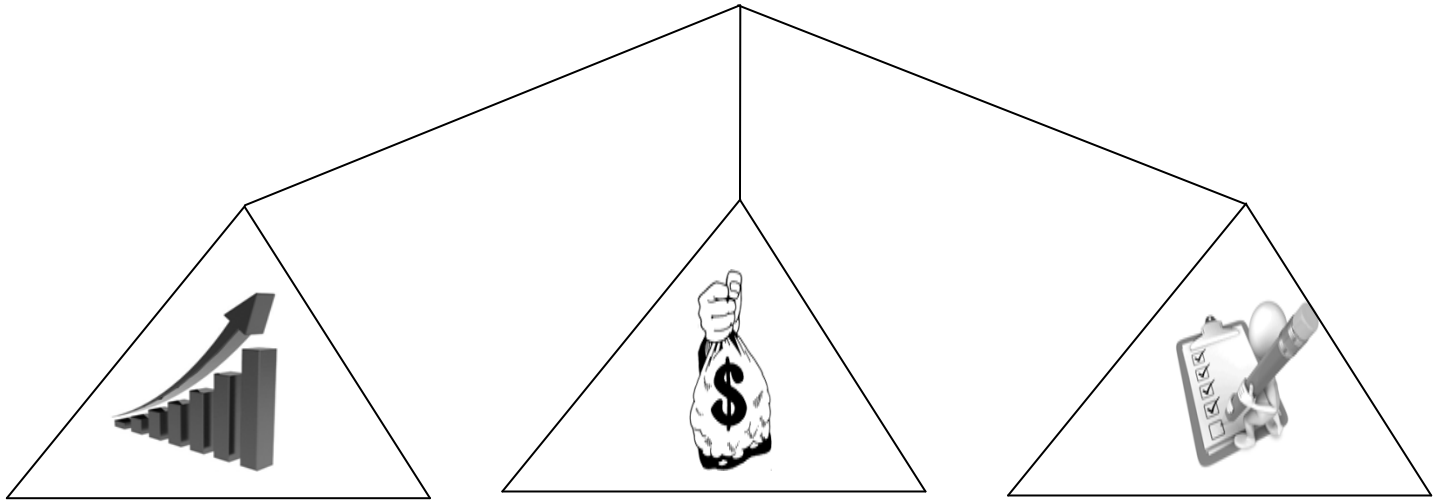
Institute of Insurance Economics

University of St.Gallen



Get the balance right:
A simultaneous equation model to analyze growth, profitability, and safety

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Background

Relevance of G, P & S in the insurance industry

Growth: The law of large numbers

Profitability: Equity providers require returns

Safety: Increasing regulatory requirements & risk sensitive policyholders

Mutual interactions among G, P & S

For example, growth influences safety and vice versa

Existence of goal conflicts among G, P & S

General example: Downsides of inorganic growth

Specific example: Underwriting discipline (D'Arcy & Gorvett, JRI, 2004; Barth & Eckles, JRI, 2009)

No simultaneous analysis of G, P & S so far

What are all the interactions among these three dimensions?

Given that goal conflicts may exist, what is the optimal balance between growth, profitability, and safety?

This paper

Discussion of the relationships/trade-offs between the three goals

- Integration of various theories
- Review of extant empirical evidence
- Formulation of two-directional hypotheses

