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Modeling Underwriting Cycles in Property-Casualty Insurance: The Impact of Catastrophic Events

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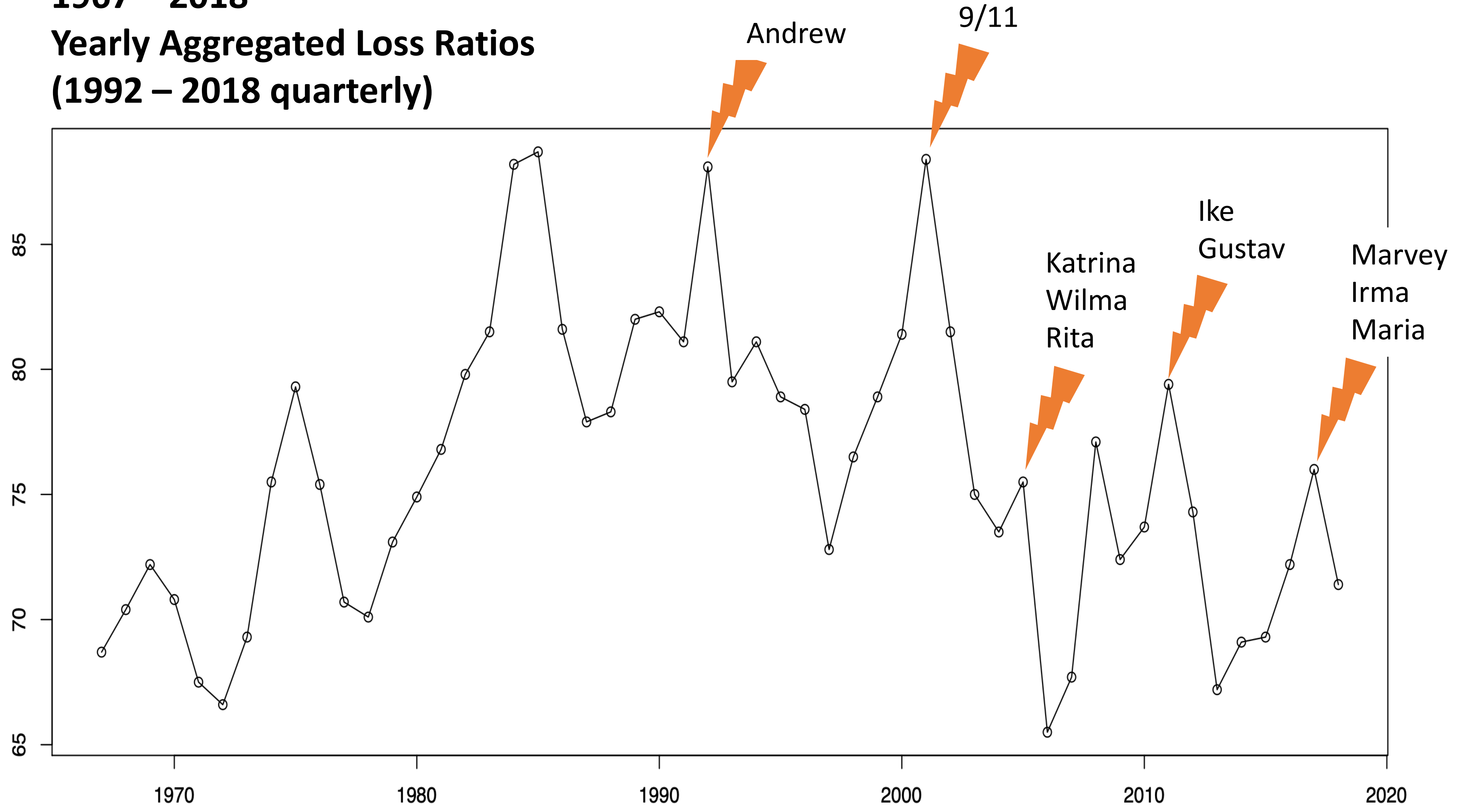
1967 – 2018
Yearly Aggregated Loss Ratios
(1992 – 2018 quarterly)



Underwriting Cycles

An underwriting cycle is defined as the tendency of property and casualty insurance premiums, profits, and available coverage to exhibit a cyclical pattern over time.

