



Validating Model Changes: Preventing Future Model Issues

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Potential Future Model Changes

- Assumption Changes
- Model Efficiency
- New Products
- Rate Changes
- New functionality
- New regulations



Need to ensure model changes are thoroughly tested to prevent your model validation work from becoming invalid.



New Products/Regulations/Functionality

- Replicate Pricing model in Inforce Model
- Update test tools with new features, code...
- Start simple (plain, standard policy) then add complexities (riders, substandard ratings, reinsurance)
 - Test AV progression and rates
 - Test reserves, benefits, and cash flows
- Run test inforce model
- Test differences between IF & NB assumptions
- Regression test all other business



New Input Review

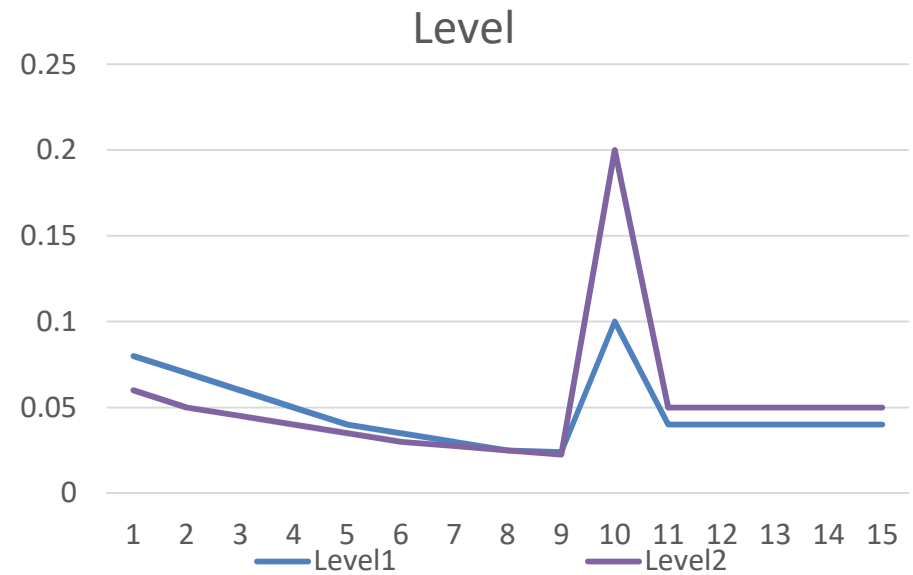
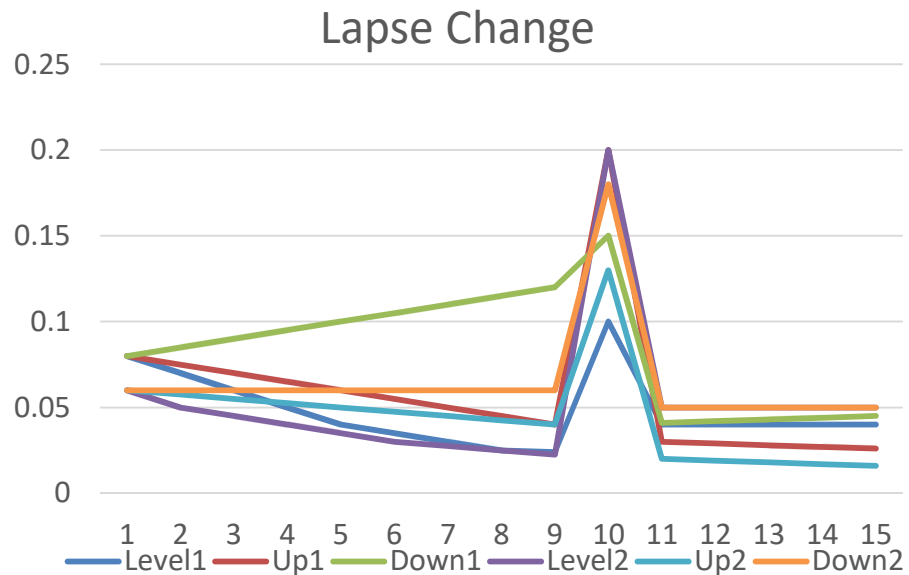
- Create dummy model point file with all new combinations
 - Confirm any newly added fields in model point file have correct information and documentation reflects any expected defaults and ranges
- Confirm no existing fields have disappeared or changed unexpectedly
- Maintain log of all changes to inputs, especially related to data transformations
- Review all model inputs and tables that vary to ensure no holes
- Test pre- and post-launch



