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# Dynamic Risk Model

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- Construction of the model
- Stochastic approach
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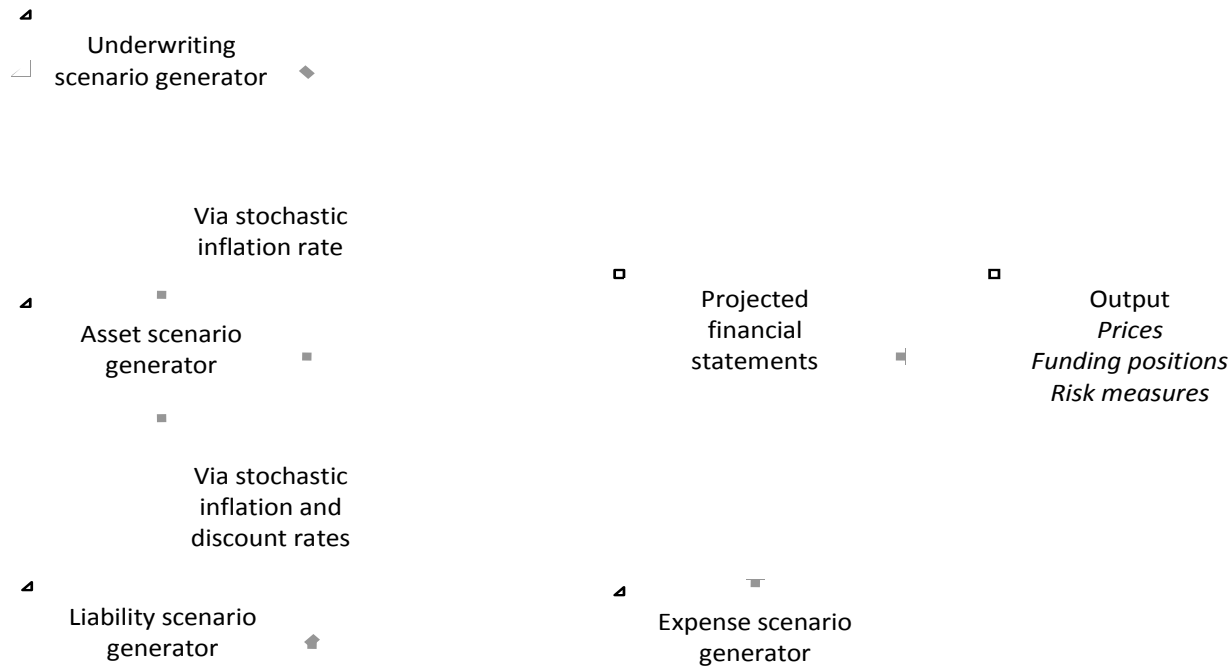


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# Dynamic Risk Model Structure



DRM is intended to achieve integrated management reporting, improved liability valuations, consistent pricing and the ability to “drill down” to key drivers



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# Model Construction

- Most complex area is liability and asset modules;
- Liability modules were developed using SAS;
- Modelling followed ACC structure of accounts and payment types;
- Asset module developed by ACC's investment team (with fat tailed equity returns and mean reversion over long horizons)



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# Stochastic Approach

- Required to indicate variability in projections of liabilities, assets, etc
- Statistical models fitted to historical experience;
  - The modelling uses statistical tests of goodness of fit;
  - The modelling measures and incorporates variability;
- Measures of variability of experience enables interpretation of past and current changes in experience;



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# Systemic Risk

- Process risk - actual results vary due to chance;
- Parameter risk – methods not representative;
- Systemic risk – common across all accounts - hardest to estimate;
- We calibrated systemic parameters, checking that aggregate systemic risk appears ‘realistic’:
  - considering historical outcomes (relative to expectations)
  - and ‘priors’ about volatility over short vs long horizons

