



THE "2014 VBT" IS COMING

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Actuaries' Club of the Southwest – June 28, 2012



Agenda

- Use of 2014 VBT
- Table development
- Underlying data
- Comparison to 2008 VBT
- Table structure
- Table aspects
- Underwriting Criteria Score (UCS) calculator – version 3.0

Significant portions presented are from work produced by the Society of Actuaries & American Academy of Actuaries Joint Project Oversight Group and American Academy of Actuaries Life Experience Sub-Committee

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2014 VBT portion of presentation

Stolen from (legally) ...
I asked and she said OK.

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Thank you Mary!!!

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Use of 2014 VBT

- Tables to be used for principles based reserves
- Will also be underlying table for CSO tables to be used for Net Premium Reserve under PBR, non-forfeiture and tax
- Similarities to 2008 VBT though there will be some material differences

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Table development

- Formed 6 VBT subgroups to focus on:
 - Older and younger age mortality
 - Select period and preferred wear-off
 - Mortality improvement
 - Graduation
 - Modeling for reasonability and analysis
 - Industry considerations
- Separate, but related, Underwriting Criteria Score calculator subgroup
- Initial focus will be on base (i.e., aggregate) table

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Underlying data

- Underlying data
 - SOA intercompany individual life experience for exposure years 2002 through 2009
 - Have recently determined to include data from 2007-2009 data call – still analyzing
 - Have seen significant improvement in mortality, especially at the older ages as exposure has increased
 - Also see significant difference in mortality based on policy amount

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Improvement in underlying mortality

Study Period	Male	Female	Aggregate	Exposure (Trillion)	# Death Claims
2002-2004	101.1%	100.5%	100.9%	\$ 7.4	699,890
2002-2007	96.2%	97.0%	96.4%	21.1	1,800,912
2002-2009 - Preliminary	94.2%	94.7%	94.3%	30.7	2,549,490
2002-2007 Common Companies	94.6	95.4	94.8	12.4	1,393,521
2002-2009 - Preliminary Common Companies	92.3%	94.3%	92.8%	19.2	1,940,403
2002 - 2009 Preliminary 100k+	88.3%	89.2%	88.5%	26.9	162,095
2002 - 2009 Preliminary 250k+	84.1%	85.4%	84.4%	20.6	46,570

Data scientist warning: A macro comparison is not necessarily the most appropriate indicator to estimate improvement

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Insured lives mortality varies by many factors

In addition to gender, life insurance mortality experience varies by many factors including face amount, smoking status, and issue age

A/E* Ratio – by Face Amount		A/E* Ratio – NS versus SM	
Face Amount Band (\$)	A/E Ratio by Amount	Smoking Status	A/E Ratio by Amount
50,000 – 99,999	105.6%	Nonsmoker	92.3%
100,000 – 249,999	97.8%	Smoker	97.5%
250,000 – 499,999	88.6%	Unknown Status	99.8%
1,000,000 – 2,499,999	81.9%	Aggregate	94.3%
5,000,000 – 9,999,999	74.1%	A/E* Ratio – By Issue Age	
Aggregate	94.3%	Issue Age	A/E Ratio by Amount
		40 – 49	100.1%
		60 – 69	95.1%
		80-89**	61.6%

* Expected basis = 2008 VBT Primary Tables, ANB
** 80-90 for common companies drops to 35%

Source: Society of Actuaries, Individual Life Experience Reports 2003 through 2009 Preliminary

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Comparison to 2008 VBT

- Additional data
 - 7 exposure years versus 2
 - Preferred experience
 - Non tobacco versus non smoker
 - Older issue ages
- Will have a true smoking aggregate table
- Slope at highest ages likely to change
- Population mortality – starting point and grading pattern likely to change
- Mortality improvement
- Number of RR Tables (actual RRs may change) versus starting level

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Table structure

- Focusing on aggregate table first, preferred tables will follow
- To date, have not excluded any data but still examining
- Potential issue with under-reporting of claims at lower face amounts at oldest issue ages
 - Escheatment work may change outlook for older age claims
 - SSA Death Master Index issues may exacerbate issue
- No terminal age
 - Will be one for respective CSO tables = 121
- Need for limited underwriting table still under examination
 - Relies partially on results from GI/SI study

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Current Status – Select Period

