

# Out of harm's way



A SIMULATION MODEL OF THE UNDERWRITING CYCLE

ACE Limited / Brunel University

## The need

The focus of this Internship project was to develop a simulation model of the underwriting cycle in order to make predictions about the direction of insurance prices.

The underwriting cycle is a phenomenon caused by alternating hard and soft markets in the industry. Hard markets mean restrictive underwriting standards, high prices and high profits, while soft markets bring relaxed underwriting standards, low profits and low prices.

Existing models cannot be used over a multi-year period which would allow ACE to use a risk profile more consistent with its status as an on-going enterprise, rather than be confined to reflecting only the business written in the coming year.

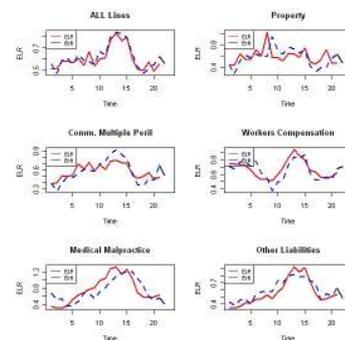
## The outcomes

This project was concerned with developing a simulation model of the underwriting cycle for Property and Liability lines based on US data which will ultimately be integrated into ACE's economic capital model.

The intern reviewed the academic literature and found a model suitable for different countries. The model determines the factors influencing the underwriting cycle and predicts the next few years' behaviour.

The figure below shows the computational results for the USA: the red lines are the original ELRs (Economic Loss Ratio) for different lines and the blue lines

are the estimates gained from our model. The black line at the end of the actual and fitted model represents the forecasted ELR for the next year. For both the USA and UK case the models fitted the data very well.



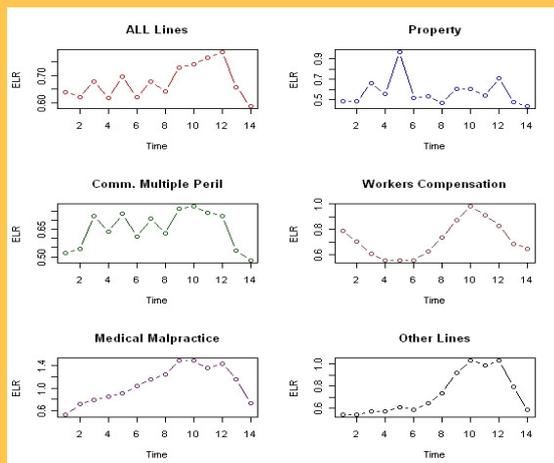
*"ACE is thankful to have had the opportunity to benefit from the industry internship programme. The work that Katharina has done constructing and parameterising a model of the general insurance pricing cycle represents a significant step forward in this area."*

**Anton Solak, ACE Limited**

## Technical summary

The first step was to review the academic publications that attempt to model the underwriting cycle and replicate some of them using currently available data for the USA.

The figure below shows the underwriting cycles for different product lines in the USA for the period 1993-2007: the Economic Loss Ratio (ELR) is a reciprocal measure of price used in many academic papers dealing with the underwriting cycle.



The second step was to decide on which factors to include into the model, for example which interest rate to use, and to introduce new significant variables not mentioned in the existing literature.

The final step was to move from aggregated industry data to by-line data (e.g. motor insurance, medical malpractice). For the aggregated industry data, the classical linear regression model was used for parameterising the model and for the by-line analysis panel data, econometrics was used. Computational results are for the USA (for the period 1985-2007) as well as the UK (for the period 1985-2004).

The model was implemented in R and the simulation model in Igloo Professional. The R code manipulates the industry and by-line data, runs the linear regression model and estimates the panel model.



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## Project Details

### Partners

ACE Limited  
Brunel University

### Project investment

£11,000

### Intern

Katharina Schwaiger

For further details  
on the technology:

**Anton Solak**

ACE Limited

[anton.solak@ace-ina.com](mailto:anton.solak@ace-ina.com)

For further information  
on internships and  
other collaborations:

**Lorcán Mac Manus**

Industrial Mathematics KTN

[lbmm@industrialmaths.net](mailto:lbmm@industrialmaths.net)

+44 (0) 1483 579108