Ph.D. Dissertation Defense: Essays on Insurance Regulation and Corporate Governance

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Agenda

Research Questions

1. Did SOX improve loss reserving estimation?
   - Estimation bias
   - Estimation error
   - Estimation consistency
2. Has the cost of compliance increased among SOX-complying insurers post-SOX?
3. Previous literatures:
   - SOX $\rightarrow$ earnings management e.g. Coates and Srinivasan (2014) for a 10-year review of SOX literature
   - SOX $\rightarrow$ cost of compliance e.g. \$697.89 (in thousand)[1]; \$5.1 million[2]
   - Earnings management among insurers e.g. Weiss (1985), Petroni (1992), Gaver and Paterson (2004), Grace and Leverty (2010, 2011).
   - SOX $\rightarrow$ earnings management among insurers e.g. Eckles et al. (2011); Brandt et al. (2013).

[1] Iliev (2010)

[2] Kron/Ferry International (2005): https://www.gpo.gov/fdsys/pkg/CREC-2005-04-15/html/CREC-2005-04-15-pt1-PgE657-3.htm

Why P&L Insurers?

- P&L industry is a good "natural experiment playground" to test the effect of SOX.
  1. I can observe both public and private companies - some of which are not affected by SOX.
  2. Schedule P Part 2 of the Statutory Annual Statement provides a good measure of managerial discretion over financial reporting.
  3. Total audit fees from both public and private firms are observable.
  4. P&L insurers in the U.S. are relatively homogenous.

Methodology: Dependent Variables

	KFS Measures	Full Information Measures
Bias Measures	$\text{KFS Bias}_{i,t} = \frac{\text{Incurred Losses}_{i,t} - \text{Incurred Losses}_{i,t+5}}{\text{Total Asset}_{i,t}}$	$\text{Full Info Bias}_{i,t} = \frac{\sum_r \left[\widehat{\text{Loss}}_{r,10}(i,t+1) - \text{Loss}_{r,10}(i,t+1)\right]}{\text{Total Asset}_{i,t}}$
Error Measures	Absolute Value of KFS Bias	Absolute Value of Full Information Bias
Consistency Measures	5-year standard deviation of KFS Bias pre- and post-SOX	5-year standard deviation of Full Information Bias pre- and post-SOX
Direct Cost of Compliance	Total Audit Fee	

- Eastman et al. (2016): Insurers with more consistent loss reserving bias have lower cost of debt.

Methodology: Independent Variables

- More independent variables are added (Grace & Leverty (2011)):
  - *Actuary*: (percentile) of actuary i's client's total premiums share in year t; or indicator variable of the Big 4 in year t
  - *Auditor*: (percentile) of actuary i's client's total premiums share in year t; or indicator variable of the Big 4 in year t
- Other control variables include:
  - *Insurer's Characteristics*
  - *Earnings Management Variables*

Methodology: Fixed Effect Model with Propensity Score Matching

- Step 1: Propensity Score Matching: Show 1-to-1 NN match using insurer's characteristics variables.
- Step 2: Fixed Effect Model

$$Y_{it} = \beta_0 + \beta_1 Post_t + \beta_2 Post_t x Treated_i + \Sigma_s \beta_s X_{it} + \gamma_i + \lambda_t + \epsilon_{it}$$

  - *Treated* - Insurers affiliated with SOX-compliant firms
  - *Post* - After 2005 (years 2003 and 2004 are dropped from the sample)
- (Sub)samples:
  - P&L insurers data from from 1998 - 2009
  - *Under-reserving insurers* - Insurers have been under-reserving on average from 1998 to 2001

Methodology: SOX and Audit Fee

- Model (Iliev, 2010):

$$\begin{aligned} Log(TotalAuditFee)_{it} = \alpha + \beta_0 Post_t x Treated_i + \beta_1 Log(Asset)_{it} + \\ \beta_2 Log(Premiums)_{it} + \\ + Controls_{it} + \gamma_i + \epsilon_{it} \end{aligned}$$

- Implied Increase Audit Fee (among the subsamples):

$$\begin{aligned} \Delta(\text{Total Audit Fee}) = & \text{TotalAuditFee}(\bar{X}, \hat{\beta})_{\text{Treated\&Post-SOX}} \\ & - \text{TotalAuditFee}(\bar{X}, \hat{\beta})_{\text{Treated\&Pre-SOX}} \end{aligned}$$

Control & Treated Insurers: The Need for Propensity Score Matching

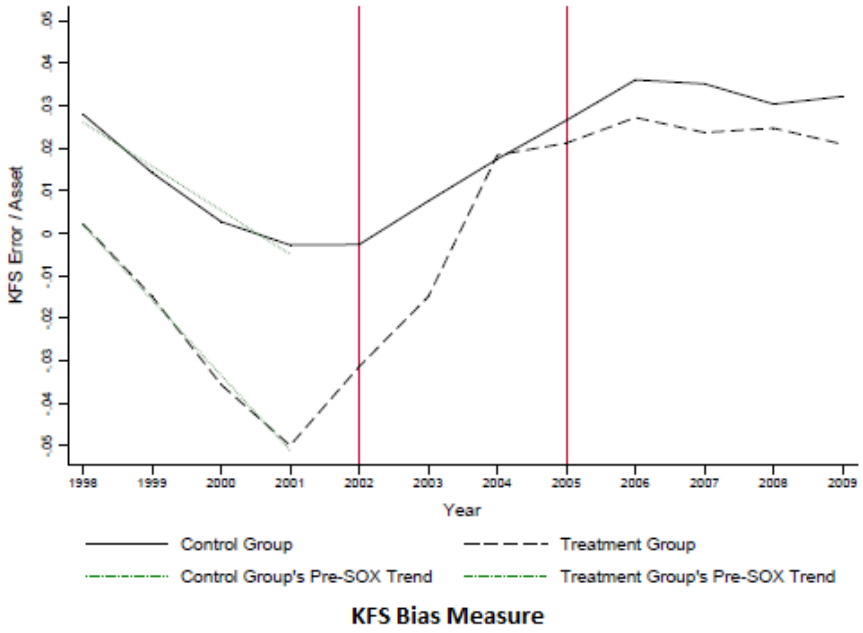
Control and treated group are significantly different. Propensity score matching method is needed.