- 2 phases
 - Observed data select period
 - Current new business (prospective) select period
- Observed data select period
 - Based on underlying data of both "common" / "all" companies
 - Data analyzed based on count rather than amount to remove influence of variations/fluctuations by size of claim
 - Attempt to normalize impact of change in socio-economic distrib. over time
 - Separate by gender/smoking status, evaluate quinquennial age groupings
 - Used Generalized Additive Model (GAM) to test fit "actual" to "GAM predicted" mortality across attained ages, comparing durations to ultimate

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Current Status – Select Period, cont'd

Initial Proposed Select Period Based on Observed Data

Issue Age	MNT	FNT	MT	FT	Issue Age	MNT	FNT	MT	FT
0-16	25	25	N/A	N/A	79	20	20	11	11
17-50	25	25	20	20	80	20	20	10	10
51	25	25	19	19	81	19	19	10	10
52	25	25	18	18	82	18	18	10	10
53	25	25	17	17	83	17	17	10	10
54	25	25	16	16	84	16	16	10	10
55	25	25	15	15	85	15	15	10	10
56	24	24	15	15	86	14	14	9	9
57	23	23	15	15	87	13	13	8	8
58	22	22	15	15	88	12	12	7	7
59	21	21	15	15	89	11	11	6	6
60	20	20	15	15	90	10	10	5	5
61-75	20	20	15	15	91	8	8	4	4
76	20	20	14	14	92	6	6	3	3
77	20	20	13	13	93	4	4	2	2
78	20	20	12	12	94+	2	2	2	2

Source: 2014 Valuation Basic Table Team of the Society of Actuaries & American Academy of Actuaries Joint Project Oversight Group

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Current Status – Select Period, cont'd

- Fit using GAM Model, Aggregate across all ages, Male, Non-smoker

Source: 2014 Valuation Basic Table Team of the Society of Actuaries & American Academy of Actuaries Joint Project Oversight Group

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Current Status – Select Period, cont'd

- Prospective select period
 - Looking to "events" or changes in underwriting which have impacted the select period or wear-off slope in the underlying 2002-2009 data, relative to today's environment
 - Examples:
 - Movement from smoker to non-smoker rates (1980's),
 - Movement from "non-smoker/smoker" to "non-tobacco/tobacco" definitions (1990's),
 - Changes in risk profile due to introduction of preferred risk products (1990s)
 - Liberal underwriting period with increased level of underwriting exceptions (2000-2005),
 - Introduction of mature age underwriting requirements such as cognitive/functionality (2005-present)

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Current Status – Mortality Improvement (from central point of data to 2014)

- Considerations
 - General population improvement
 - US Vital Statistics
 - Human Mortality Data Base (HMD)
 - Social Security Administration Data (SSA)

} After looking at 3 sources, SSA data selected as source for general population

- Insured data
 - Common company data for period 2002-2009
 - Given short period of time for historical experience and volatility from year over year, believe general population data is preferable
- Additional factors

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Current Status – Mortality Improvement, cont'd

- Additional factors considered
 - Gender
 - Attained age
 - Smoker status
 - Socio-economic status
 - Differences in cause of death for insured lives vs general population
- Recommendations based on 2002-2007 data; will revisit using 2002-2009 data to ensure recommendations still valid

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Current Status – Mortality Improvement, cont'd

- Preliminary recommendation
 - For period 2002-2009:
 - Apply actual mortality improvement to adjust each experience year
 - For period 2009-2014:
 - Apply average annual improvement rates varying by attained age and gender
 - Based on general population data (SSA) = average of (1) and (2) where,
 - Average annual improvement rates implied by the SSA's most recent intermediate level projection of mortality for the social security population and
 - Actual average annual improvement rates from historical SSA data for the most recent 10-year period