Specification of a simultaneous equation model

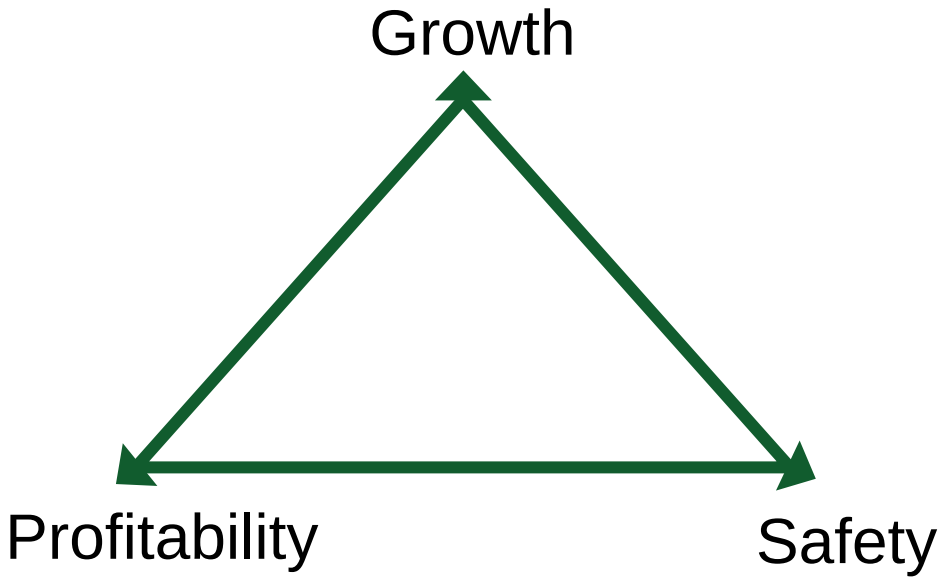
- Analysis of the two-directional relationships/trade-offs
- Testing for non-linearity (i.e., trade-offs)
- Mankai and Belgacem (JRI, 2016): Risk taking, capital, and reinsurance
- Miller and Leiblein (AMJ, 1996): Risk and return
- Oviatt and Bauerschmidt (MS, 1991): Risk and return
- Schendel and Patton (MS, 1978): Profitability, market share, and efficiency

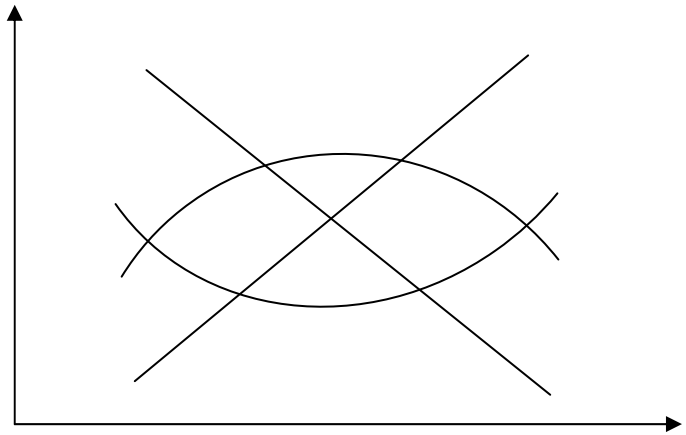
Analysis of the relationships over time

- Companies may trade the strategic goals over time:

For example: First focus on growth and then increase profitability and safety

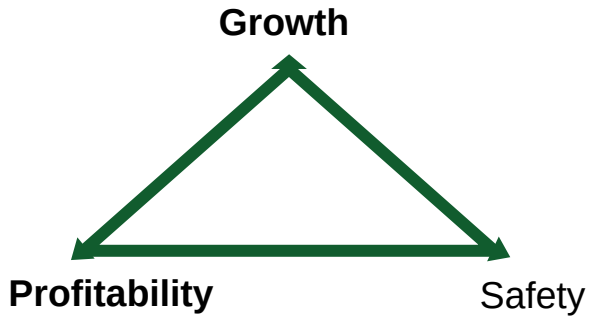
Theoretical background & hypotheses



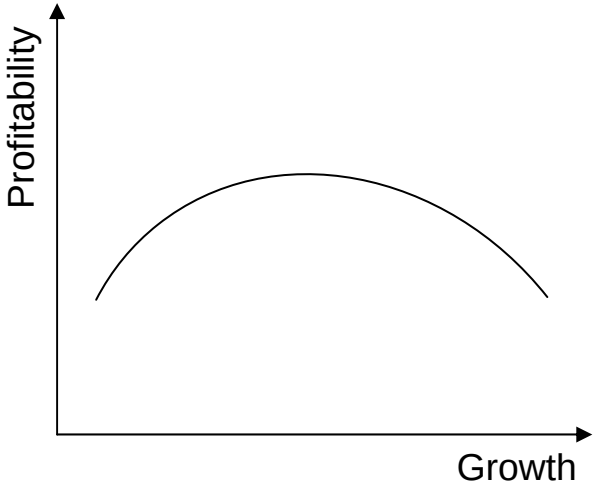


PS1
PS2

Theoretical background & hypotheses



Hypothesis 1a



+ Larger scale / scale economies (Yuengert, 1993)
+ Stronger market position (Davidson et al., 2009)
+ Price increases decrease loss ratio (Barth & Eckles, 2009)

