estudy2: an R package for the event study in insurance

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Introduction

- Purposes:
  - examine the impact of selected shocks and their significance on the stock valuation of insurance companies
  - investigate the relation of companies characteristics and the effect caused by such events
  - compare different test statistics on the same set of events and firms
- Approach: event study analysis
- Application:
  - for academic literature: add to the understanding of the market stock valuation behavior of non-life insurers
  - for practitioners: improve companies in their risk, investment and crisis management strategies

Methodology

Market models:

- Adjusted mean-returns model:
  $R_{i,t} = \bar{R}_i + \epsilon_{i,t}$ $\quad A_{i,t} = R_{i,t} - \bar{R}_i$
- Adjusted market-returns model:
  $R_{i,t} = R_{M,t} + \epsilon_{i,t}$ $\quad A_{i,t} = R_{i,t} - R_{M,t}$
- Single-index market model:
  $R_{i,t} = \alpha_i + \beta_i \cdot R_{M,t} + \epsilon_{i,t}$ $\quad A_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i \cdot R_{M,t}$

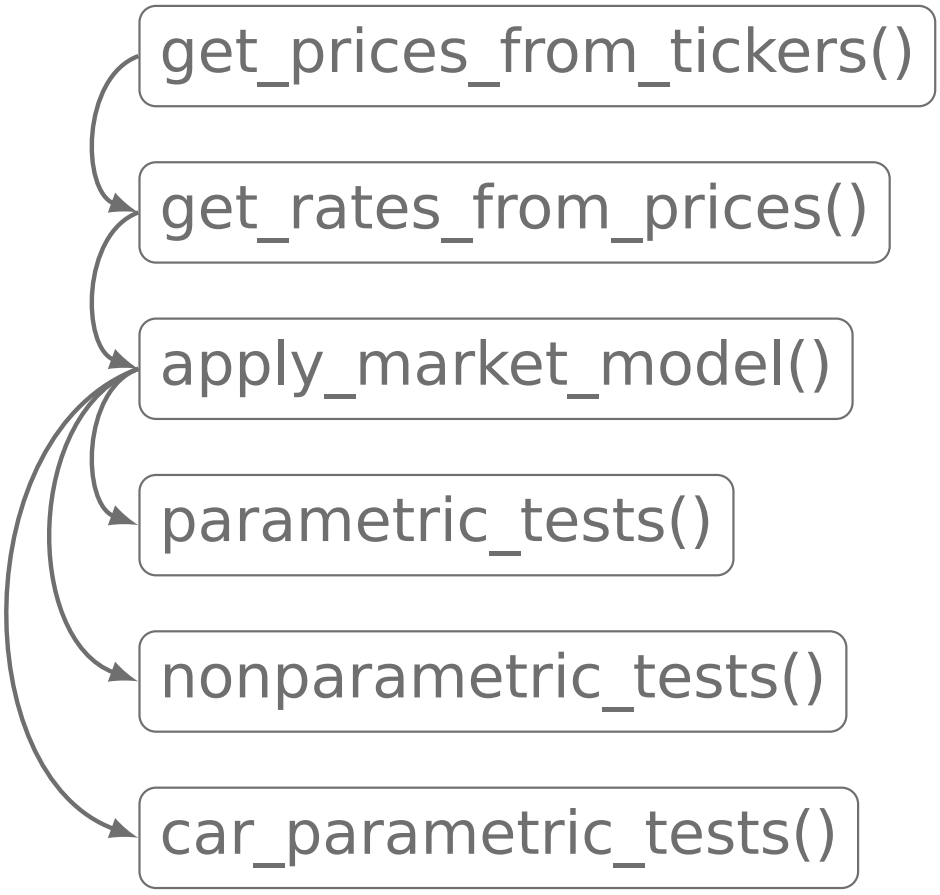
Methodology (cont.)

- Parametric tests:
  - Student's *t*-test
  - Brown and Warner (1980)
  - Brown and Warner (1985)
  - Patell (1976)
  - Boehmer et al. (1991)
  - Lamb (1995)
- Nonparametric tests:
  - Sign test
  - Generalized sign test
  - Corrado and Zivney (1992)
  - Rank test
  - Modified rank test
  - Wilcoxon signed-rank test

Existing commercial solutions

- eventstudymetrics.com
- eventstudytools.com
- eventstudy.com*

github.com/irudnyts/estudy2



tseries

C++ (Rcpp)

S3 OO

Reference case of 9/11 terrorist attacks: Setup

- 31 European non-life companies
  17 FL, 10 P&C, 4 Re
- $\Delta = 120$, $w_b = 0$, $w_a = 17$
- Single-index market model with STOXX Global 1800 as proxy is used