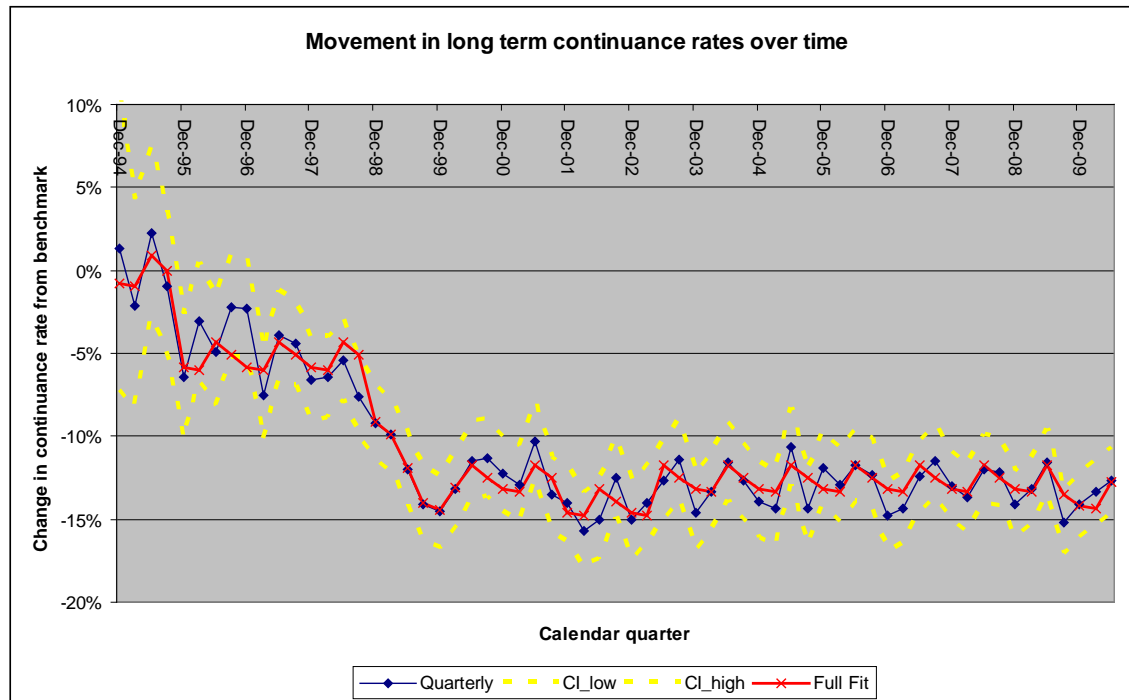


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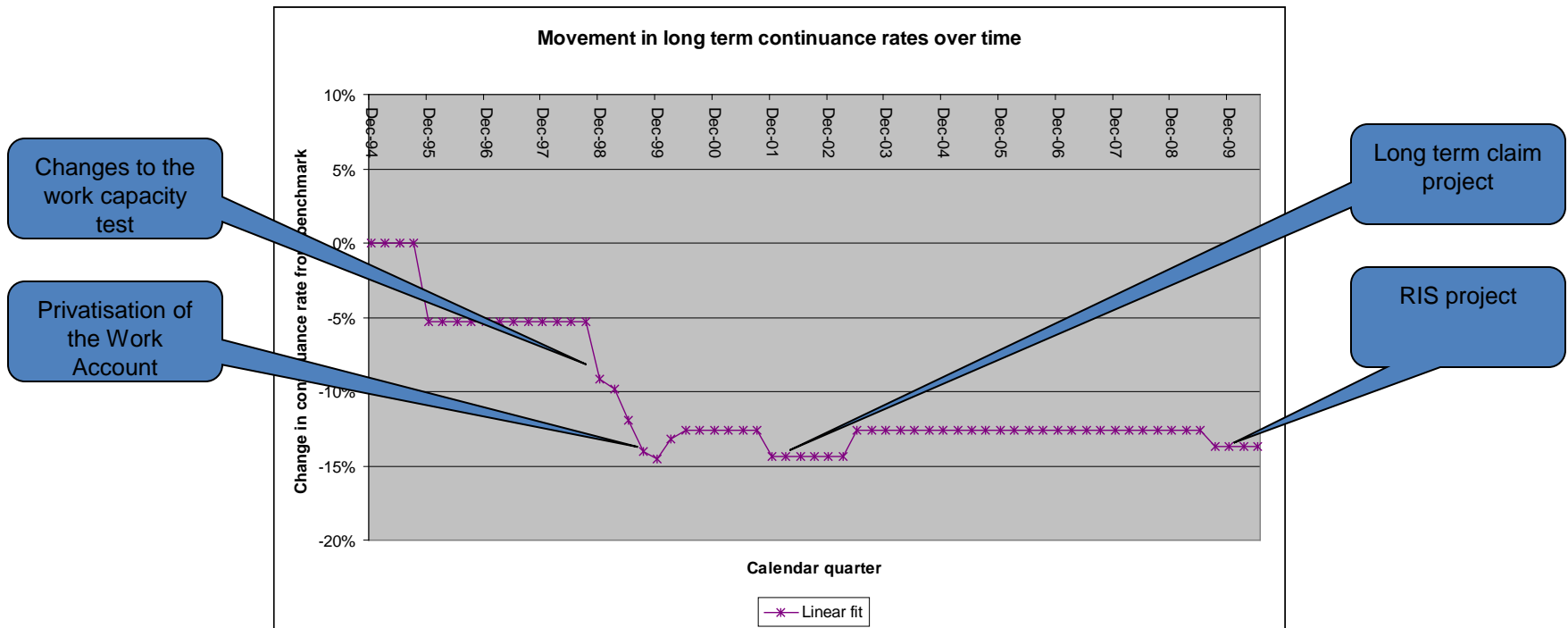
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# Long Term Continuance





## Long Term Continuance



- Underlying systemic changes
  - Legislatively driven, plus
  - Occasional project based periods of lower continuance



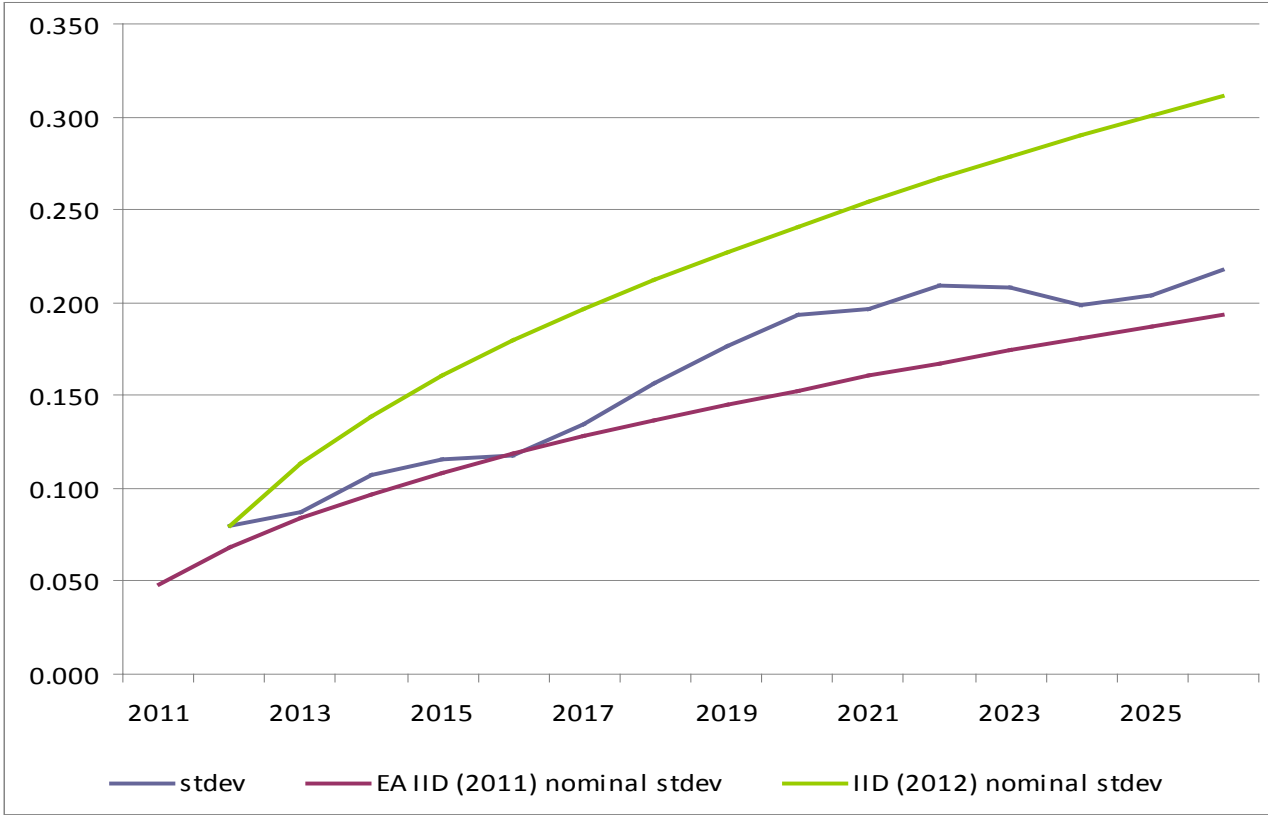


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## Standard Deviations





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# Applications

- Used for pricing – levy setting
  - Provides a range of possible financial outcomes
  - Probability of ruin
  
- Funding ratio =  $\text{Assets}/\text{Liabilities}$ 
  - Liabilities based on central estimates, discounted at risk free rates, includes risk margins



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# **Application : Levy Setting**