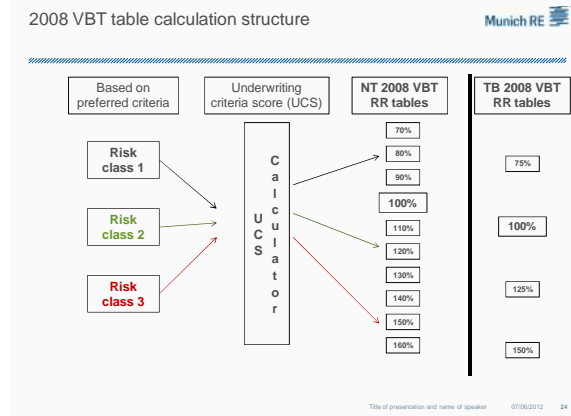
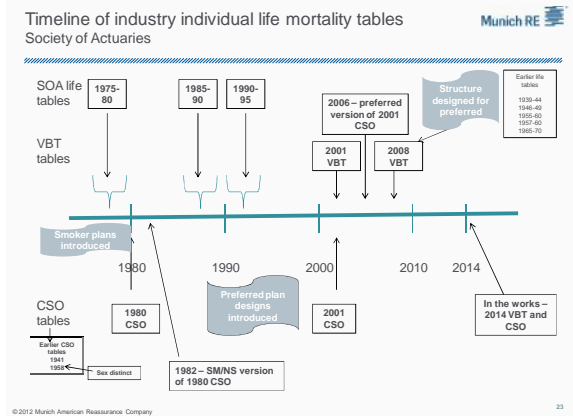
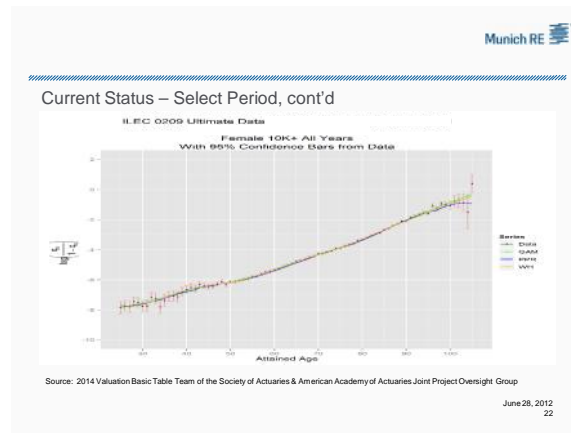
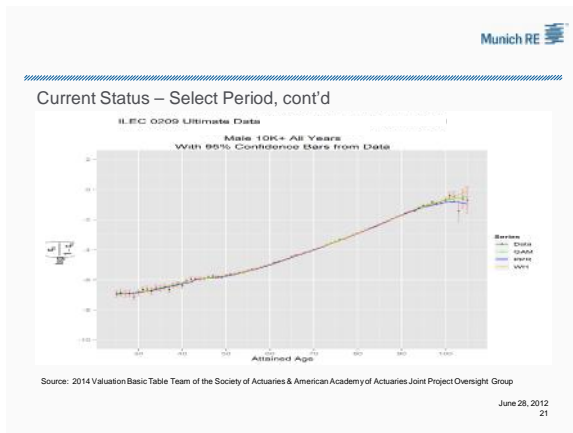
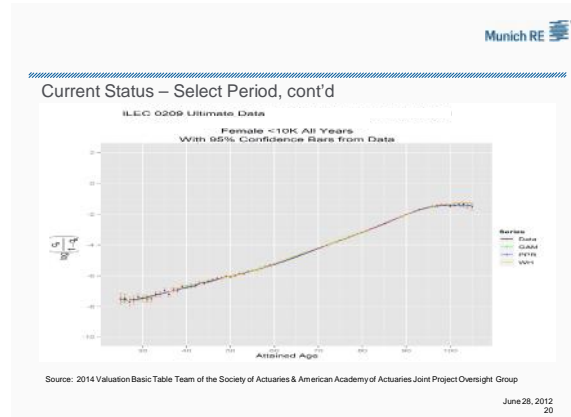
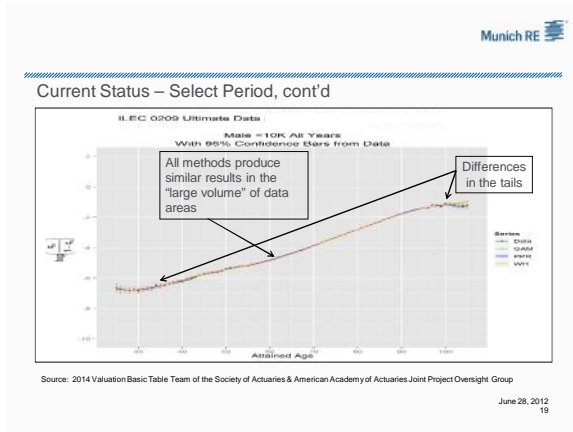
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Current Status – Graduation approaches

- Explored 3 separate approaches to graduating data and resulting fit
 - Projection pursuit regression (PPR)
 - Whittaker-Henderson (WH)
 - Graph values use order 4, smoothness 20000
 - Generalized Additive Model (GAM)
- PPR – good fit with ultimate model but loss of fit to model in select period
- WH – loss of model fit
- GAM – best fit overall, little to no loss of model fit