Reference case of 9/11 terrorist attacks: Parametric tests

Date	W.day	$\bar{A}_t$, %	BW1980		BW1985		t-test		Patell		BMP		Lamb	
09-11	Tues	-5.624	-15.090	***	-11.229	***	-4.961	***	-19.424	***	-4.855	***	-10.942	***
09-12	Wed	-3.664	-9.829	***	-7.314	***	-2.674	**	-11.190	***	-1.934	*	-7.280	***
09-13	Thurs	-0.286	-0.767		-0.571		-0.282		-1.344		-0.353		-0.568	
09-14	Fri	-3.097	-8.310	***	-6.184	***	-4.081	***	-10.881	***	-4.061	***	-6.111	***
09-17	Mon	0.673	1.806	*	1.344		0.763		2.767	***	0.993		1.302	
09-18	Tues	-0.512	-1.373		-1.022		-0.722		-1.266		-0.487		-1.016	
09-19	Wed	-1.061	-2.846	***	-2.118	**	-1.022		-1.560		-0.603		-2.101	**
09-20	Thurs	-5.064	-13.587	***	-10.111	***	-5.516	***	-15.608	***	-4.686	***	-9.814	***
09-21	Fri	-4.292	-11.515	***	-8.568	***	-4.401	***	-16.331	***	-4.829	***	-8.505	***
09-24	Mon	3.496	9.381	***	6.981	***	3.418	***	10.527	***	3.491	***	6.750	***
09-25	Tues	1.573	4.221	***	3.141	***	1.820	*	4.479	***	1.531		3.126	***
09-26	Wed	2.475	6.641	***	4.942	***	3.691	***	8.779	***	3.361	***	4.921	***
09-27	Thurs	0.400	1.074		0.799		0.396		1.905	*	0.525		0.792	
09-28	Fri	1.437	3.855	***	2.869	***	1.918	*	6.270	***	2.211	**	2.788	***

*, **, *** stands for statistically significant at the 10%, 5%, 1% percent level, respectively, for two-sided tests.

09/11 - 09/21: significantly negative abnormal returns
09/24 - 09/28: significantly positive abnormal returns

Reference case of 9/11 terrorist attacks: Nonparametric tests

Date	W.day	Sign		G.sign		C.sign		Rank		M.rank		Wlcx	
09-11	Tues	-3.413	***	-3.628	***	-2.019	**	-2.828	***	-2.907	***	48.000	***
09-12	Wed	-3.413	***	-3.628	***	-2.131	**	-2.242	**	-2.331	**	98.000	***
09-13	Thurs	-0.180		-0.392		0.336		-0.187		-0.199		240.000	
09-14	Fri	-3.413	***	-3.628	***	-2.131	**	-2.693	***	-2.789	***	52.000	***
09-17	Mon	0.180		-0.033		0.112		0.134		0.110		268.000	
09-18	Tues	-0.539		-0.752		-0.112		-0.568		-0.579		207.000	
09-19	Wed	-0.898		-1.111		-0.561		-0.510		-0.532		207.000	
09-20	Thurs	-3.413	***	-3.628	***	-2.131	**	-3.054	***	-3.152	***	33.000	***
09-21	Fri	-3.413	***	-3.628	***	-1.906	*	-2.873	***	-2.943	***	57.000	***
09-24	Mon	3.053	***	2.843	***	1.906	*	2.537	**	2.611	***	403.000	***
09-25	Tues	1.976	**	1.764	*	1.234		1.407		1.446		348.000	**
09-26	Wed	3.772	***	3.562	***	1.906	*	2.570	**	2.642	***	430.000	***
09-27	Thurs	-0.180		-0.392		-0.336		-0.071		-0.099		253.000	
09-28	Fri	1.616		1.405		1.009		1.244		1.286		347.000	**

*, **, *** stands for statistically significant at the 10%, 5%, 1% percent level, respectively, for two-sided tests.

09/11 - 09/21: significantly negative abnormal returns
09/24 - 09/28: significantly positive abnormal returns

Research summary and main findings

The impact of 13 major catastrophes (6 hurricanes, 3 earthquakes, 2 winter storms, and 2 airline crashes) on 87 listed non-life insurer have been analyzed:

- There is no clear pattern in stock responses to catastrophes
- North American and Western European companies behave differently
- Only for several events the market capitalization is the essential characteristic, which influence the reaction
- Reinsurance companies are the most sensitive to the catastrophe events

Planned updates

- Incorporate dividends to the rate of return
- Use a value-weighted and equally-weighted index
- Implement other market models (e.g. Fama and French 3-factor model)
- Use GARCH for stock prices modeling

Thank you!