	Control	Obs	Treated	Obs	Control - Treated	t-statistics
KFS Measures						
Bias	0.02	8656	0.01	4317	0.02***	(9.58)
Error	0.06	8656	0.05	4317	0.01***	(4.39)
Consistency	0.02	8520	0.01	4276	0.01**	(2.86)
Full Information Measures						
Bias	0.00	8656	-0.00	4317	0.01**	(2.67)
Error	0.06	8656	0.06	4317	-0.01**	(-2.66)
Consistency	0.01	8620	0.06	4317	-0.05*	(-2.09)
Cost of Compliance						
Audit Fee / Asset	0.004	8656	0.002	4317	0.001***	(18.38)
Control Variables						
Mutual	0.37	8656	0.03	4317	0.35***	(59.69)
Group	0.55	8656	0.99	4317	-0.43***	(-76.83)
Direct	0.26	8626	0.15	4317	0.11***	(14.49)
Total Asset (Million USD)	595.07	8656	1775.65	4317	-1180.58***	(-13.62)
Growth	0.07	8656	0.13	4317	-0.05	(-1.46)
Reinsurance	0.33	8507	0.45	4236	-0.12***	(-22.98)
Long Tail	0.75	8656	0.70	4317	0.05***	(9.29)
Product Herf.	0.71	8656	0.85	4317	-0.14	(-0.28)
State Herf.	2.72	8656	5.05	4317	-2.33	(-0.87)
Stochastic Fit (For Full Info. Measures)	0.96	8656	0.97	4317	-0.01***	(-5.14)

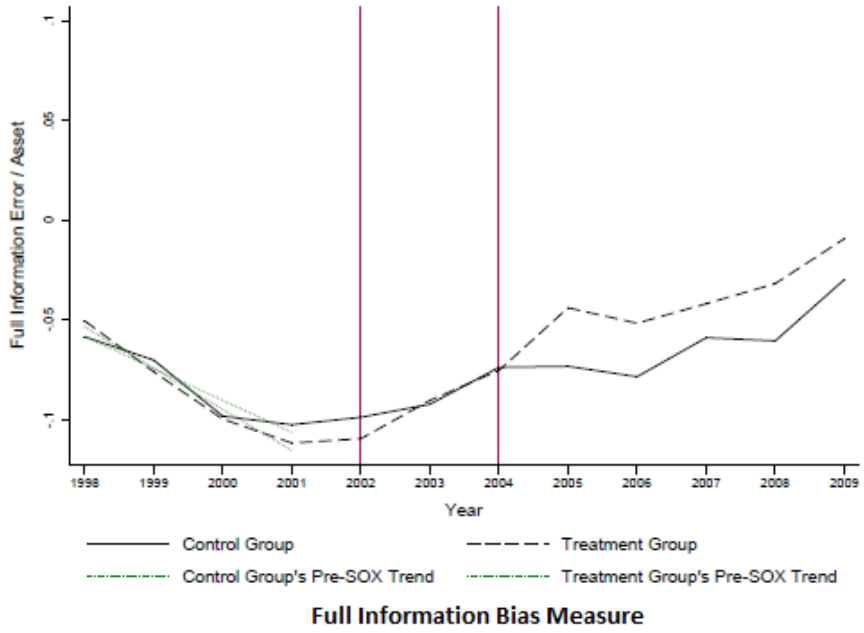
Main Research Findings

- SOX improves loss reserve estimation of the under-reserving insurers i.e. bias upward (more conservative), downward error, more consistency. The effect is strong during 2005.
- SOX makes loss reserve estimation of the over-reserving insurers to bias upward without improving error or consistency measures. The effect is strong during 2005.
- SOX does not increase audit fee *except* among insurers at the top asset quintile and among the under-reserving insurers at the top asset quintile.
- Implied increase in audit fee (in thousand) is $ 750.11 among the top asset quintile; $ 812.39 among the under-reserving top asset quintile.

Average Loss Reserves Bias Over Time (Control & Treated Insurers)

