01 Premium Income
6	POLICY_WL_BD...	October 15, 2014	October 15, 2014	-3,142.70	CF01 Premium Income
7	POLICY_WL_BD...	October 15, 2015	October 15, 2015	-3,044.13	CF01 Premium Income

© Cartoonbank.com



"I think you should be more explicit here in step two."

	L	M	N	O	P	R	S	T	U	V			
1	Reconciliation												
2	Customer Age	Applicable Mortality Factor	Contract Age	Applicable Lapse	Mortality Improvement Factor	Improved Mortality Factor	Lapsed Improved Mortality Factor	Survival Rate adapted for non integer year lapse	Cumulated Survival Rate	Actuarial Discounted Premium	Maturity Benefit Payment	Cumulated Death probability	Actuarially Discounted Death Benefits
3	31	0,11%	8	5,00%	99,00%	0,1080110%	5,1026105%	95,9517016%	95,9517016%	3,838,07	-	0,0852348%	852,35
4	32	0,11%	9	4,00%	98,22%	0,1124450%	4,1079472%	95,8920528%	92,0100584%	3,680,40	-	0,1078929%	1,078,93
5	33	0,12%	10	4,00%	97,24%	0,1170836%	4,1124002%	95,8875998%	88,2262347%	3,529,05	-	0,1077286%	1,077,29
6	34	0,13%	11	4,00%	96,26%	0,1221944%	4,1173066%	95,8826934%	84,5936901%	3,383,75	-	0,1078075%	1,078,08
7	35	0,13%	12	4,00%	95,30%	0,1278194%	4,1227066%	95,8772934%	81,1061404%	3,244,25	-	0,1081272%	1,081,27
8	36	0,14%	13	3,00%	94,35%	0,1340043%	3,1299842%	96,8700158%	78,5675310%	3,142,70	-	0,1086857%	1,086,86
9	37	0,15%	14	3,00%	93,40%	0,1407989%	3,1365749%	96,8634251%	76,1032016%	3,044,13	-	0,1106222%	1,106,22
10	38	0,16%	15	2,00%	92,47%	0,1482573%	2,1452922%	97,8547078%	74,4705655%	2,978,62	-	0,1128268%	1,128,29
11	39	0,17%	15	2,00%	91,55%	0,1564389%	2,153100%	97,8466909%	72,8669934%	2,914,68	-	0,1165009%	1,165,01
12	40	0,18%	15	2,00%	90,63%	0,1654077%	2,1620995%	97,8379005%	71,2915267%	2,851,66	-	0,1205278%	1,205,28
13	41	0,20%	15	2,00%	89,72%	0,1752341%	2,1717295%	97,8282705%	69,7432676%	2,789,73	-	0,1249271%	1,249,27
14	42	0,21%	15	2,00%	88,83%	0,1859947%	2,1822748%	97,8177252%	68,2212779%	2,728,85	-	0,1297188%	1,297,19
15	43	0,22%	15	2,00%	87,94%	0,1977726%	2,1938172%	97,8061828%	66,7246278%	2,668,99	-	0,1349230%	1,349,23
16	44	0,24%	15	2,00%	87,06%	0,2106586%	2,2064455%	97,7935545%	65,2523853%	2,610,10	-	0,1405612%	1,405,61
17	45	0,26%	15	2,00%	86,19%	0,2247516%	2,2202566%	97,7797434%	63,8036149%	2,552,14	-	0,1466556%	1,466,56
18	46	0,28%	15	2,00%	85,33%	0,2401592%	2,2353561%	97,7646439%	62,3773769%	2,495,10	-	0,1532303%	1,532,30
19	47	0,30%	15	2,00%	84,47%	0,2569987%	2,2518588%	97,7481412%	60,9727265%	2,438,91	-	0,1603091%	1,603,09
20	48	0,33%	15	2,00%	83,63%	0,2753978%	2,2698989%	97,7301102%	59,5887128%	2,383,55	-	0,1679175%	1,679,18
21	49	0,36%	15	2,00%	82,79%	0,2954954%	2,2895855%	97,7104145%	58,2243783%	2,328,98	-	0,1760819%	1,760,82