**Deterministic  
Model**

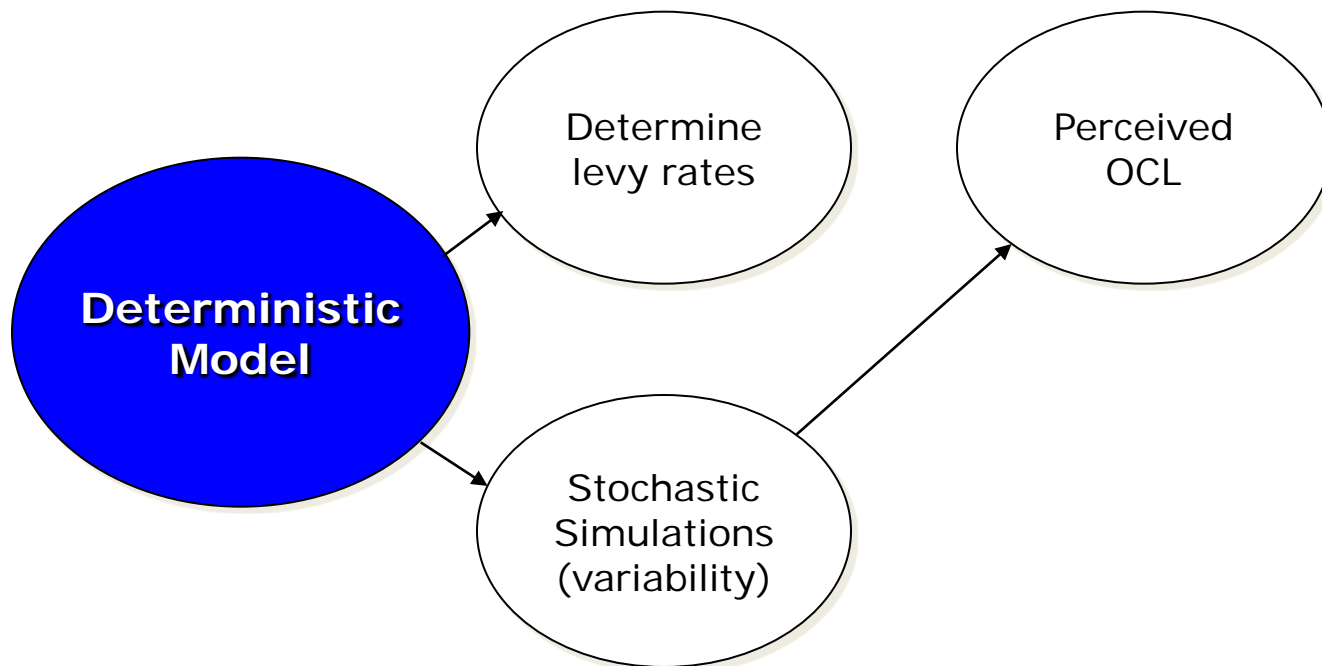


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## Application : Levy Setting