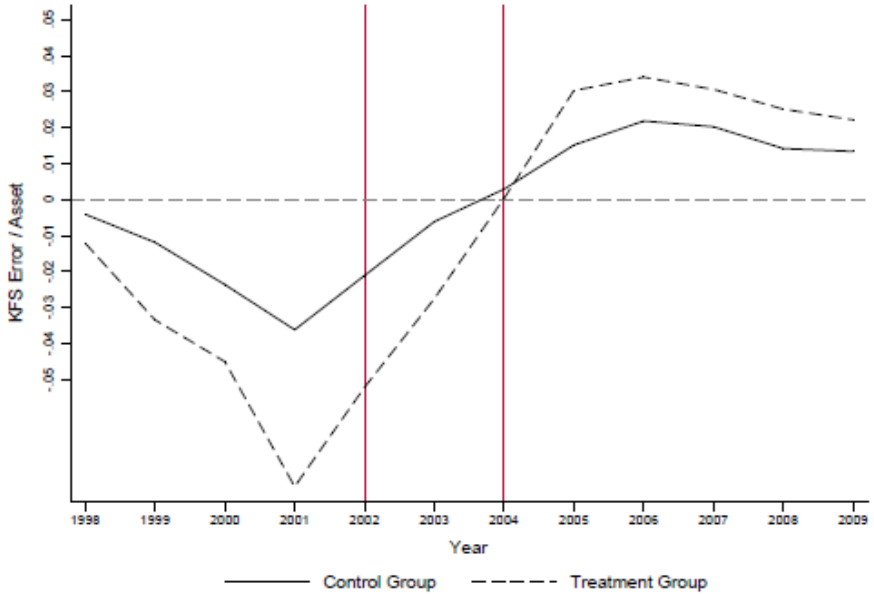


KFS Bias Measure

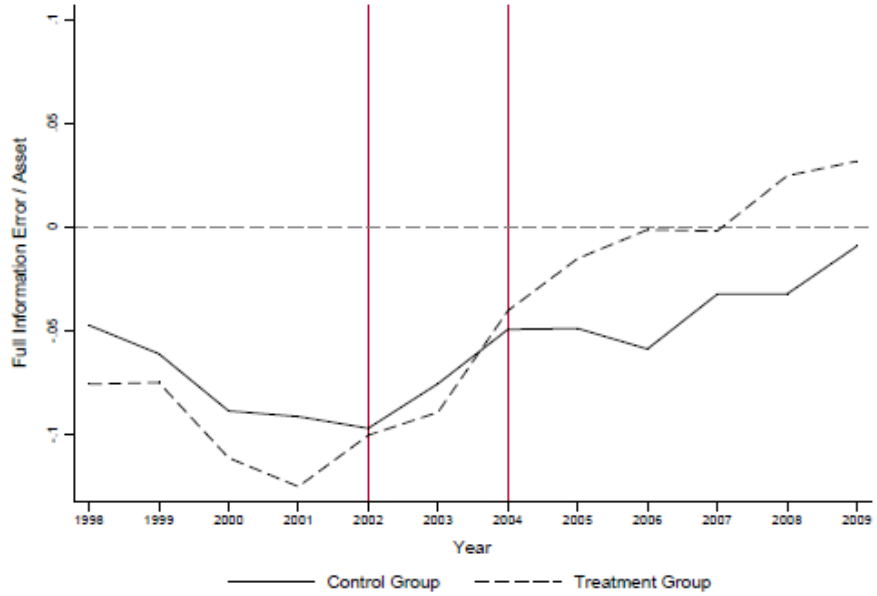


Full Information Bias Measure

Average Loss Reserves Bias Over Time (Control & Treated *Under-reserving* Insurers)

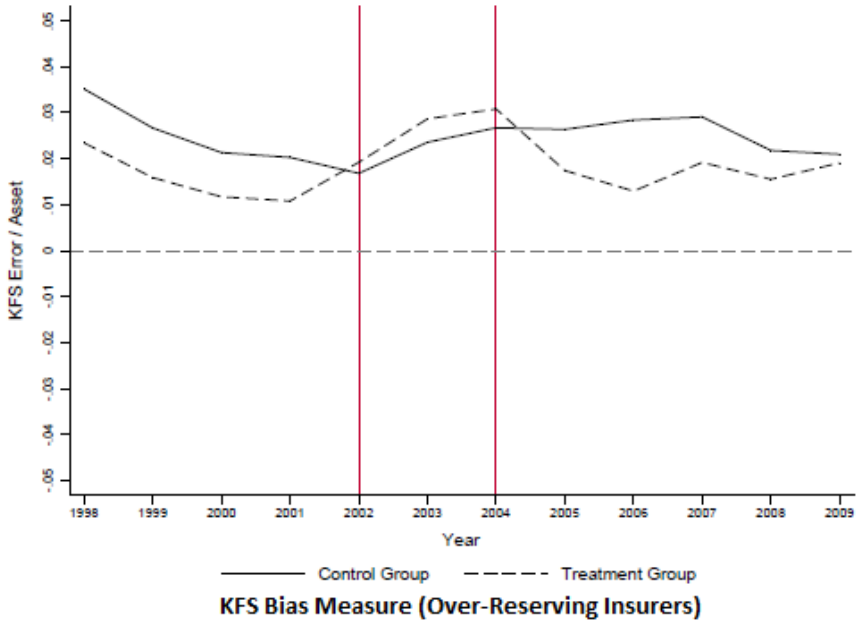


KFS Bias Measure (Under-reserving Insurers)

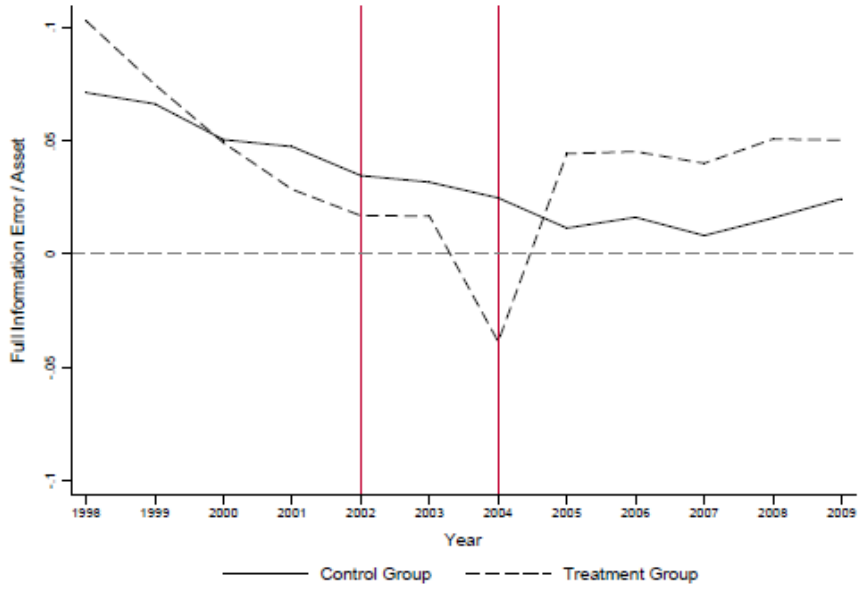


Full Information Bias Measure (Under-reserving)