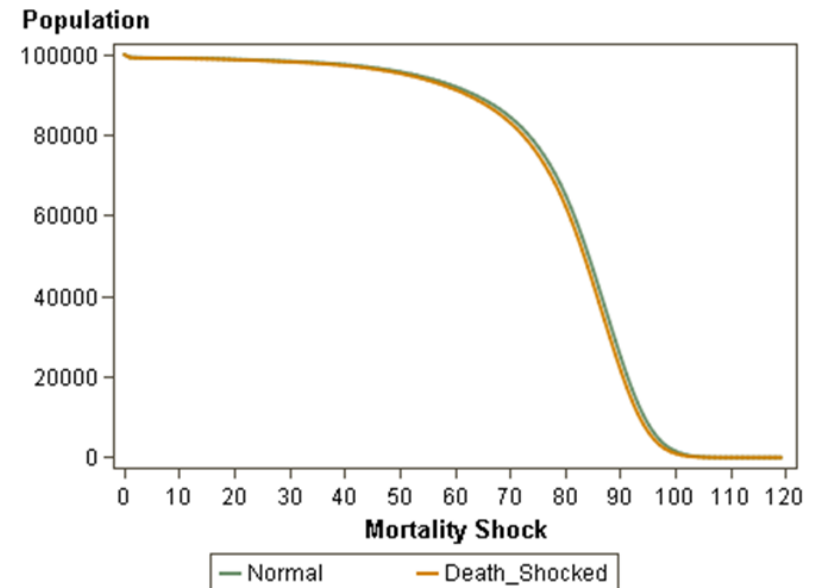
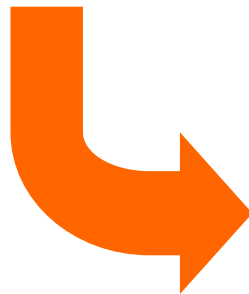
Mortality Risk SCR (2): Mortality shock

$$Life_{mort} = (\Delta NAV | mortshock)$$

where

ΔNAV = The change in the net value of assets minus liabilities

$mortshock$ = A permanent 15% increase in mortality rates for each age and each policy where the payment of benefits (either lump sum or multiple payments) is contingent on mortality risk



Life SCR (4): Portfolio Level

shock_type	CCY	COUNTRY_CD	risk_value	REGULATORY_SIMULATION_NM	SIMULATION_LABEL	REGULATORY_SIMULATION_DESC
BASECASE	EUR	BE	2,855,251.61	BASECASE	BASECASE	BASECASE
LF_MORT	EUR	BE	3,174,817.17	LF_MORT	LF_MORT	Mortality rates shock

- Therefore, SCR_{mort} = 319.566

Filter and Sort ▾

Input Data | Code | Log | Output Data

Modify Task | Filter and Sort | Query Builder | Data ▾ | Describe ▾ | Graph ▾ | Analyze ▾ | Export ▾ | Send To ▾ | ✓

INSTID	SHOCK_TYPE	SUBRISK_TYPE	LIAB	RISK_VALUE	OUTV_LIAB_VALUE
1 0000006	LF_MORT	LF_MORT	2,855,251.61	319,565.56	2,855,251.61

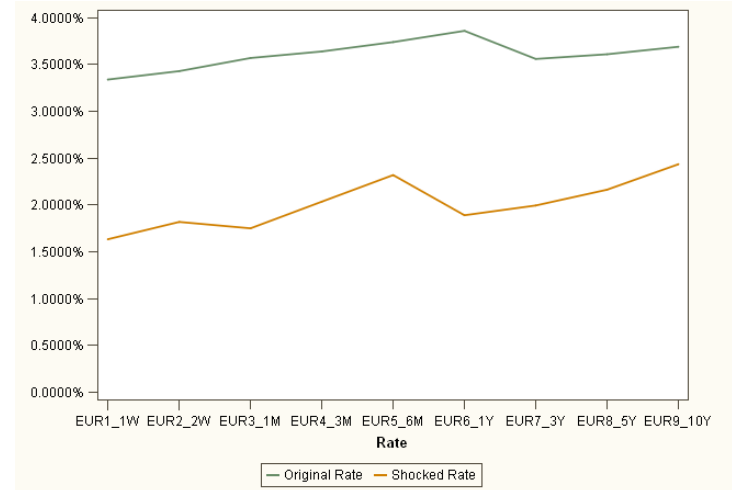
Market Risk SCR: Interest rate risk

What's says the regulation?

Mkt_{int}^{Up} = Capital requirement for interest rate risk after upward shocks

Mkt_{int}^{Down} = Capital requirement for interest rate risk after downward shocks

Maturity t (years)	relative change $s^{up}(t)$	relative change $s^{down}(t)$
0.25	70%	-75%
0.5	70%	-75%
1	70%	-75%
2	70%	-65%
3	64%	-56%
4	59%	-50%
5	55%	-46%
6	52%	-42%
7	49%	-39%
8	47%	-36%
9	44%	-33%
10	42%	-31%
11	39%	-30%
12	37%	-29%



