Time Series Data Mining Techniques for the Identification and Measurement of Insurance Cycles

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Abstract

Non-life insurance markets experience multi-year cycles, known as underwriting cycles. Identification of these cycles and estimation of the cycle length are important to insurers in the context of risk management. Conventional time series methods, involving de-trended ARIMA processes or cointegrated processes, have typically been used for this purpose. The cycle period estimate is very sensitive to model parameter estimates and hence is unreliable.

In this paper, we apply novel time series data mining techniques, notably motif-based periodicity detection (MBPD) and dynamic time warping (DTW), to identify the presence of cycles and to estimate their periods. Cycles of about 7–9 years appear to be present on US, UK, French and Canadian non-life markets (aggregated and by product line). We also report the standard error on these estimates using bootstrap resampling, suitably modified for serially dependent data.