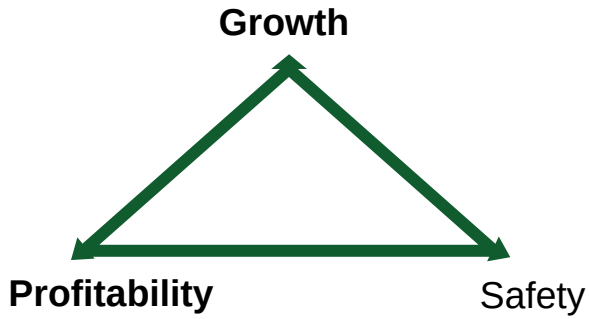
- Growth at any cost to meet managers' ambitions (Eisenhardt, 1989)
- Increased complexity (Nicholls-Nixon, 2005)
- High growth due to underpricing (D'Arcy & Gorvett (2004)

Folie 5

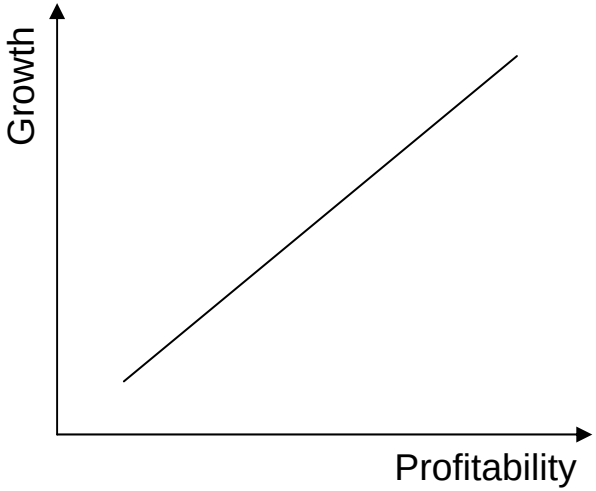
PS1 Philipp Schaper; 06.03.2017

PS2 Philipp Schaper; 06.03.2017

Theoretical background & hypotheses

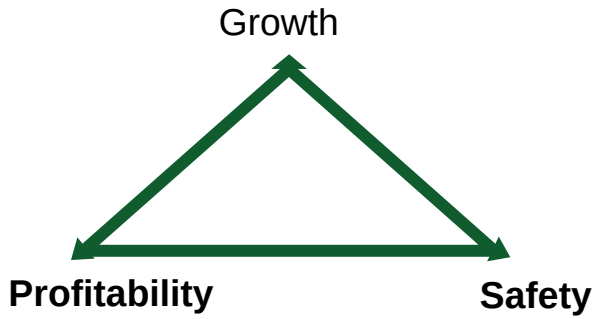


Hypothesis 1b

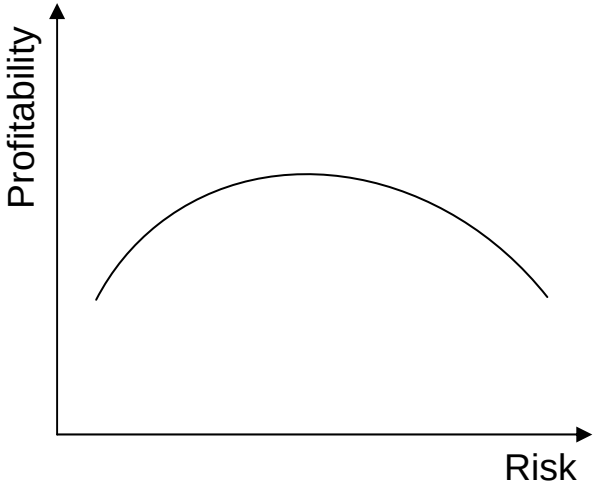


+ Supply of internal and external financial resources (Whittington, 1980)
+ High profitability reflects competitive advantages (Davidson et al., 2009)
+ Efficient structure hypothesis (Choi & Weiss, 2005;)