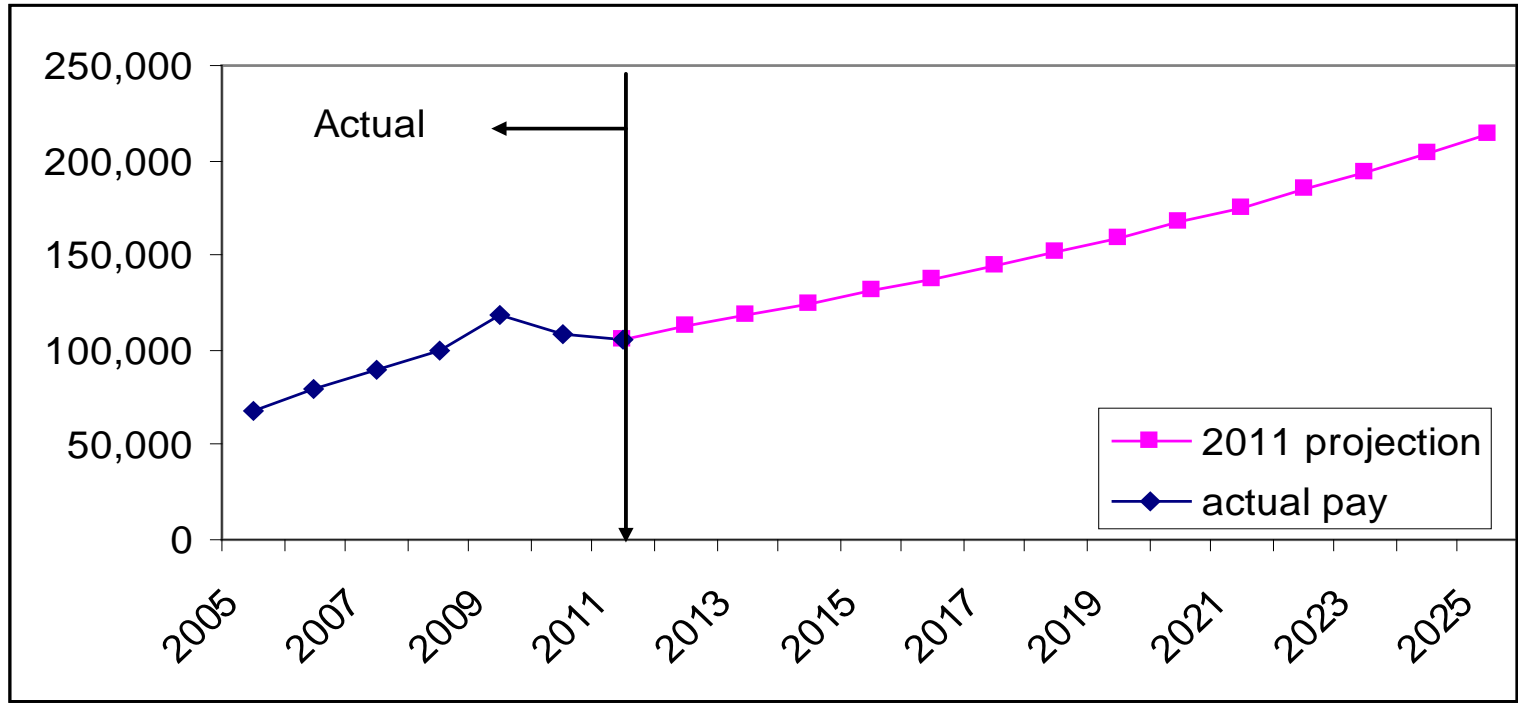


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# Perceived OCL



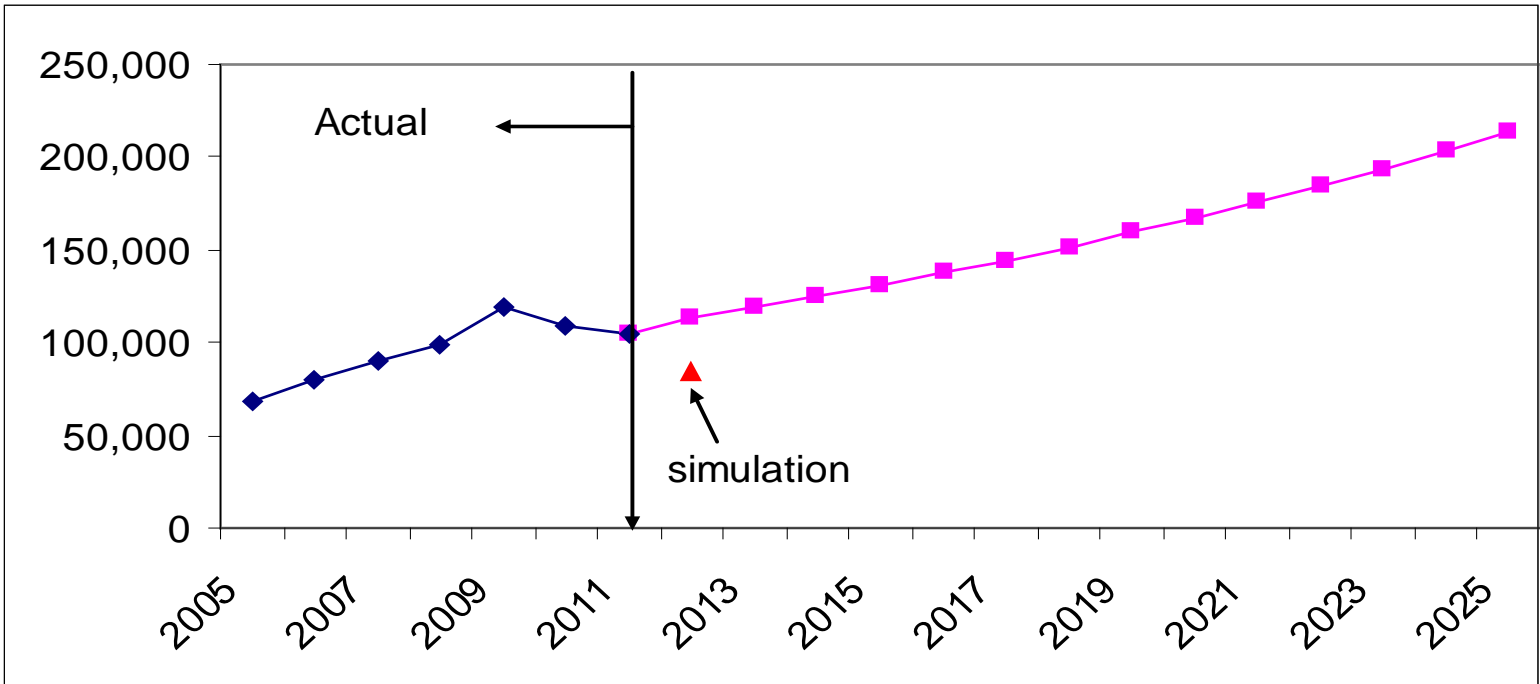


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# Perceived OCL



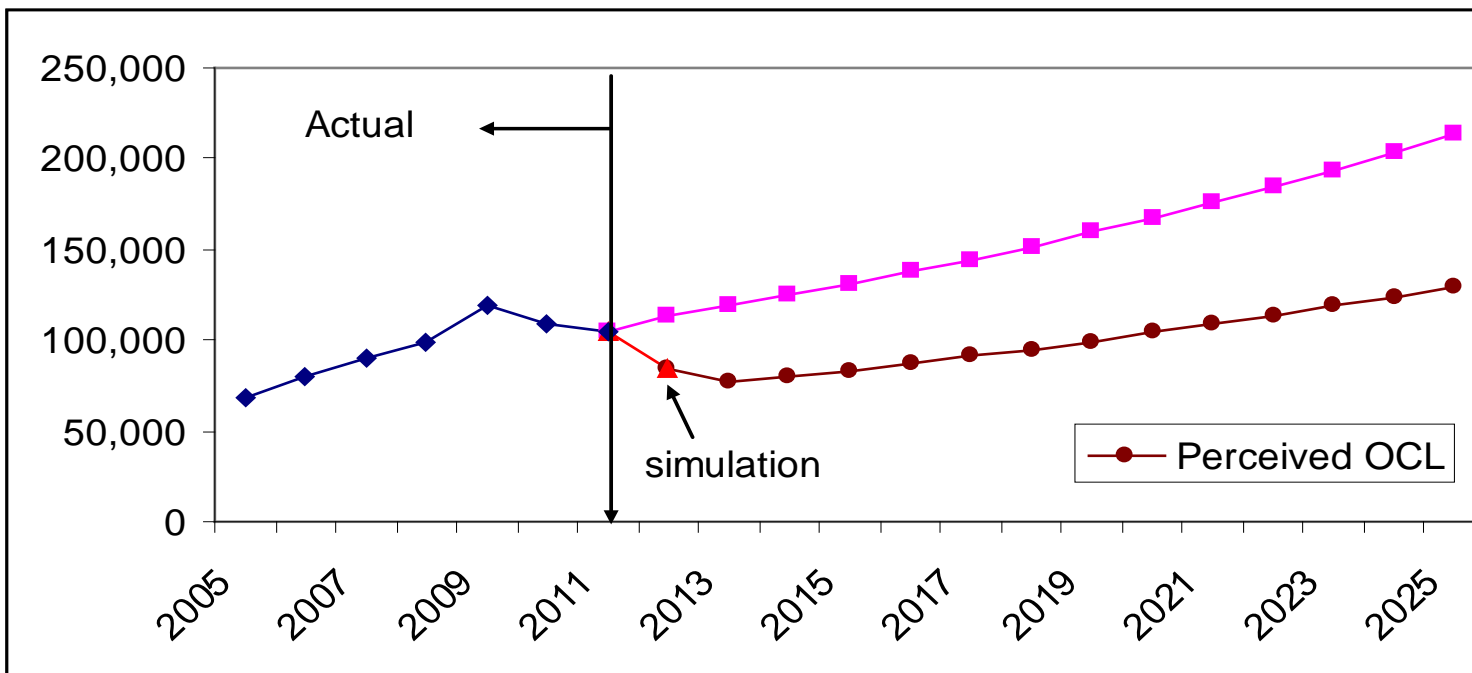


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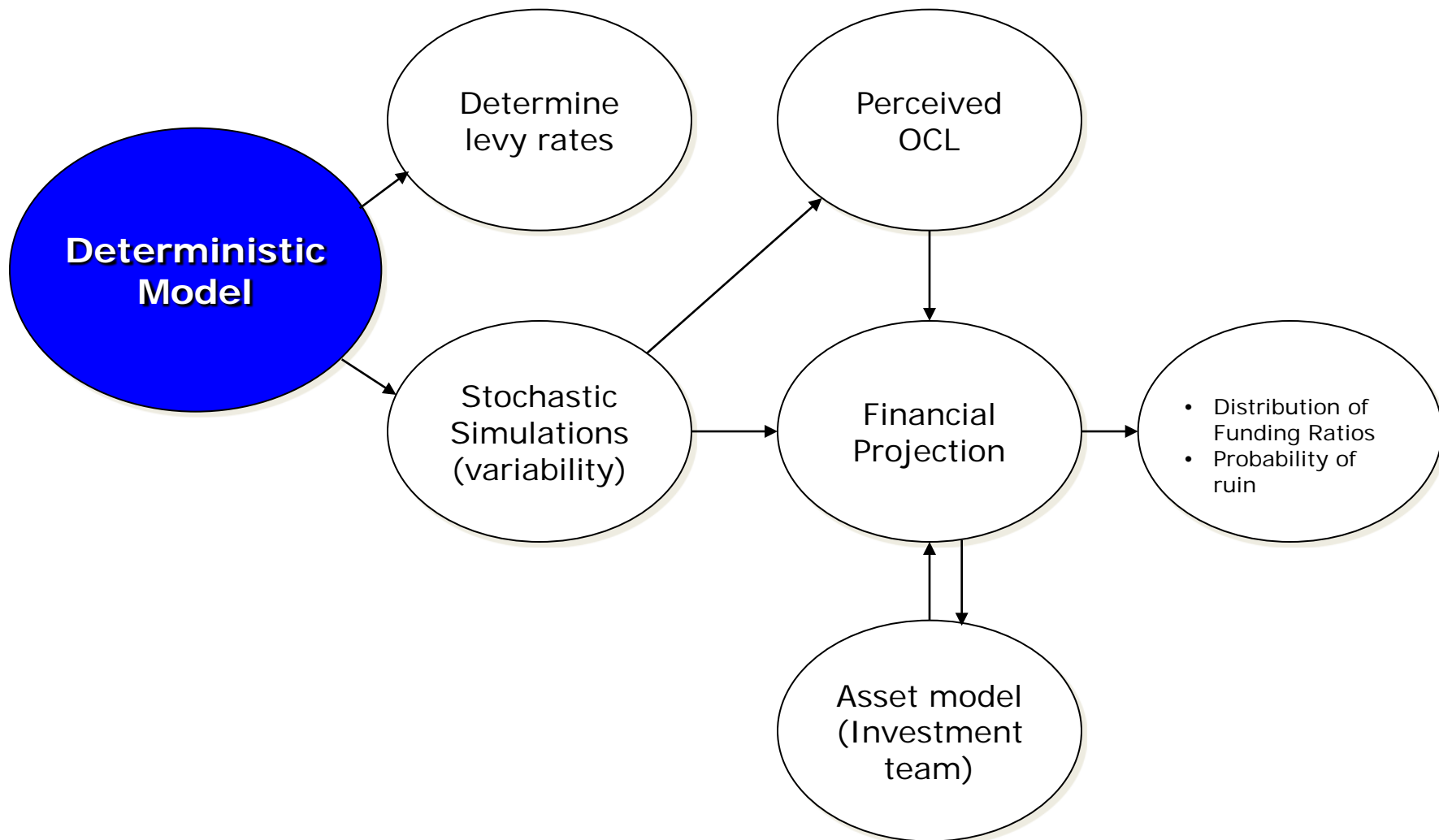
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# Perceived OCL





# Application : Levy Setting







**Balance Sheet as Beginning of Period** 30-Jun-2011 30-Jun-2012 30-Jun-2013 30-Jun-2014 30-Jun-2015

Assets	5.7	6.2	7.0	7.7	7.9
Outstanding Claim Liability	6.3	5.5	5.4	6.4	5.8
Funding Balance	-0.6	0.7	1.6	1.3	2.2
Funding Ratio	90%	113%	130%	120%	137%
Levy Income in Financial June Year	1.3	1.3	1.3	1.3	1.6
Expenses	0.0	0.0	0.0	0.0	0.0
Claims payments	1.0	1.0	1.1	1.2	1.3
Investment Income	0.2	0.6	0.5	0.2	0.6