Average Loss Reserves Bias Over Time (Control & Treated *Over-reserving* Insurers)



KFS Bias Measure (Over-Reserving Insurers)



Full Information Bias Measure (Over-reserving Insurers)

SOX → Loss Reserves Bias and Error (KFS Measures)

Table 3: Effect of SOX on Bias and Error KFS Measures

	All Samples		Under-Reserving		Over-Reserving	
	Bias	Error	Bias	Error	Bias	Error
Post	0.043***	0.024**	0.024***	-0.014	0.028*	0.026*
	(0.011)	(0.010)	(0.009)	(0.010)	(0.015)	(0.014)
Post x Treated	0.020*	0.009	0.023**	0.005	0.020*	0.011
	(0.010)	(0.009)	(0.010)	(0.011)	(0.011)	(0.010)
R^2	0.203	0.054	0.271	0.051	0.136	0.047
Observations	3645	3645	2822	2822	2326	2326

SOX → Loss Reserves Bias and Error (Full Info. Measures)

Table 4: Effect of SOX on Bias and Error Full Information Measures

	All Samples		Under-Reserving		Over-Reserving	
	Bias	Error	Bias	Error	Bias	Error
Post	0.010	-0.021*	0.065***	0.032	0.006	0.005
	(0.012)	(0.011)	(0.022)	(0.024)	(0.013)	(0.014)
Post x Treated	-0.024	0.033	-0.023	0.040	0.034**	0.028
	(0.016)	(0.037)	(0.018)	(0.041)	(0.016)	(0.024)
R^2	0.074	0.047	0.089	0.067	0.072	0.053
Observations	3645	3645	2822	2822	2326	2326

SOX → Loss Reserves Bias and Error *by year* (KFS Measures)

Table 5: Effect of SOX on Bias and Error KFS Measures by Year

	All Samples		Under-Reserving		Over-Reserving	
	Bias	Error	Bias	Error	Bias	Error
Treated x Year = 2005	0.017*	0.019**	0.020**	0.023**	0.007	0.017*
	(0.010)	(0.008)	(0.009)	(0.009)	(0.015)	(0.010)
Treated x Year = 2006	-0.002	0.010	0.007	0.015	-0.018	0.005
	(0.015)	(0.014)	(0.015)	(0.013)	(0.023)	(0.023)
Treated x Year = 2007	0.010	0.016**	0.013	0.009	0.003	0.024**
	(0.012)	(0.008)	(0.014)	(0.010)	(0.012)	(0.010)
Treated x Year = 2008	0.010	0.015	0.010	0.010	0.008	0.024*
	(0.012)	(0.009)	(0.011)	(0.013)	(0.015)	(0.012)
Treated x Year = 2009	0.013	0.023**	0.004	0.007	0.025	0.043**
	(0.014)	(0.011)	(0.011)	(0.013)	(0.019)	(0.018)
Constant	0.005	-0.000	0.007	-0.001	0.007	-0.003
	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)	(0.005)
R^2	0.206	0.056	0.273	0.053	0.142	0.052
Observations	3645	3645	2822	2822	2326	2326

SOX → Loss Reserves Bias and Error *by year* (Full Info. Measures)

Table 6: Effect of SOX on Bias and Error Full Information Measures by Year

	All Samples		Under-Reserving		Over-Reserving	
	Bias	Error	Bias	Error	Bias	Error
Treated x Year = 2005	-0.004	0.019**	-0.032	0.022**	0.038*	0.017*
	(0.018)	(0.008)	(0.023)	(0.009)	(0.021)	(0.010)
Treated x Year = 2006	0.004	0.010	0.008	0.015	-0.003	0.004
	(0.015)	(0.014)	(0.021)	(0.013)	(0.021)	(0.023)
Treated x Year = 2007	-0.005	0.016**	-0.006	0.009	-0.007	0.023**
	(0.016)	(0.008)	(0.020)	(0.010)	(0.019)	(0.011)
Treated x Year = 2008	-0.034	0.016	-0.026	0.011	-0.055**	0.025**
	(0.024)	(0.010)	(0.028)	(0.013)	(0.026)	(0.012)
Treated x Year = 2009	0.002	0.025**	0.034	0.009	-0.038	0.043**
	(0.027)	(0.011)	(0.034)	(0.014)	(0.028)	(0.018)
Constant	-0.014	-0.000	-0.013	-0.001	-0.013	-0.002
	(0.010)	(0.005)	(0.011)	(0.005)	(0.013)	(0.005)
R^2	0.077	0.058	0.095	0.054	0.083	0.056
Observations	3645	3645	2822	2822	2326	2326

SOX → Loss Reserves Consistency (KFS Measures)