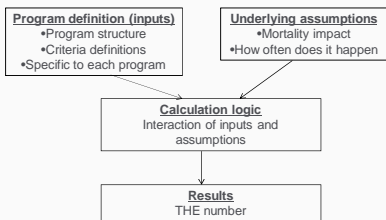
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UCS Calculator basics

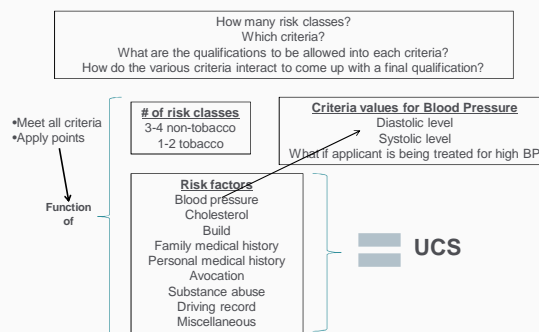


4 key elements



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YOUR program
what does it look like



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Inputs
age splits



UCS 1.0/2.0

BP recognizes difference between ages 45 and 65

But what about build, etc.

Blood Pressure (NO, DC, Esm)		Build (NO, DC, Esm)	
I. Systolic Limit - Age 45	Treated Allowed (Y/N)	A. Male Weight Limit at 5'10" in Bu	Female Weight Limit at 5'10" in Bu
Diastolic Limit - Age 45		Male Weight Limit at 5'7" in Bu	Female Weight Limit at 5'7" in Bu
II. Systolic Limit - Age 65		Female Weight Limit at 5'10" in Bu	Male Weight Limit at 5'10" in Bu
Diastolic Limit - Age 65		Female Weight Limit at 5'7" in Bu	Male Weight Limit at 5'7" in Bu
Treated Allowed (Y/N)		B. Max BMI Limit (M/F)	Female BMI Limit (M/F)

UCS 3.0 (Build)

Ages 18 - 32

Ages 33 - 59

Ages 60 - 90

Build - BMI for Males for All			
Risk Class	DC Points	Maximum	
Std	25.9	35.9	
Super Pref	25.9	35.0	
Pref	32.9	35.9	
Std	25.9		

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Inputs
Combo inputs



UCS 1.0/2.0

BP recognizes difference between ages 45 and 65

Blood Pressure (NO, DC, Esm)		Risk class 1		Risk class 2	
I. Systolic Limit - Age 45	Treated Allowed (Y/N)				
Diastolic Limit - Age 45					
II. Systolic Limit - Age 65					
Diastolic Limit - Age 65					
Treated Allowed (Y/N)					

Treated / Untreated
Different values can be inserted
Note: untreated is shown here, but there are separate boxes for treated and untreated.

UCS 3.0

Input alternative 1

Input alternative 2

Blood Pressure - Systolic - Untreated				Blood Pressure - Diastolic - Untreated				Blood Pressure - Combo - Systolic/Diastolic - Untreated					
Risk Class	DC Points	Maximum		Risk Class	DC Points	Maximum		Risk Class	DC Points	Minimum	Maximum	Diastolic	Diastolic
Super Pref	154			Super Pref	104			Super Pref	90	154	104	Maximum	104
Pref				Pref				Pref	90	135	85	75	75
Std				Std				Std	90	135	85	104	104

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Inputs

Other features of UCS 3.0



- Flexible age banding possible for all criteria
- Multiple input structures for blood pressure, cholesterol, build
- Knock-out and debit-credit entry locations combined
- Better definition for allowing flat extras
- Family history
 - Cardio → Coronary, cerebro
- Personal history
 - Cardio → Coronary, cerebro
 - Mental / nervous added
- Separate NT/TB input worksheets

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Assumptions - relative risk and prevalence
Blood pressure as the example



UCS 1.0/2.0

GENERAL PARAMETERS Table			
Age 45 / Age 65 (Weighting factor)	50%		
Diastolic Weight Relative to Systolic	2	0.0	6.00
Add to Diastolic: Pressure reading value if Treated	2.5	3.0	3.40
Add to Systolic: Pressure reading value if Treated	5	6.0	3.30
Slope to minimum	1	100.0	13.50
Slope to maximum	2	127.0	0.00

DIASTOLIC VALUES - AGE 45 Table			
Slope to minimum	1		
Slope to maximum	2		
Min	DIP Value	Min Score	Slope
	75	-19.8	6.60
	80	33.0	6.60
	85	67.0	6.60
Max	90	100.0	13.50
	92	127.0	0.00