<b>Balance Sheet End of period</b>	<b>30-Jun-2012</b>	<b>30-Jun-2013</b>	<b>30-Jun-2014</b>	<b>30-Jun-2015</b>	<b>30-Jun-2016</b>
Accrued Assets	6.2	7.0	7.7	7.9	8.9
Outstanding Claim Liability	5.5	5.4	6.4	5.8	5.7
Funding Balance	0.7	1.6	1.3	2.2	3.2
Funding Ratio	113%	130%	120%	137%	157%



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## Balance Sheet as Beginning of Period

	30-Jun-2011	30-Jun-2012	30-Jun-2013	30-Jun-2014	30-Jun-2015
Assets	5.7	6.4	7.5	8.2	8.3
Outstanding Claim Liability	6.3	4.4	4.3	5.1	4.6
Funding Balance	-0.6	2.0	3.1	3.1	3.7
Funding Ratio	90%	146%	172%	161%	180%
Levy Income in Financial June Year	1.3	1.3	1.3	1.3	1.6
Expenses	0.0	0.0	0.0	0.0	0.0
Claims payments	0.8	0.8	0.9	1.4	1.2
Investment Income	0.2	0.6	0.4	0.2	0.6

## Balance Sheet End of period

	30-Jun-2012	30-Jun-2013	30-Jun-2014	30-Jun-2015	30-Jun-2016
Accrued Assets	6.4	7.5	8.2	8.3	9.3
Outstanding Claim Liability	4.4	4.3	5.1	4.6	4.5
Funding Balance	2.0	3.1	3.1	3.7	4.8
Funding Ratio	146%	172%	161%	180%	205%