	All Samples	Under-Reserving	Over-Reserving
Post	0.002	0.005*	-0.002
	(0.003)	(0.003)	(0.003)
Post x Treated	0.001	0.002	0.002
	(0.005)	(0.006)	(0.004)
R^2	0.220	0.275	0.465
Observations	1124	692	432

SOX → Loss Reserves Bias and Error (Full Info. Measures)

	All Samples	Under-Reserving	Over-Reserving
Post	0.017*	0.027	0.007
	(0.009)	(0.018)	(0.011)
Post x Treated	-0.037**	-0.056*	-0.008
	(0.018)	(0.031)	(0.015)
R^2	0.065	0.124	0.109
Observations	1116	676	440

SOX → Log of Audit Fee

- Implied increase audit fee in thousand (among the q5 subsamples) = \$750.11

Table 9: Effect of SOX on Direct Cost of Compliance: Audit Fee

	All Samples		All Samples: Asset Quintiles				
			q1	q2	q3	q4	q5
Post x Treated	-0.024						
	(0.103)						
Treated x Year = 2005		-0.012	0.206	-0.127	0.008	-0.169	0.263*
		(0.092)	(0.266)	(0.191)	(0.123)	(0.134)	(0.149)
Treated x Year = 2006		0.143	0.354	0.110	-0.046	-0.050	0.510***
		(0.115)	(0.260)	(0.226)	(0.137)	(0.196)	(0.156)
Treated x Year = 2007		-0.018	0.374	-0.053	-0.316	-0.051	0.245
		(0.124)	(0.243)	(0.182)	(0.341)	(0.208)	(0.184)
Treated x Year = 2008		-0.078	-0.063	-0.193	-0.430	-0.192	0.305
		(0.153)	(0.319)	(0.236)	(0.386)	(0.205)	(0.226)
Treated x Year = 2009		-0.170	-0.092	-0.445	-0.415	-0.127	0.215
		(0.144)	(0.342)	(0.423)	(0.369)	(0.224)	(0.232)
R^2	0.181	0.183	0.195	0.273	0.238	0.211	0.188
Observations	8115	8115	1411	1621	1706	1732	1645

SOX → Log of Audit Fee

- Implied increase audit fee in thousand (among the q5 subsamples) = \$812.30

	Under-reserving Sample: Asset Quintiles				
	q1	q2	q3	q4	q5
Treated x Year = 2005	0.005	-0.061	-0.218	-0.302	0.405**
	(0.425)	(0.251)	(0.167)	(0.199)	(0.174)
Treated x Year = 2006	0.429	0.427	-0.117	-0.097	0.798***
	(0.430)	(0.261)	(0.156)	(0.278)	(0.157)
Treated x Year = 2007	0.452	0.031	-0.602	-0.234	0.475*
	(0.441)	(0.226)	(0.585)	(0.236)	(0.239)
Treated x Year = 2008	0.227	-0.119	-0.703	-0.404	0.382
	(0.398)	(0.277)	(0.659)	(0.250)	(0.302)
Treated x Year = 2009	0.111	-0.469	-0.694	-0.269	0.525
	(0.479)	(0.292)	(0.589)	(0.251)	(0.388)
R^2	0.178	0.353	0.226	0.251	0.228
Observations	435	683	787	929	943

Paper Conclusion

- SOX improves loss reserve estimation of the under-reserving insurers i.e. bias upward (more conservative), downward error, more consistency. The effect is strong during 2005.
- SOX makes loss reserve estimation of the over-reserving insurers to bias upward without improving error or consistency measures. The effect is strong during 2005.
- SOX does not increase audit fee *except* among insurers at the top asset quintile and among the under-reserving insurers at the top asset quintile.
- Implied increase in audit fee (in thousand) is $ 750.11 among the top asset quintiles; $ 812.39 among the under-reserving top asset quintiles.

Agenda

1. Essay 1: SOX & Insurers
   - Introduction
   - Research Findings
2. Essay 2: SOX-lite & Insurers
   - Introduction
   - Research Findings
3. Essay 3: SOX & Insurers ICM
   - Introduction
   - Research Findings

Research Questions

What if SOX is cheaper & lighter, does it still have the punch?

1. Did SOX-lite *overall* improve loss reserving estimation?
   - Estimation bias
   - Estimation error
   - Estimation consistency
2. Did *each provision* of SOX-lite improve loss reserving estimation?
   - (Super)majority board of director independence
   - Management report of internal control
3. Has the cost of compliance increased among SOX-lite-complying insurers after SOX-lite?

SOX-lite in Two Pictures

The differences between SOX and SOX-lite (Model Audit Rule 205)

	SOX (2002)	SOX-Lite (2010)
Targeted Insurers	Public insurers and their subsidiaries	All Insurers. SOX-compliant entities and their subsidiaries are exempt from this regulation
Audit Partner 5-year Rotation	Yes	Required unless GPW below $100 may request for exemption
Director Independence	100% independent audit/nomination/remuneration committee	Majority or supermajority independent board of directors at certain premiums thresholds
Management Internal Control Report and CPA Attestation	Required	Required if GPW exceeds $500 mil but **no CPA attestation required**
Enhanced Criminal Penalty for Material Misstatement	Yes	**No**

SOX-lite in Two Pictures

Larger insurers need to comply with stricter rules

Gross Premiums Written	Auditor Independence	Audit Committee	Board Independence	Management Report over Internal Control
< $100 Million	May ask for exemption	Yes	Not required	Not required
$100 - $300 Million	Yes	Yes	Not required	Not required
$300 - $500 Million	Yes	Yes	> 50%	Not required
> $500 Million	Yes	Yes	> 75%	Yes but without CPA attestation