DIASTOLIC VALUES - AGE 65 Table			
Slope to minimum	1		
Slope to maximum	2		
Min	DIP Value	Min Score	Slope
	77	-30.0	10.00
	80	33.0	10.00
	83.3	33.0	10.00
	86.7	67.0	10.00
	90	100.0	13.50
	92	127.0	0.00

Note: Score is the interpolated value for the specified Blood Pressures

Result is the BP component of the score

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UCS 1.0/2.0 calculation example
Blood pressure



BP Criteria (program specific example)

- 2 risk classes
- BP requirement for preferred
Age SBP/DBP
45 140/80
65 140/80

Final BP UCS factor

Preferred 33.3
Std/residual 127.0

Preferred	Factor	Wgt
Age	44.3	50%
45		
65	22.3	50%

Age 45 calculation

Preferred Score	SBP	DBP	Value	Wgt
	140	80	2	33
	Combined		3	44.3

Standard/Residual Score	SBP	DBP	Value	Wgt
	152	92	1	127
	Combined		3	127

Age 65 calculation

Preferred Score	SBP	DBP	Value	Wgt
	140	80	2	0
	Combined		3	22.3

Standard/Residual Score	SBP	DBP	Value	Wgt
	152	92	1	127
	Combined		3	127

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Calculation



UCS 1.0/2.0
2008 VBT RR table

BP component

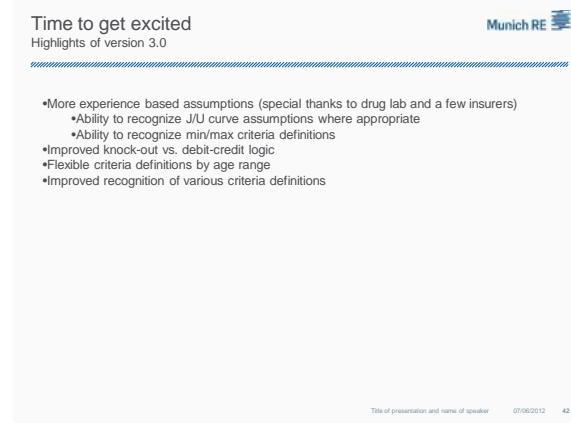
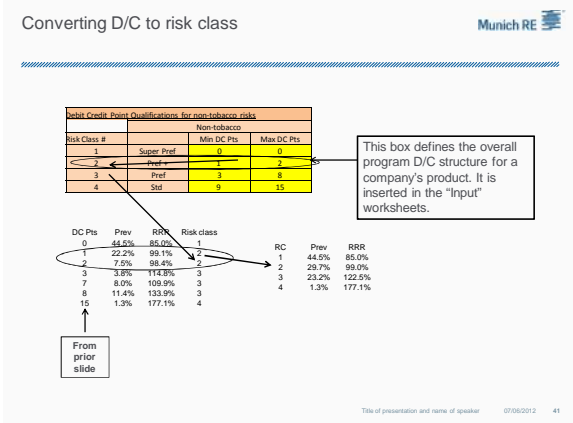
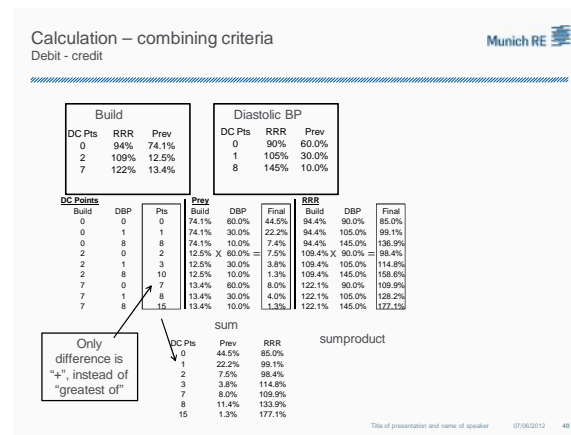
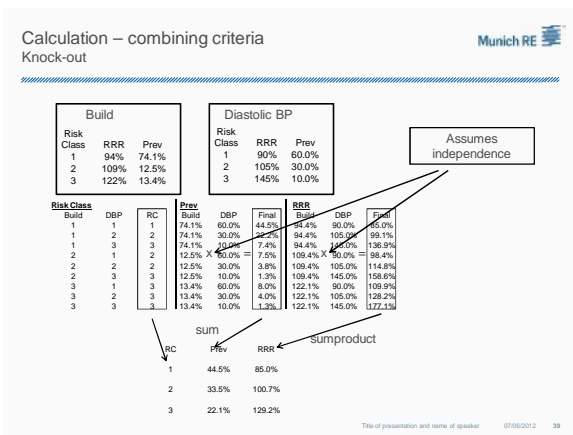
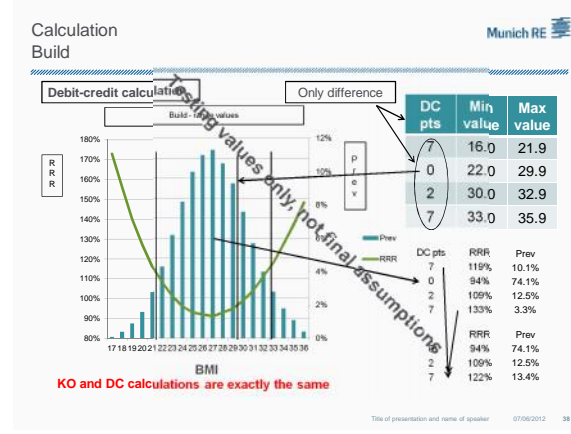
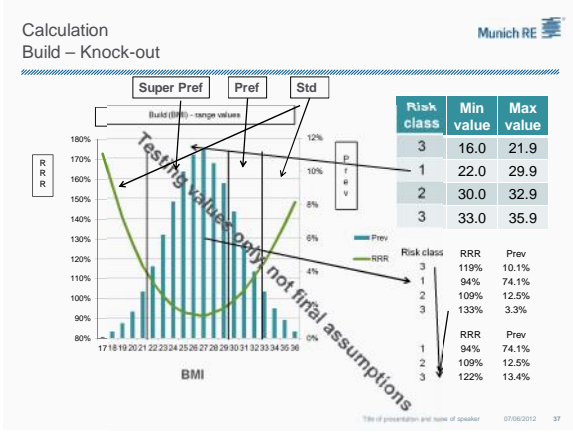
UCS 2.0 addition For debit credit