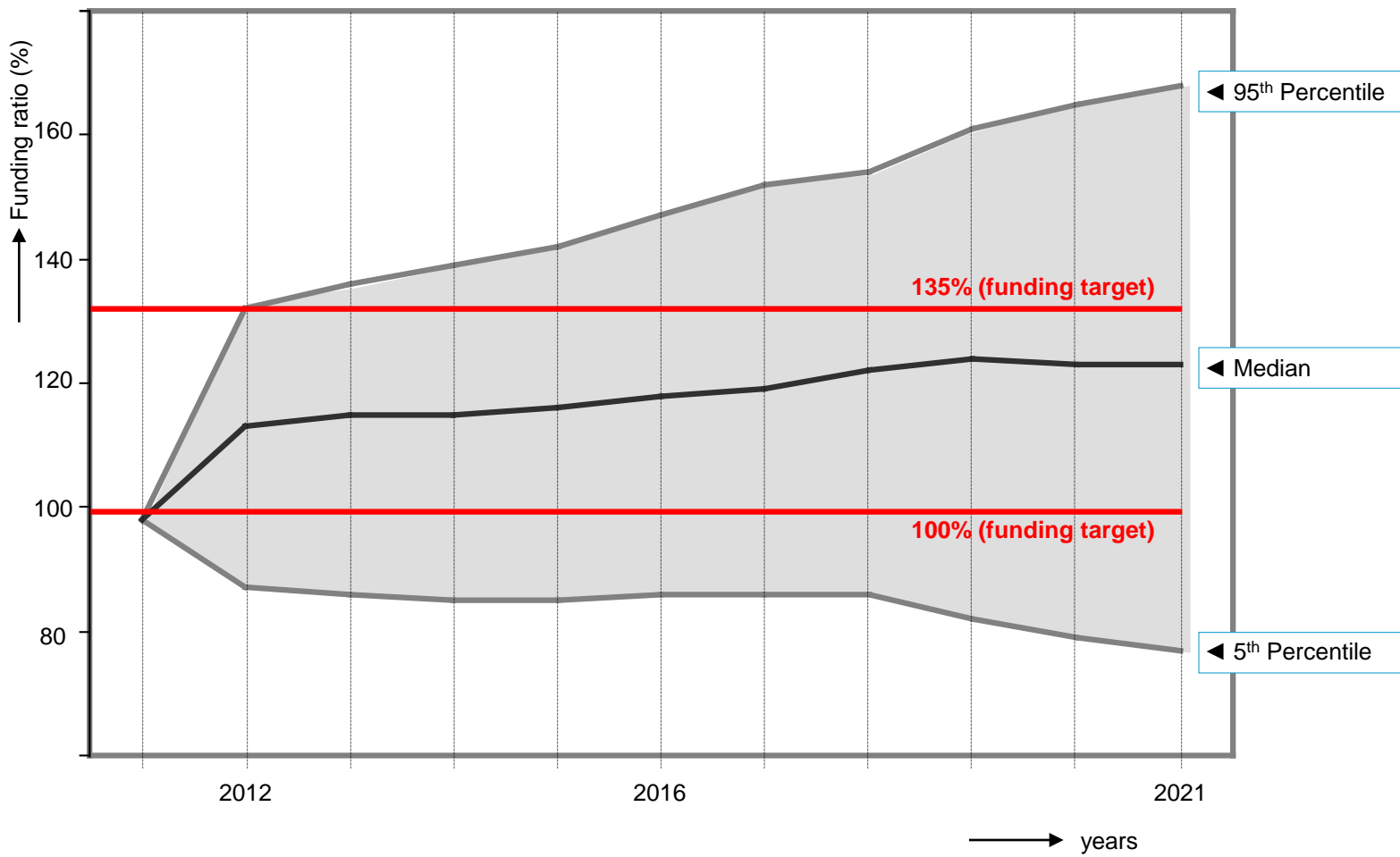
actual
"actual"
simulated CF
simulated investment return
perceived OCL



# Sufficiency of Levy Rates (Earners' Account)

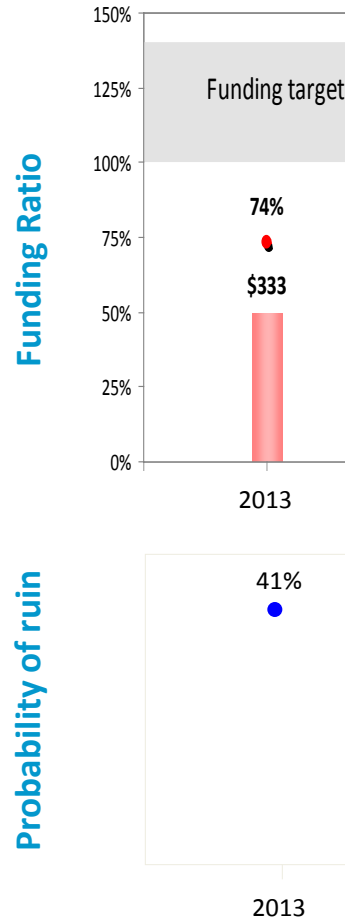
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## Sufficiency of Levy Rates (Motor Vehicle Account)



Funding ratio and probability of ruin for 2013.

- Proposed levy rate for Motor Vehicle Account for 2012/13 is \$333
- Projected funding ratio in 2013: 74% (IFRS basis and deterministic method)
- From 500 simulated cash flows and Investment returns consistent with current investment strategy, 41% chance that assets are insufficient to meet liabilities



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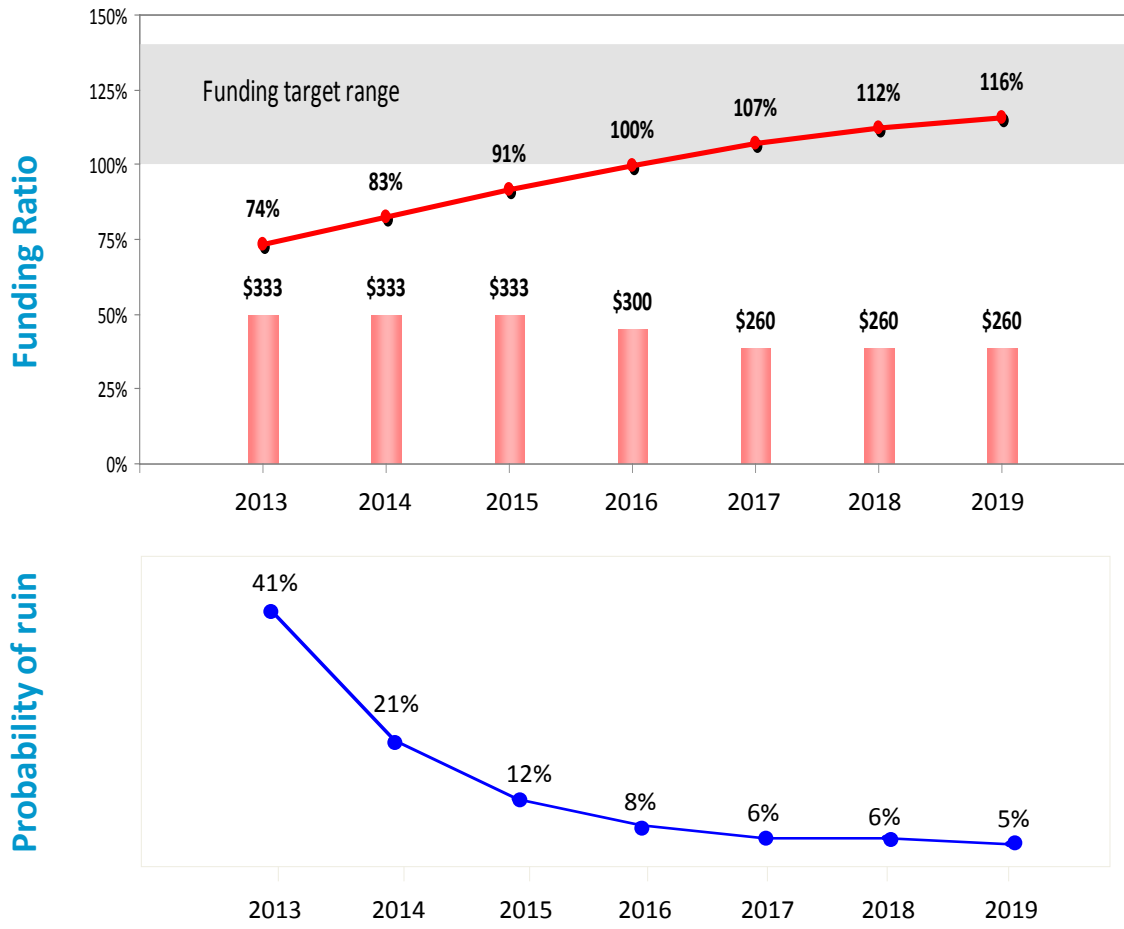
Example 1