Methodology: Dependent & Independent Variables

	KFS Measures	Full Information Measures
Bias Measures	$\text{KFS bias}_{i,t} = \frac{\text{Incurred Losses}_{i,t} - \text{Incurred Losses}_{i,t+j}}{\text{Total Asset}_{i,t}}$ ** 3-year KFS Bias is used instead of 5-year	$\text{Full Info Bias}_{i,t} = \frac{\sum_r \left[\widehat{\text{Loss}}_{r,10}(i,t+1) - \text{Loss}_{r,10}(i,t+1)\right]}{\text{Total Asset}_{i,t}}$
Error Measures	Absolute Value of 3-year KFS Bias	Absolute Value of 1-year Full Information Bias
Consistency Measures	4-year standard deviation of 1-year KFS Bias pre- and post-SOX-lite	4-year standard deviation of 1-year Full Information Bias pre- and post-SOX-lite
Direct Cost of Compliance	Total Audit Fee	

- Eastman et al. (2016): Insurers with more consistent loss reserving bias have lower cost of debt.
- Independent variables are similar to SOX's paper

Methodology: Measuring the *Overall* Impact of SOX-lite on Insurers

- Fixed-effect Model

$$Y_{it} = \beta_0 + \beta_1 \text{SOX-lite}_t + \beta_2 \text{SOX-lite}_t x \text{Treated}_i + \Sigma_s \beta_s X_{it} + \gamma_i + \lambda_t + \epsilon_{it}$$

- *Treated*: Insurers with direct premiums written & reinsurance assumed greater than $500 million & have not been subject to SOX regulation
- *Control*: Insurers with direct premiums written & reinsurance assumed greater than $500 million & have been subject to SOX regulation
- *SOX-lite*: After 2011 (black out 2010)

Methodology: Measuring the Impact of SOX-lite *by Provisions* on Insurers

- Sharp Regression Discontinuity Design (use OLS):

$$Y = \beta_0 + \beta_1 Complier + \beta_2 GPW + \beta_3 GPW^2 + \beta_4 GPW^3 + \gamma X + \epsilon \tag{1}$$

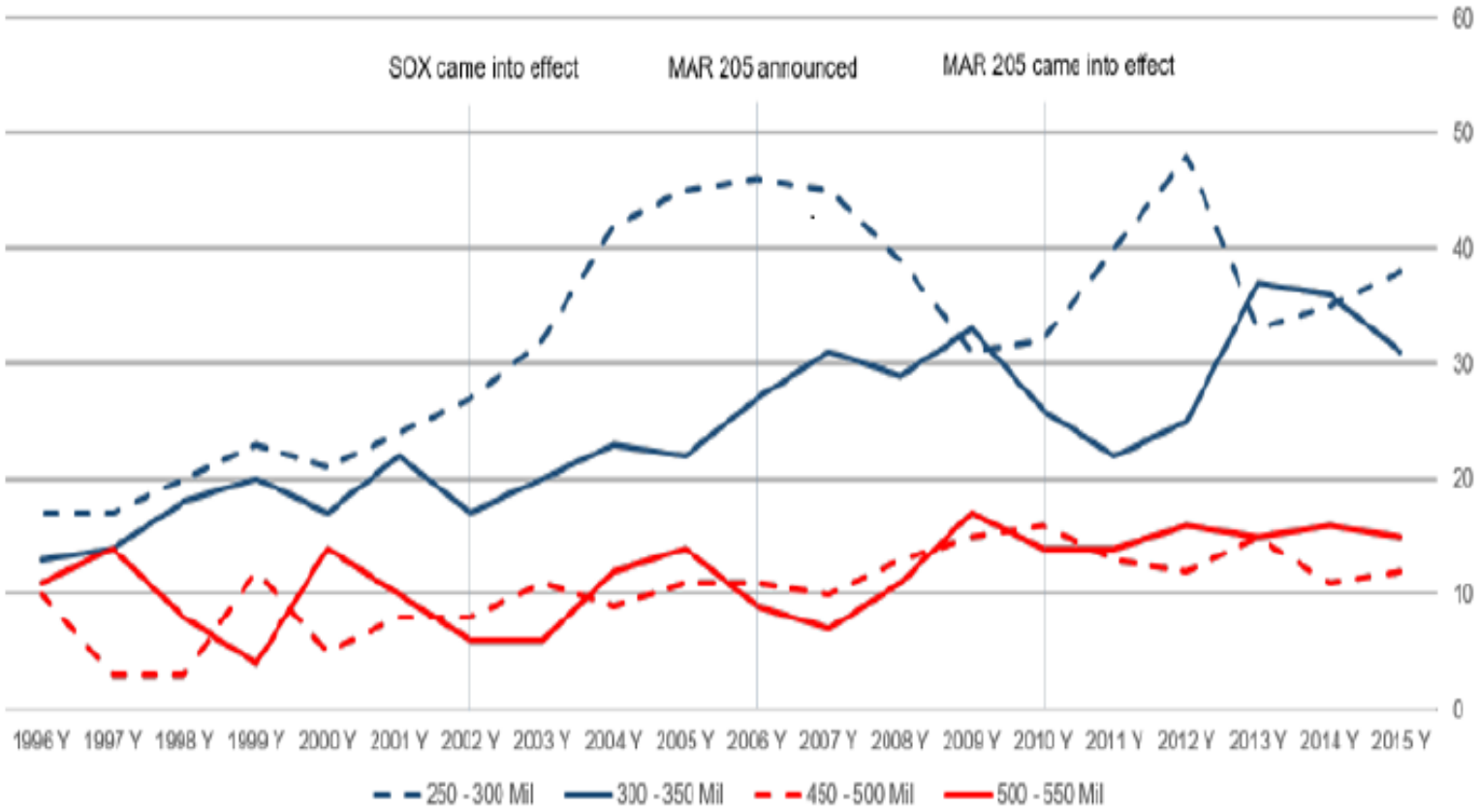
- Fuzzy Regression Discontinuity Design (use IV):

$$\begin{aligned} Complier &= \alpha_0 + \alpha Above_{2005} + \theta X + \eta \\ Y &= \beta_0 + \beta \hat{Complier} + \gamma X + \epsilon \end{aligned} \tag{2}$$