UCS	Score	Prevalence	UCS	RR	UCS	RR	UCS	RR	UCS	RR
-1	0.0%	0.000%	17.1	-12.4	-7.4	-4.6	-11.6	-6.5	17.1	10.0
0	0.0%	0.000%	17.9	-11.5	-6.2	-3.3	-10.7	-5.4	17.9	10.0
1	32.3%	0.036%	18.7	-10.5	-5.1	-2.0	-9.7	-7.3	18.7	20.8
2	32.3%	0.036%	19.4	-9.6	-3.9	-0.7	-8.7	-4.2	19.4	21.6
3	32.3%	0.036%	20.2	-8.7	-2.7	0.6	-7.6	-5.2	20.2	22.5
4	32.3%	0.036%	21.0	-7.7	-1.6	1.9	-6.8	-4.1	21.0	23.4
5	32.3%	0.036%	21.8	-6.8	-0.4	3.2	-5.8	-3.0	21.8	24.2
6	32.3%	0.036%	22.6	-5.9	0.7	4.5	-4.8	-2.0	22.6	25.1
7	32.3%	0.036%	23.3	-4.9	1.8	5.6	-3.9	-0.3	23.3	26.0
8	32.3%	0.036%	24.1	-4.0	3.1	6.4	-3.0	0.6	24.1	26.9
9	32.3%	0.036%	24.9	-3.1	4.2	6.9	-2.1	1.9	24.9	27.7
10	32.3%	0.036%	25.7	-2.1	5.4	7.4	-1.0	4.5	25.7	28.5
11	32.3%	0.036%	26.4	-1.2	6.6	7.9	0.0	3.4	26.4	29.4
12	32.3%	0.036%	27.2	-0.3	7.7	8.2	1.0	4.5	27.2	30.2
13	32.3%	0.036%	28.0	0.7	8.9	8.5	1.9	5.5	28.0	31.2
14	32.3%	0.036%	28.8	1.6	10.1	8.8	2.9	6.6	28.8	32.0
15	32.3%	0.036%	29.6	2.6	11.2	9.1	3.9	7.7	29.6	32.9
16	32.3%	0.036%	30.4	3.6	12.4	9.4	4.8	8.7	30.4	33.8
17	32.3%	0.036%	31.2	4.6	13.6	9.7	5.7	9.7	31.2	34.7
18	32.3%	0.036%	32.0	5.6	14.8	10.0	6.6	10.6	32.0	35.6
19	32.3%	0.036%	32.8	6.6	16.0	10.3	7.5	11.5	32.8	36.5
20	32.3%	0.036%	33.6	7.6	17.2	10.6	8.4	12.4	33.6	37.4
21	32.3%	0.036%	34.4	8.6	18.4	10.9	9.3	13.3	34.4	38.3
22	32.3%	0.036%	35.2	9.6	19.6	11.2	10.2	14.2	35.2	39.2
23	32.3%	0.036%	36.0	10.6	20.8	11.5	11.1	15.1	36.0	40.1
24	32.3%	0.036%	36.8	11.6	22.0	11.8	12.0	16.0	36.8	41.0
25	32.3%	0.036%	37.6	12.6	23.2	12.1	12.9	16.9	37.6	41.9
26	32.3%	0.036%	38.4	13.6	24.4	12.4	13.8	17.8	38.4	42.8
27	32.3%	0.036%	39.2	14.6	25.6	12.7	14.7	18.7	39.2	43.7
28	32.3%	0.036%	40.0	15.6	26.8	13.0	15.6	19.6	40.0	44.6
29	32.3%	0.036%	40.8	16.6	28.0	13.3	16.5	20.5	40.8	45.5
30	32.3%	0.036%	41.6	17.6	29.2	13.6	17.4	21.4	41.6	46.4
31	32.3%	0.036%	42.4	18.6	30.4	13.9	18.3	22.3	42.4	47.3
32	32.3%	0.036%	43.2	19.6	31.6	14.2	19.2	23.2	43.2	48.2
33	32.3%	0.036%	44.0	20.6	32.8	14.5	20.1	24.1	44.0	49.1
34	32.3%	0.036%	44.8	21.6	34.0	14.8	21.0	25.0	44.8	50.0