# Sufficiency of Levy Rates (Motor Vehicle Account)

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Indicative Motor Vehicle Account funding path





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# Applications

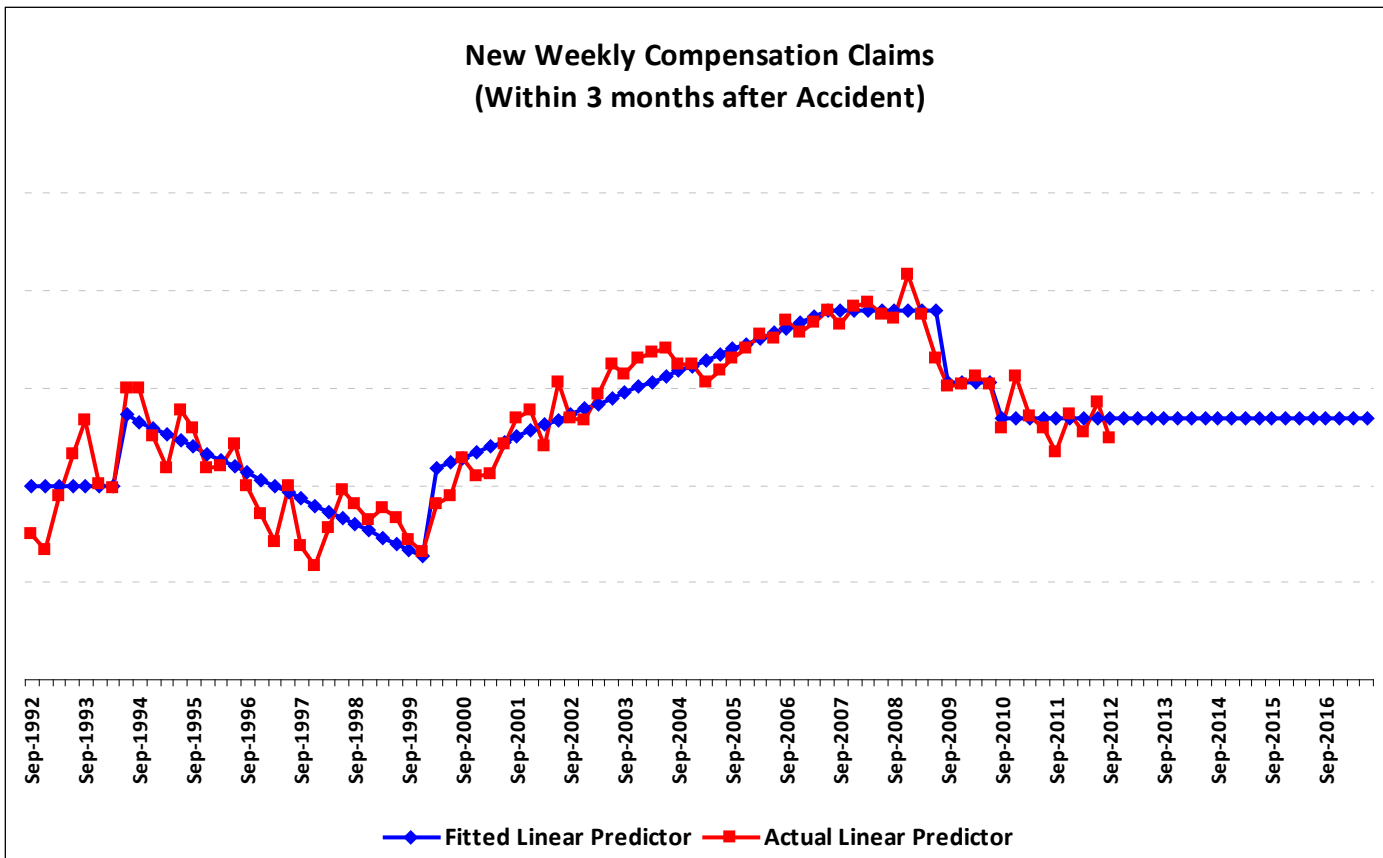
- Used for pricing – levy setting
  - provides a range of possible financial outcomes
  - Projection of financial position with confidence intervals – probability of ruin
- Allows simple graphical representation of each parameter – transparency of assumptions to management and Board; sensitivity testing