Theoretical background & hypotheses



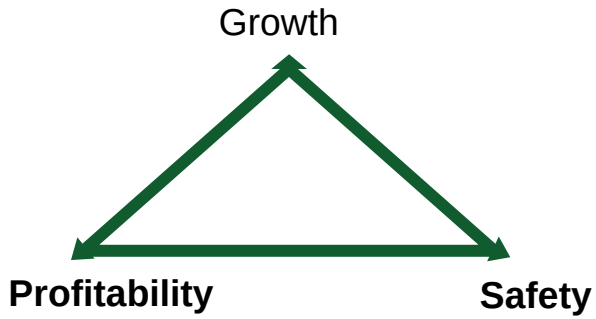
Hypothesis 2a



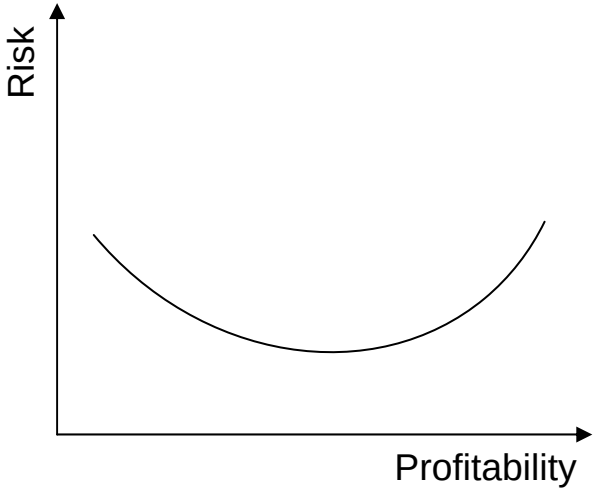
+ CAPM (Sharpe, 1964)
+ Riskier insurance business requires higher returns (Fairley, 1979)

- Risk increase reduces willingness to pay (Wakker et al. ,1997)
- Insolvency risk decreases prices (Sommer, 1996; Phillips et al., 1998)

Theoretical background & hypotheses

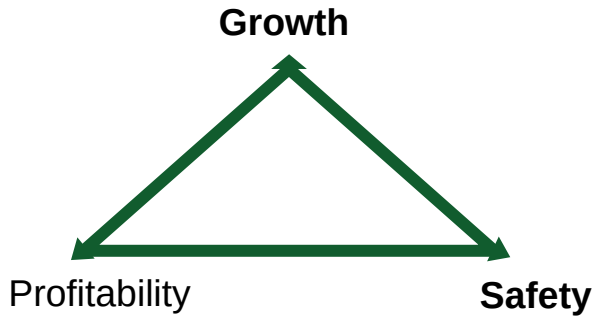


Hypothesis 2b

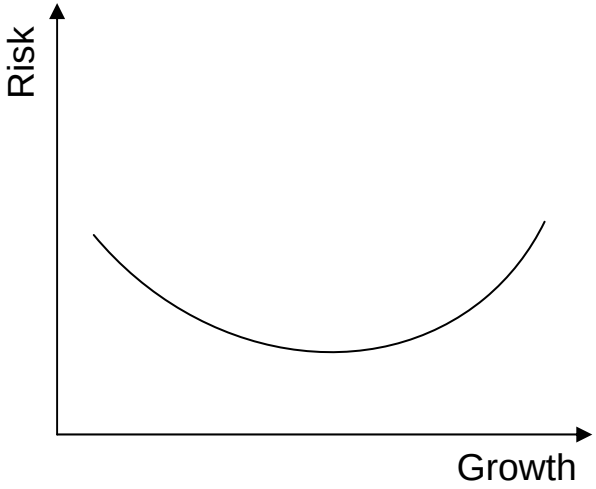


Prospect theory (Nickel & Rodriguez, 2002)
Firms have target return (TR)
Firms with profitability < TR are risk-seeking
Firms with profitability > TR are risk-averse