- Thresholds: \$300 million (testing the effect of majority board of director independence), \$500 million (testing the effect of supermajority board of director independence & management report of internal control)
- Bandwidth: I reported the $\pm$ \$200 million bandwidth
- Year: 2011 (the results are similar when using other years)

Distribution of Insurers Around The Thresholds

Figure 1: Distribution of Insurers at Different Direct Premiums Written and Reinsurance Assumed from 1996 to 2015



Research Findings

- I have found no evidence that *each provision* increase the cost of compliance or could improve the loss reserving estimation
- *Overall* SOX-lite might be able to reduce loss reserving estimation error in some identifications, could improve loss reserving estimation consistency, while did not significantly increase the audit fee.

Summary Statistics

Table 1: Summary Statistics

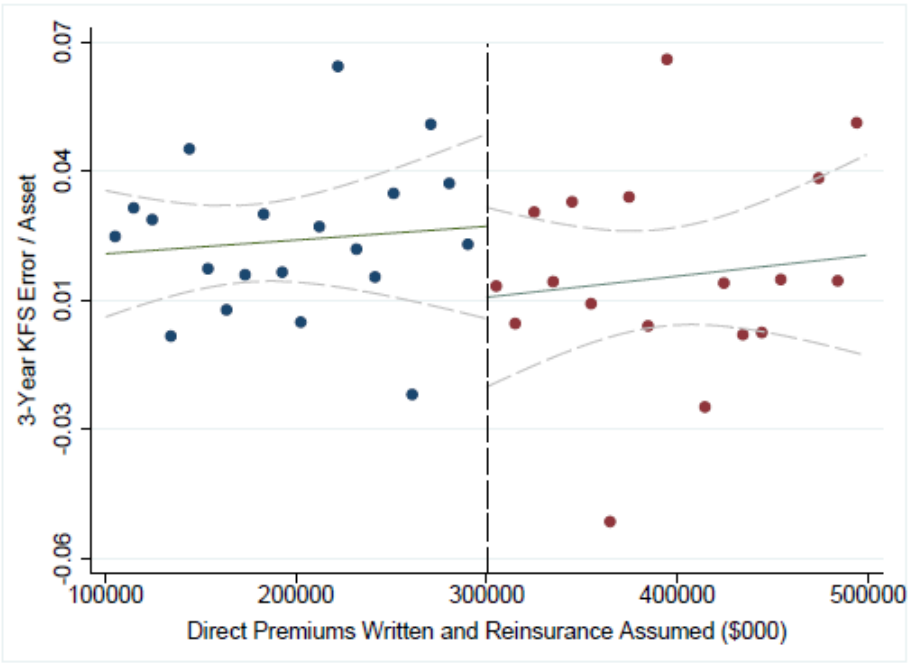
	Mean	Std.Dev.	Min	Max	Obs
KFS Measures					
Bias	0.01	0.09	-1.00	0.34	271
Error	0.04	0.08	0.00	1.00	271
Consistency	0.05	0.80	-0.14	12.76	253
Full Info. Measures					
Bias	0.02	0.15	-1.00	1.00	271
Error	0.06	0.14	0.00	1.00	271
Consistency	0.09	0.34	0.00	10.37	270
Cost of Compliance					
Audit Fee/Asset	.003	.007	0.000	0.117	268