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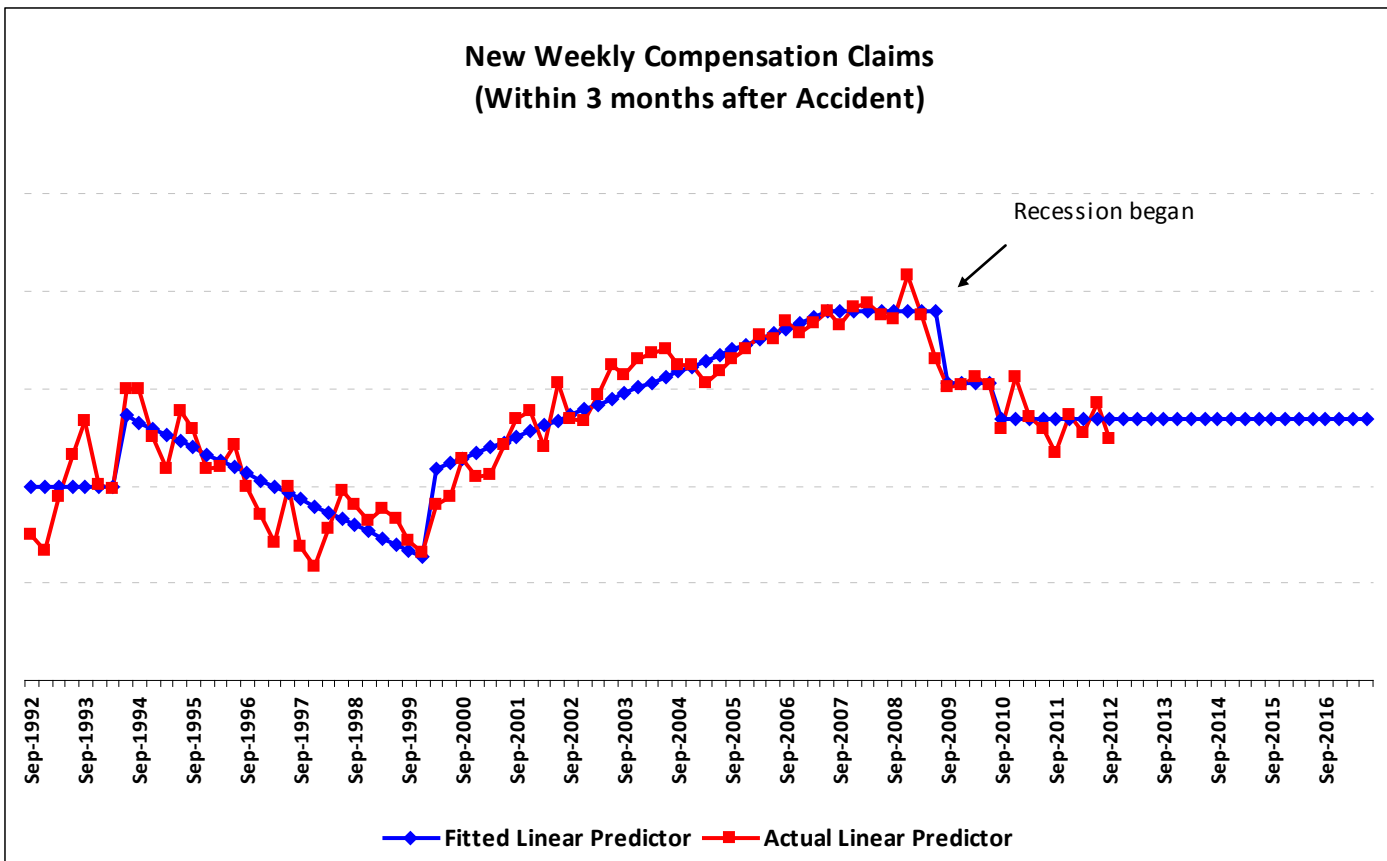




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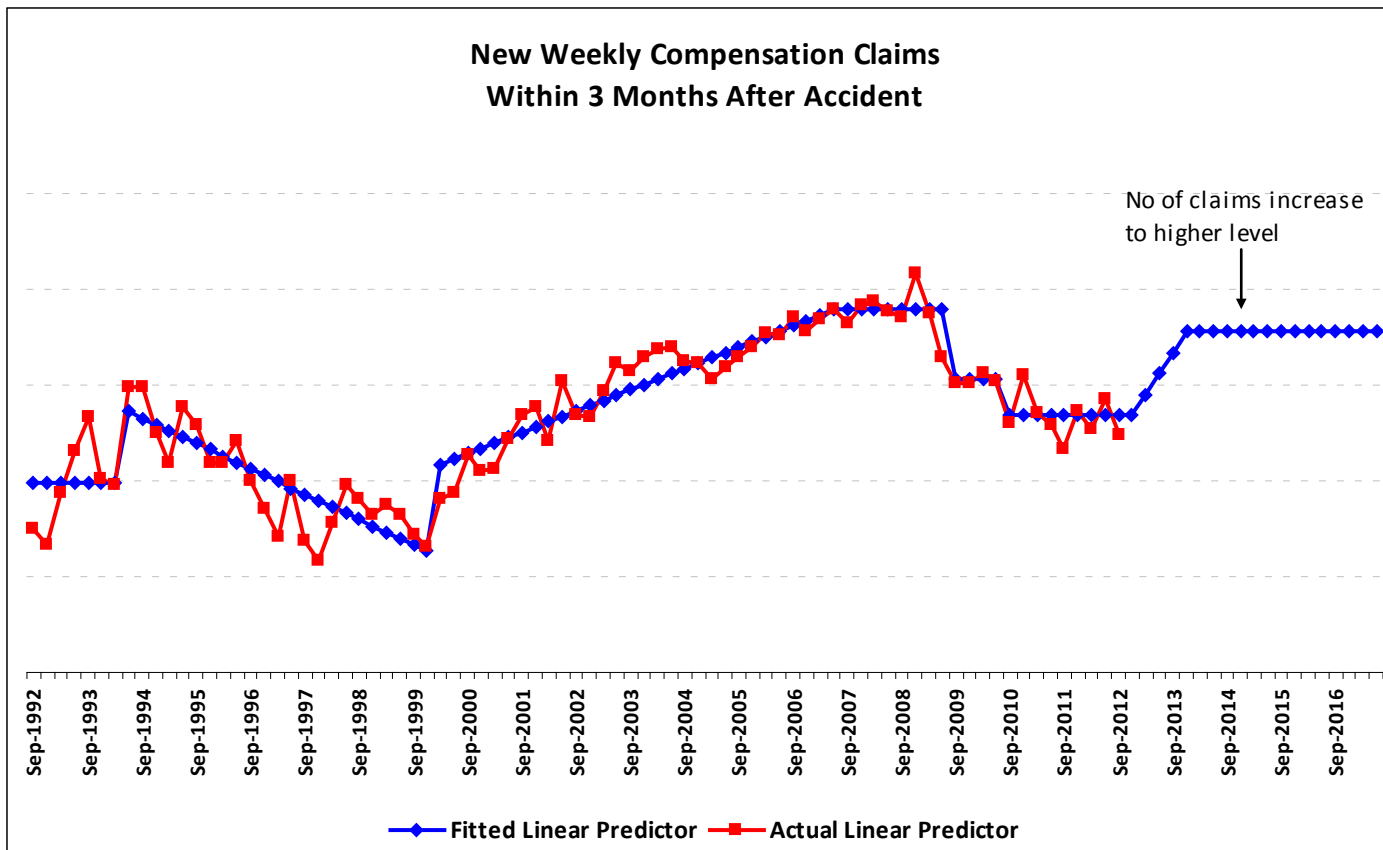




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# Applications

- Used for pricing
  - provides a range of possible financial outcomes
  - Projection of financial position with confidence intervals – probability of ruin
- Allows simple graphical representation of each parameter – transparency of assumptions to management and Board; sensitivity testing
- Stochastic Monitoring