Theoretical background & hypotheses



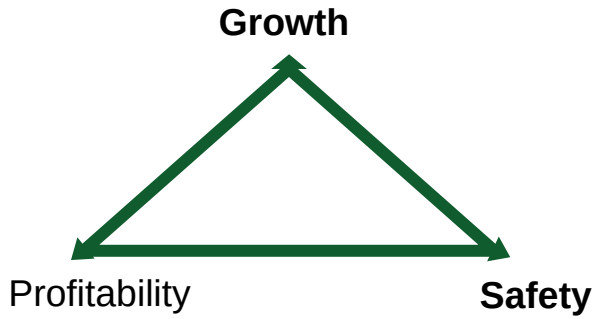
Hypothesis 3a



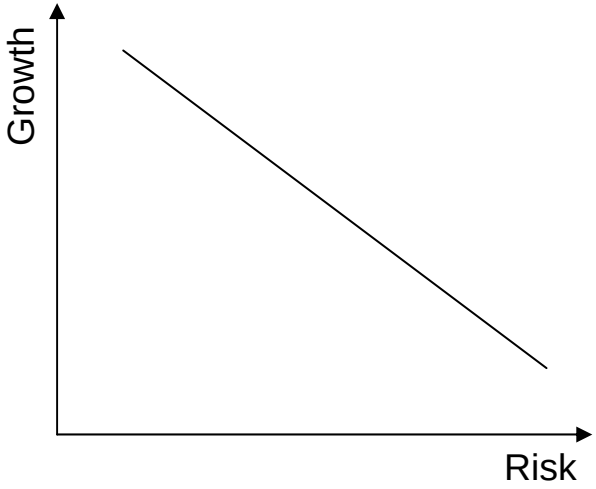
+ More effective risk pooling (Cummins & Rubio-Misas, 2006)
+ More stable underwriting results
+ Lower failure rates of large insurers (Cheng & Weiss, 2012)

- Aggresive sales strategies increase risk (Rauch & Wende, 2015)
- Looser underwriting discipline leads to insufficient reserving
- New & unfamiliar business is risky (Barth & Eckles, 2009)

Theoretical background & hypotheses



Hypothesis 3a



Risk sensitivity of insurance demand
Zanjani (2002)
Epermanis and Harrington (2006)
Baranoff and Sager (2007)
Eling and Schmit (2012)

Measures and data

$$Risk_{i,t} = \left(\frac{1}{(t-(t-3))} \sum_{x=t-3}^{t} (Profitability_{ix} - \emptyset Profitability_i)^2 \right)^{0.5}$$

In robustness tests: 4- and 5-year moving windows

Measures and data II

All life and non-life insurers in the Best's Insurance Reports database

1,988 insurance companies

14 European countries

Sample period 2003-2013

9'298 firm years

Variable/statistic	Mean	St. Dev.	Min	25th	Median	75th	Max
Strategic goals							
Growth	0.049	0.251	-0.686	-0.057	0.027	0.117	3.311
Profitability	0.123	0.173	-0.723	0.034	0.111	0.208	0.806
Safety (Risk)	0.107	0.103	0.005	0.041	0.076	0.137	0.876
Firm characteristics							
OWN (mutual=1, stock=0)	0.225	0.418	0	0	0	0	1
LOB (life=1, non-life=0)	0.337	0.473	0	0	0	1	1
SIZE (millions USD)	4.905	16.844	0.0003	0.091	0.504	2.877	537.494
Market conditions							
IG	0.049	0.099	-0.298	-0.015	0.038	0.104	1.634
IP	0.123	0.063	-0.307	0.090	0.126	0.160	0.467
IR	0.107	0.041	0.029	0.083	0.094	0.123	0.416
GDP	0.010	0.025	-0.085	0.002	0.011	0.031	0.066
LIR	0.035	0.014	0.006	0.026	0.037	0.042	0.106
INF	0.020	0.012	-0.045	0.014	0.022	0.026	0.049
COMP	0.505	0.143	0.340	0.380	0.440	0.600	0.920
Penetration	0.039	0.021	0.015	0.029	0.032	0.038	0.148

Methodology

$$Growth_{i,t} = \gamma_{11} Profitability_{i,t} + \gamma_{12} Profitability_{i,t}^2 + \gamma_{15} Risk_{i,t} + \gamma_{16} Risk_{i,t}^2 + \delta_1 Control\ variables_1 + \varepsilon_{i,t}$$

$$Profitability_{i,t} = \gamma_{23} Growth_{i,t} + \gamma_{24} Growth_{i,t}^2 + \gamma_{25} Risk + \gamma_{26} Risk_{i,t}^2 + \delta_2 Control\ variables_2 + \varepsilon_{i,t}$$

$$Risk_{i,t} = \gamma_{31} Profitability_{i,t} + \gamma_{32} Profitability_{i,t}^2 + \gamma_{33} Growth_{i,t} + \gamma_{34} Growth_{i,t}^2 + \delta_3\ Control\ variables + \varepsilon_{i,t}$$

Choice of methodology (pooled 2SLS)

Hausman specification & DWH test

Order and rank identification of the SEM (industry levels & lagged depdendent)

Test for weak instruments

Test for non-linear impacts

Hierachical regression approach (Lechner, Frankenberger, & Floyd, SMJ, 2010)