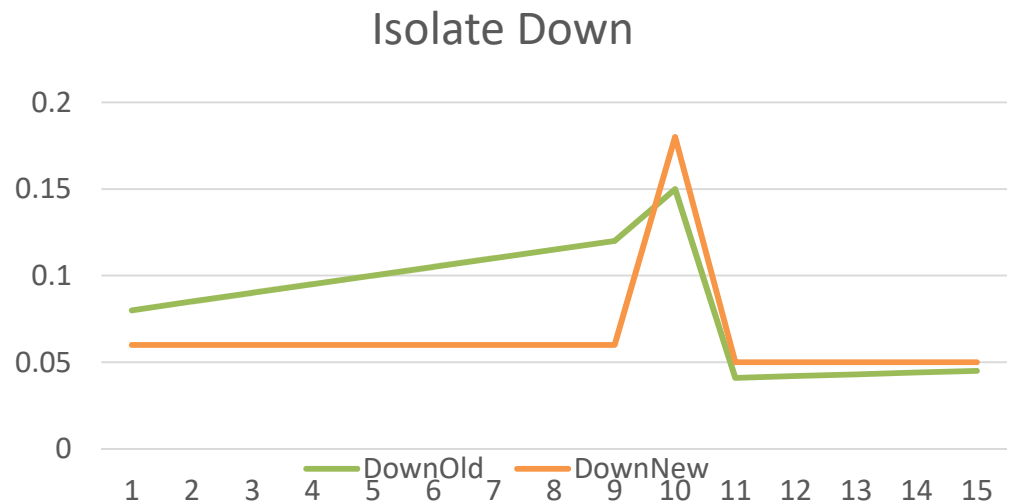
Assumption/Inforce Change Review

- Single cell testing
 - Table and code review
 - Sufficient number of cells to test range of possibilities
 - Test boundary conditions, especially $t=0$, at issue, at decrement timing
- Aggregate impact
 - Reasonableness checks for new blocks of code
 - Review all modeled applications
 - Ensure runtimes are not negatively impacted
- Scenario testing including extremes
- Review Present Values and various points in time
- Actual vs Expected

Analysis of Output – Visual Validation



	Level1	Up1	Down1	Level2	Up2	Down2
1	0.08	0.08	0.08	0.06	0.06	0.06
2	0.07	0.075	0.085	0.05	0.0575	0.06
3	0.06	0.07	0.09	0.045	0.055	0.06
4	0.05	0.065	0.095	0.04	0.0525	0.06
5	0.04	0.06	0.1	0.035	0.05	0.06
6	0.035	0.055	0.105	0.03	0.0475	0.06
7	0.03	0.05	0.11	0.0275	0.045	0.06
8	0.025	0.045	0.115	0.025	0.0425	0.06
9	0.024	0.04	0.12	0.0225	0.04	0.06
10	0.1	0.2	0.15	0.2	0.13	0.18
11	0.04	0.03	0.041	0.05	0.02	0.05
12	0.04	0.029	0.042	0.05	0.019	0.05
13	0.04	0.028	0.043	0.05	0.018	0.05
14	0.04	0.027	0.044	0.05	0.017	0.05
15	0.04	0.026	0.045	0.05	0.016	0.05



Analysis of Output - Aggregate Comparison

- Compare Income Statement and Balance Sheet by duration
- Review sources of profits and/or income statement PVs
- Break down by blocks of business

	Old	Diff	New	Pct Diff		Old	Diff	New	Pct Diff
Investment Income	10,500		10,449	0%	Gross prem	6,600	99	6,699	2%
(-) Interest Credited	(8,400)		(8,293)	-1%	Inv inc	3,000	62	3,062	2%
Interest Margin	2,100	56	2,156	3%	Ceded prem	(900)	(29)	(929)	3%
AV released by Surr	40,000		39,709	-1%	PH div	3,050	(68)	2,982	-2%
(-) Surr Benefits	(39,250)		(38,938)	-1%	TOTAL INC	11,750	64	11,814	1%
AV released PW	12,600		13,155	4%	Surr ben	8,500	83	8,583	1%
(-) PW Paid	(13,000)		(13,574)	4%	Death Ben	5,400	149	5,549	3%
Surrender Margin	350	3	353	1%	Ceded Claims	(4,500)	(165)	(4,665)	4%
AV released by Death	5,060		5,069	0%	Div paid	3,700	121	3,821	3%
(-) Death Benefits	(4,800)		(4,838)	1%	Comm	50	1	51	2%
Mortality Margin	260	(29)	231	-11%	Maint exp	3,600	69	3,669	2%
(-) Expenses	(600)	(14)	(614)	2%	Incr in rsv	(5,900)	(323)	(6,223)	5%
Rider Chg	100		106	6%	Incr in loading	(50)	1	(49)	-2%
(-) Rider Benefits Paid	(80)		(120)	50%	TOTAL BEN & EXP	10,800	(64)	10,736	-1%
Rider Margin	20	(34)	(14)	-172%	PT Profit	950	128	1,078	13%
Chg in AV	(62,500)		(62,887)	1%	Taxes	(500)	(4)	(504)	1%
(-) Chg in Rsv	60,700		60,913	0%	AT Profit	1,450	132	1,582	9%
Reserve Margin	(1,800)	(175)	(1,975)	10%					
PT Profit	330	(193)	137	-58%					
Taxes	(350)		(391)	12%					
AT Profit	680	(152)	528	-22%					



Tips for Success

- Plan for quarterly release to understand business changes and impact on current models
 - Set initial plan and start as early as possible
 - Set appropriate interim and final deadlines
 - Identify main tasks and sub-tasks
 - Assign responsibilities
 - Include time for iterative process, peer review and end user testing
- Update tools for policy level recalculation of reserves, key benefits, and assumptions (assuming tools already exist)
- Ensure sufficient testing, review, and documentation
- De-brief to ensure smoother process next period