PARAMETER_NM	MATURITY_LENGTH_OF_TIME_CNT	MATURITY_TIME_UOM_CD	REGULATORY_PARAMETER_SET_ID	PARAMETER_VALUE	PA	
37	MKT_INT_DN_RISK_SHOCK	17	YR	QIS4	-0.33000	QIS4: TS.XI.B.5 downward
38	MKT_INT_DN_RISK_SHOCK	18	YR	QIS4	-0.32000	QIS4: TS.XI.B.5 downward
39	MKT_INT_DN_RISK_SHOCK	19	YR	QIS4	-0.31000	QIS4: TS.XI.B.5 downward
40	MKT_INT_DN_RISK_SHOCK	20	YR	QIS4	-0.31000	QIS4: TS.XI.B.5 downward
41	MKT_INT_UP_RISK_SHOCK	0.25	YR	QIS5	0.70000	Upward shock to the interes
42	MKT_INT_UP_RISK_SHOCK	0.5	YR	QIS5	0.70000	Upward shock to the interes
43	MKT_INT_UP_RISK_SHOCK	1	YR	QIS5	0.70000	Upward shock to the interes
44	MKT_INT_UP_RISK_SHOCK	2	YR	QIS5	0.70000	Upward shock to the interes
45	MKT_INT_UP_RISK_SHOCK	3	YR	QIS5	0.64000	Upward shock to the interes
46	MKT_INT_UP_RISK_SHOCK	4	YR	QIS5	0.59000	Upward shock to the interes
47	MKT_INT_UP_RISK_SHOCK	5	YR	QIS5	0.55000	Upward shock to the interes
48	MKT_INT_UP_RISK_SHOCK	6	YR	QIS5	0.52000	Upward shock to the interes
49	MKT_INT_UP_RISK_SHOCK	7	YR	QIS5	0.49000	Upward shock to the interes
50	MKT_INT_UP_RISK_SHOCK	8	YR	QIS5	0.47000	Upward shock to the interes
51	MKT_INT_UP_RISK_SHOCK	9	YR	QIS5	0.44000	Upward shock to the interes

Market Risk SCR: Assets

- Are we anywhere near our Excel version of the truth?

BOND1	MTM	1,017,012,37		
	IR Up	900,934,53		
	IR Down	1,113,437,30		
BOND2	MTM	559,307,73	MTM	3,282,741
	IR Up	506,120,64	IR Up	2,907,501
	IR Down	600,611,04	IR Down	3,599,543
BOND3	MTM	183,551,20		
	IR Up	171,936,88		
	IR Down	190,960,54		
BOND4	MTM	634,903,70		
	IR Up	579,186,80		
	IR Down	676,291,52		
BOND5	MTM	887,966,23		
	IR Up	749,322,30		
	IR Down	1,018,242,53		

INSTVALS ▾

Filter and Sort | Query Builder | Data ▾ | Describe ▾ | Graph ▾ | Analyze ▾ | Export ▾ | Send To ▾ |

InstNumber	InstID	Currency	COUNTRY_CD	LOB_ID	Value
1	BD_BOND_001	EUR	BE	L007	1,017,012.37
2	BD_BOND_002	EUR	BE	L007	559,307.74
3	BD_BOND_003	EUR	BE	L007	183,551.19
4	BD_BOND_004	EUR	BE	L007	634,903.71
5	BD_BOND_005	EUR	BE	L007	887,966.23

	AnalysisName	_date_	Value	Exposure	PL
1	Project_Valuation_Scenarios_MKT	December 31, 2008	3,282,741.24	3,282,741.24	0.00
2	Project_Valuation_Scenarios_MKT	December 31, 2008	2,907,501.23	2,907,501.23	-375,240.01
3	Project_Valuation_Scenarios_MKT	December 31, 2008	3,599,542.92	3,599,542.92	316,801.69

Market Risk SCR: Liabilities

⚠ shock_type	⚠ CCY	⚠ COUNTRY_CD	🔍 risk_value	⚠ REGULATORY_SIMULATION_NM	⚠ SIMULATION_LABEL	⚠ REGULATORY_SIMULATION_DESC
BASECASE	EUR	BE	2,855,251.61	BASECASE	BASECASE	BASECASE
LF_MORT	EUR	BE	3,174,817.17	LF_MORT	LF_MORT	Mortality rates shock
MKT_INT	EUR	BE	1,268,625.58	MKT_INT_UPWARD	MKT_INT_UPWARD	Upward Interest Rate shock
N_MKT_INT	EUR	BE	5,226,534.56	MKT_INT_DOWNWARD	MKT_INT_DOWNWARD...	Downward Interest Rate shock w/ risk miti...

SCR Computations

- To summarize previous calculations,

	MtM	Mortality Shock	Int Up Shock	Int Down Shock
Assets	3.282.741	3.282.741	2.907.501	3.599.543
Liabilities	2.855.252	3.174.817	1.268.626	5.226.535
NAV	427.490	107.924	1.638.876	- 1.626.992
dNAV	-	-	319.566	1.211.386 - 2.054.481
SCR	-	319.566	-	2.054.481

- Therefore,
 - $SCR_{Life} = € 319.566 = € 427.490 - € 107.924$
 - $SCR_{Mkt} = € 2.054.481 = € 427.790 - (- € 1.626.992)$

Questions?



sas.forum
BELUX 2010



THE
POWER
TO KNOW.



www.sas.com

sas.forum BELUX 2010



Silver



Bronze