Soft market *: low prices and generous coverage, low underwriting profits*
Hard market *: high premiums, limited coverage, high underwriting profits*

Why do they even exist? → There are several hypotheses in the literature:

- **Financial pricing hypothesis**: premiums reflect the discounted value of costs associated with losses; temporary (but not long-term) deviations from an assumed market equilibrium could be explained by random changes in demand and supply\
- **Capacity constraints hypothesis**: the capital market is not perfect in the sense that shocks to capital – by events such as, e.g., large catastrophic losses – result incycles. Capital cannot move immediately and without cost into and out of the insurance market, creating capacity constraints.
- **Financial quality hypothesis**: This hypothesis assumes that an insurance company's premiums endogenously depend on its insolvency potential.
- **Option pricing approach**: This hypothesis assumes policyholders to have a short position in a put option on insurer assets. This put option is referred to as the insolvency put. An insurer's insolvency risk, and hence the value of the option, increases when insurer capacity goes down.

=> little consensus with respect to which hypothesis best explains the pricing patterns and "no single hypothesis can explain thoroughly the insurance cycle" (Browne et al. 2014)

Test for hidden periodicity

- We use a robust version of Fisher's test introduced in Ahdesmäki et al. (2005) which is applicable for short time series, being also insensitive to a large range of alternative anomalies (e.g. outliers, missing values, non-Gaussian noise). Ahdesmäki et al. (2005) follow the original approach by Fisher (1929) who considers the following model with a harmonic wave of frequency λ:

$$Y_t = a\cos(2\pi\lambda t) + b\sin(2\pi\lambda t) + \varepsilon_t,$$

with (ε_t) Gaussian white noise, ε_t is i.i.d. ~ N.

Here ($_Y$t) models loss ratios after having eliminated the trend whereas the frequency λ is unknown, $0 < \lambda < 0.5$.

We obtain the p-value of 8×10^{-5} for the robust test of Ahdesmäki et al. (2005). Thus, we can reject the null hypothesis in favor of a hidden periodicity (significance level 5%).

We study the following loss events

2000/Q1 (Progressive): major investment into a new corporate building structure. This capital shock was, of course, anticipated by the company.

2000/Q4 (Cincinnati): Cincinnati required a very expensive upgrade of its company software. This constituted a major catastrophic cost for them and which can be considered an unforeseen major loss event.

2001/Q3 (Protective): the major and one-of-a-kind terrorist events of 9/11.

2011/Q1 (Protective): major claims from earthquakes in Japan and New Zealand, and potentially also major flooding in Australia, in the first quarter of 2011.

2011/Q2 (Cincinnati, State Auto): tornadoes occurring in the south/mid-west in the second quarter of 2011.