35	32.3%	0.036%	45.6	22.6	35.2	15.1	21.9	25.9	45.6	50.9
36	32.3%	0.036%	46.4	23.6	36.4	15.4	22.8	26.8	46.4	51.8
37	32.3%	0.036%	47.2	24.6	37.6	15.7	23.7	27.7	47.2	52.7
38	32.3%	0.036%	48.0	25.6	38.8	16.0	24.6	28.6	48.0	53.6
39	32.3%	0.036%	48.8	26.6	40.0	16.3	25.5	29.5	48.8	54.5
40	32.3%	0.036%	49.6	27.6	41.2	16.6	26.4	30.4	49.6	55.4
41	32.3%	0.036%	50.4	28.6	42.4	16.9	27.3	31.3	50.4	56.3
42	32.3%	0.036%	51.2	29.6	43.6	17.2	28.2	32.2	51.2	57.2
43	32.3%	0.036%	52.0	30.6	44.8	17.5	29.1	33.1	52.0	58.1
44	32.3%	0.036%	52.8	31.6	46.0	17.8	30.0	34.0	52.8	59.0
45	32.3%	0.036%	53.6	32.6	47.2	18.1	30.9	34.9	53.6	59.9
46	32.3%	0.036%	54.4	33.6	48.4	18.4	31.8	35.8	54.4	60.8
47	32.3%	0.036%	55.2	34.6	49.6	18.7	32.7	36.7	55.2	61.7
48	32.3%	0.036%	56.0	35.6	50.8	19.0	33.6	37.6	56.0	62.6
49	32.3%	0.036%	56.8	36.6	52.0	19.3	34.5	38.5	56.8	63.5
50	32.3%	0.036%	57.6	37.6	53.2	19.6	35.4	39.4	57.6	64.4
51	32.3%	0.036%	58.4	38.6	54.4	19.9	36.3	40.3	58.4	65.3
52	32.3%	0.036%	59.2	39.6	55.6	20.2	37.2	41.2	59.2	66.2
53	32.3%	0.036%	60.0	40.6	56.8	20.5	38.1	42.1	60.0	67.1
54	32.3%	0.036%	60.8	41.6	58.0	20.8	39.0	43.0	60.8	68.0
55	32.3%	0.036%	61.6	42.6	59.2	21.1	39.9	43.9	61.6	68.9
56	32.3%	0.036%	62.4	43.6	60.4	21.4	40.8	44.8	62.4	69.8
57	32.3%	0.036%	63.2	44.6	61.6	21.7	41.7	45.7	63.2	70.7
58	32.3%	0.036%	64.0	45.6	62.8	22.0	42.6	46.6	64.0	71.6
59	32.3%	0.036%	64.8	46.6	64.0	22.3	43.5	47.5	64.8	72.5
60	32.3%	0.036%	65.6	47.6	65.2	22.6	44.4	48.4	65.6	73.4
61	32.3%	0.036%	66.4	48.6	66.4	22.9	45.3	49.3	66.4	74.3
62	32.3%	0.036%	67.2	49.6	67.6	23.2	46.2	50.2	67.2	75.2
63	32.3%	0.036%	68.0	50.6	68.8	23.5	47.1	51.1	68.0	76.1
64	32.3%	0.036%	68.8	51.6	70.0	23.8	48.0	52.0	68.8	77.0
65	32.3%	0.036%	69.6	52.6	71.2	24.1	48.9	52.9	69.6	77.9
66	32.3%	0.036%	70.4	53.6	72.4	24.4	49.8	53.8	70.4	78.8
67	32.3%	0.036%	71.2	54.6	73.6	24.7	50.7	54.7	71.2	79.7
68	32.3%	0.036%	72.0	55.6	74.8	25.0	51.6	55.6	72.0	80.6
69	32.3%	0.036%	72.8	56.6	76.0	25.3	52.5	56.5	72.8	81.5
70	32.3%	0.036%	73.6	57.6	77.2	25.6	53.4	57.4	73.6	82.4