3 steps proposed by Lind and Mehlum (OBES, 2010)

Dynamic analysis

Non-prametric analysis following Davidsson, Steffens, and Fitzsimmons (JBV, 2009)

Granger causality tests

Empirical results

Analysis of marginal effects

	Model (1)			Model (2)		
	Growth	Profitability	Risk	Growth	Profitability	Risk
Growth		0.228*** (0.019)	-0.029** (0.012)		0.276*** (0.021)	-0.042*** (0.013)
Growth²					-0.084*** (0.022)	0.020** (0.009)
Profitability	0.199*** (0.030)		0.043** (0.018)	0.129*** (0.043)		-0.316*** (0.027
Profitability²				0.238** (0.114)		1.218*** (0.074)
Risk	-0.043 (0.036)	0.058* (0.031)		0.024 (0.091)	0.318*** (0.072)	
Risk²				-0.190 (0.171)	-0.532*** (0.140)	
$Growth_{t-1}$	-0.008 (0.007)			-0.008 (0.007)		
$Profitability_{t-1}$		-0.014 (0.011)			-0.014 (0.011)	
$Risk_{t-1}$			0.015 (0.011)			0.014 (0.010)
OWN (Mutual=1, stock=0)	-0.022*** (0.006)	-0.046*** (0.006)	0.002 (0.005)	-0.021*** (0.006)	-0.045*** (0.005)	0.005 (0.004)
LOB (Life=1, non-life=0)	0.016** (0.008)	-0.026*** (0.007)	0.007 (0.004)	0.016** (0.008)	-0.022*** (0.007)	0.002 (0.004)
$Ln(SIZE)_{t-1}$	-0.004*** (0.001)	0.007*** (0.001)	0.001 (0.001)	-0.004*** (0.001)	0.007*** (0.001)	0.001 (0.001)
IG	-0.013 (0.025)			-0.015 (0.025)		
IP		-0.053 (0.047)			-0.058 (0.047)	
IR			-0.004 (0.044)			0.00004 (0.040)
GDP	0.886*** (0.116)	0.390*** (0.079)	-0.315*** (0.046)	0.881*** (0.116)	0.358*** (0.079)	-0.316*** (0.043)
LIR	-0.149 (0.202)	-0.021 (0.174)	0.210* (0.112)	-0.202 (0.203)	-0.008 (0.176)	-0.002 (0.103)
INF	-2.174*** (0.266)	-0.672*** (0.198)	0.591*** (0.121)	-2.204*** (0.267)	-0.618*** (0.200)	0.379*** (0.111)
COMP	0.035* (0.019)	-0.012 (0.020)	0.075*** (0.012)	0.033* (0.019)	-0.018 (0.020)	0.062*** (0.011)
Penetration	0.149 (0.153)	-0.127 (0.142)	0.406*** (0.086)	0.138 (0.153)	-0.139 (0.142)	0.318*** (0.077)
Number of firms	1,784	1,784	1,784	1,784	1,784	1,784
Observations	9,298	9,298	9,298	9,298	9,298	9,298
F Statistic	21.157***	43.115***	26.781***	18.680***	40.431***	100.167***

Note: ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively; the numbers in parentheses are robust standard errors clustered at the firm level. A constant term is included but not reported.

H1a H3b H1b H2b H3a H2a

Empirical results

Effects over time: short summary

Final performance group	High growth, high profitability			Low growth, low profitability		
Initial performance group	High growth, low profitability	*z-test*	High profitability, low growth	High growth, low profitability	*z-test*	High profitability, low growth
2006–2013	6.60		7.77	5.19	***	9.71
2006–2012	11.79		13.59	14.15		11.65
2006–2011	8.49	***	15.53	21.23	***	12.14
2006-2010	11.32		16.02	15.09		12.62
2006–2009	13.68		14.08	18.40		14.08
2006–2008	6.60	***	16.50	18.40	**	11.65
2006–2007	9.43	***	22.82	26.42	****	8.25

Insurers that **initially** focus on

profitability more likely transit to the “profitable growth” state
growth more likely transit to the “low growth, low profitability” state

profitability more likely transit to the “high profitability, high safety” state

safety more likely transit to the “high safety, high growth” state
growth more likely transit to the “low growth, low safety” state

Granger causality tests confirm our anticipation of mutual interactions (no one-way impacts)

Questions and Discussion