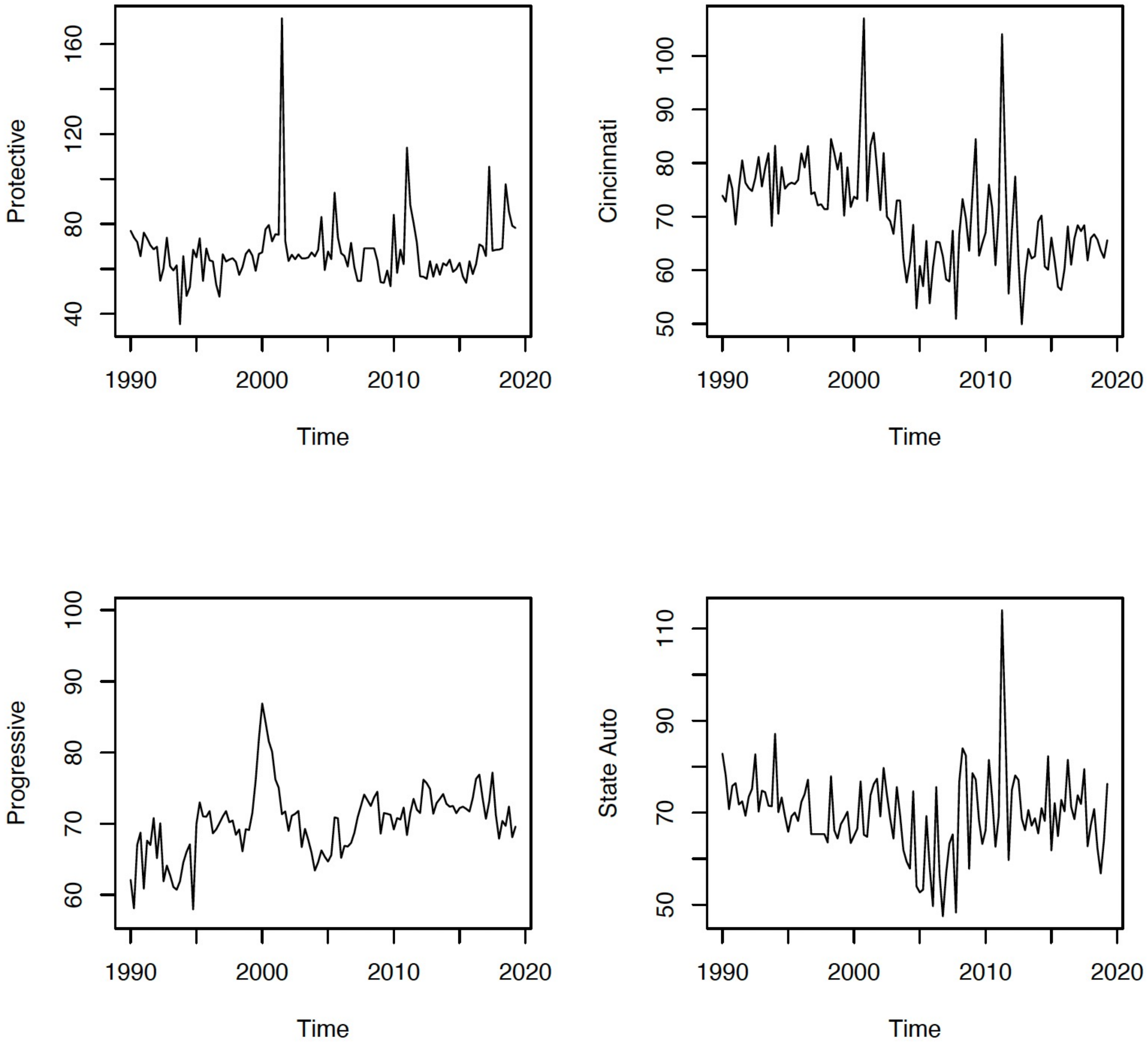


Figure 3 Quarterly loss ratio data for 4 insurance companies: 1990/Q1 - 2019/Q2. (Source: Bloomberg)

Findings

This article extends the literature on underwriting cycles in the property and casualty insurance industry.

Following previous research, it challenges the question of existence and predictability of this phenomenon. Our results confirm the existence of underwriting cycles with a length of 8 to 9 years.

Interestingly, this value is consistent with former findings (Owadally et al., 2019b; Lazar and Denuit,2012; Meier and Outreville, 2006; Grace and Hotchkiss, 1995).

Since time series models require particularly large data samples to ensure reliable estimates, much longer time series are used than in previous studies containing quarterly company-based data. We also demonstrate that it is possible to increase forecasting performance by using an additional source of information: information on catastrophes or major losses.

Findings (2)

Our analysis builds on the idea of (dis-)connecting cycles and catastrophic events – which seems intuitive for modeling purposes since many catastrophes are unsystematic and rare events following autonomous dynamics. As a result, going beyond previous studies, we suggest that **reliable forecasts should be done net of the irregular peaks in loss distributions arising from natural and other catastrophes as well as big 'unusual' black swan events.**

It is noteworthy that loss tails, i.e., the time frame that an insurance company needs to solve and settle its incoming claims, largely depend on the type of loss that occurred. As an example, in this paper we considered only two types of loss tail dynamics with immediate and lingering settlements. However, in practice, insurers have the possibility to estimate this loss tail more accurately depending on the type of major loss event. As a consequence, based on the intervention models introduced in this paper, insurers should be able to yield even superior forecasting performance when modeling and predicting underwriting cycles.

Thank you! Questions?

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