71	32.3%	0.036%	74.4	58.6	78.4	25.9	54.3	58.3	74.4	83.3
72	32.3%	0.036%	75.2	59.6	79.6	26.2	55.2	59.2	75.2	84.2
73	32.3%	0.036%	76.0	60.6	80.8	26.5	56.1	60.1	76.0	85.1
74	32.3%	0.036%	76.8	61.6	82.0	26.8	57.0	61.0	76.8	86.0
75	32.3%	0.036%	77.6	62.6	83.2	27.1	57.9	61.9	77.6	86.9
76	32.3%	0.036%	78.4	63.6	84.4	27.4	58.8	62.8	78.4	87.8
77	32.3%	0.036%	79.2	64.6	85.6	27.7	59.7	63.7	79.2	88.7
78	32.3%	0.036%	80.0	65.6	86.8	28.0	60.6	64.6	80.0	89.6
79	32.3%	0.036%	80.8	66.6	88.0	28.3	61.5	65.5	80.8	90.5
80	32.3%	0.036%	81.6	67.6	89.2	28.6	62.4	66.4	81.6	91.4
81	32.3%	0.036%	82.4	68.6	90.4	28.9	63.3	67.3	82.4	92.3
82	32.3%	0.036%	83.2	69.6	91.6	29.2	64.2	68.2	83.2	93.2
83	32.3%	0.036%	84.0	70.6	92.8	29.5	65.1	69.1	84.0	94.1
84	32.3%	0.036%	84.8	71.6	94.0	29.8	66.0	70.0	84.8	95.0
85	32.3%	0.036%	85.6	72.6	95.2	30.1	66.9	70.9	85.6	95.9
86	32.3%	0.036%	86.4	73.6	96.4	30.4	67.8	71.8	86.4	96.8
87	32.3%	0.036%	87.2	74.6	97.6	30.7	68.7	72.7	87.2	97.7
88	32.3%	0.036%	88.0	75.6	98.8	31.0	69.6	73.6	88.0	98.6
89	32.3%	0.036%	88.8	76.6	100.0	31.3	70.5	74.5	88.8	99.5
90	32.3%	0.036%	89.6	77.6	100.0	31.6	71.4	75.4	89.6	100.0

Final RR
UCS 1.0/2.0



Cumulative Risk class	UCS	RR	Prev
Preferred	33.3	61.5%	10.72%



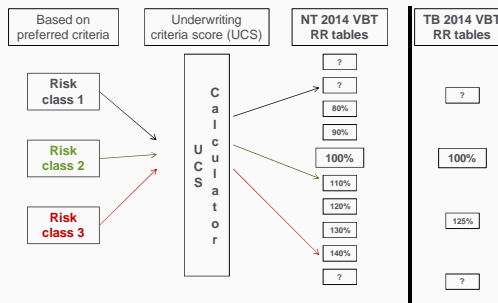
But there's more



- Not a pricing tool
 - Not intended to be a pricing tool
 - No assumption granularity by gender, smoking status, issue age
 - More granular assumptions would have greater "correlations" among criteria
- Excel only tool
 - ".xls" version (as opposed to ".xlsx")
 - No macros
 - SOA requirements
- Committee still has a few open issues
 - Agreeing upon assumptions
 - Reflect TB definition
 - Company specific definition of "standard"
 - Input/output structures
- The standard disclaimer
 - UCS 3.0 is a work in progress
 - Nothing has been approved by anyone

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2014 VBT table calculation structure
So how is the RRR going to be used????



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