Summary Statistics

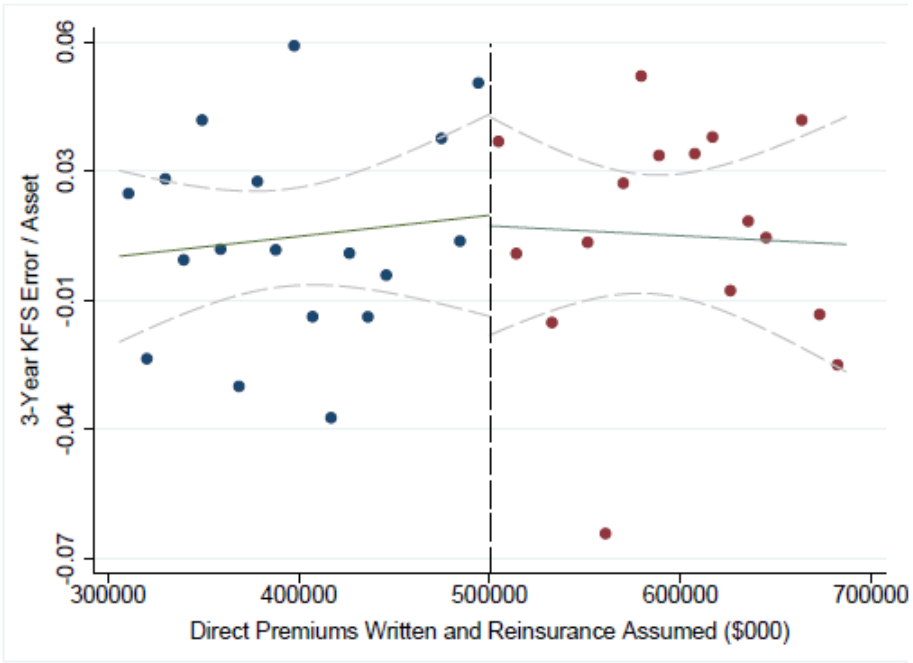
Table 1: Summary Statistics

	Mean	Std.Dev.	Min	Max	Obs
Control Variables					
Mutual	0.35	0.48	0.00	1.00	271
Group	0.78	0.42	0.00	1.00	271
Direct	0.13	0.34	0.00	1.00	270
Asset	561.34	665.62	30.54	6040.12	271
Growth	0.04	0.32	-1.26	1.99	266
Long Tail	0.40	0.42	0.00	1.00	266
Product Herf.('0000)	2.89	39.77	0.12	1.00	264
State Herf.('0000)	0.52	0.37	0.04	1.00	268
Smooth	0.04	0.08	-0.37	0.45	270
Rate Regulation	3.92	1.15	2.15	8.00	264
Tax	0.46	0.50	0.00	1.00	271
Large Profit	0.05	0.22	0.00	1.00	271
Small Profit	0.00	0.06	0.00	1.00	271
Small Loss	0.00	0.06	0.00	1.00	271
Large Loss	0.04	0.21	0.00	1.00	271
Related	0.26	0.44	0.00	1.00	271
Actuary	0.87	0.16	0.27	0.99	249
Auditor	0.97	0.05	0.59	0.99	270

KFS Bias Measure

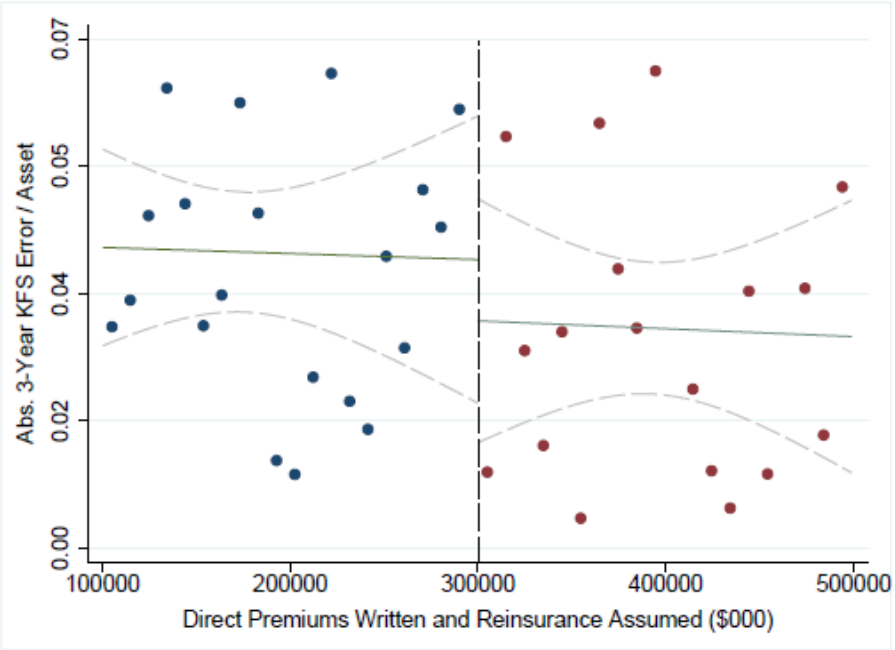


(a) Bias Measure: 300 Million

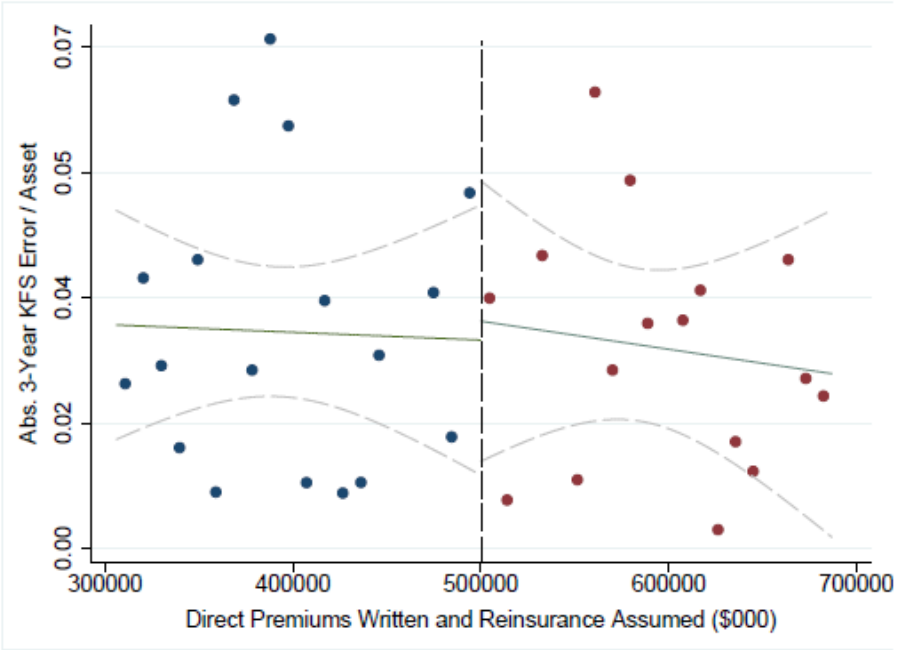


(b) Bias Measure: 500 Million

KFS Error Measure

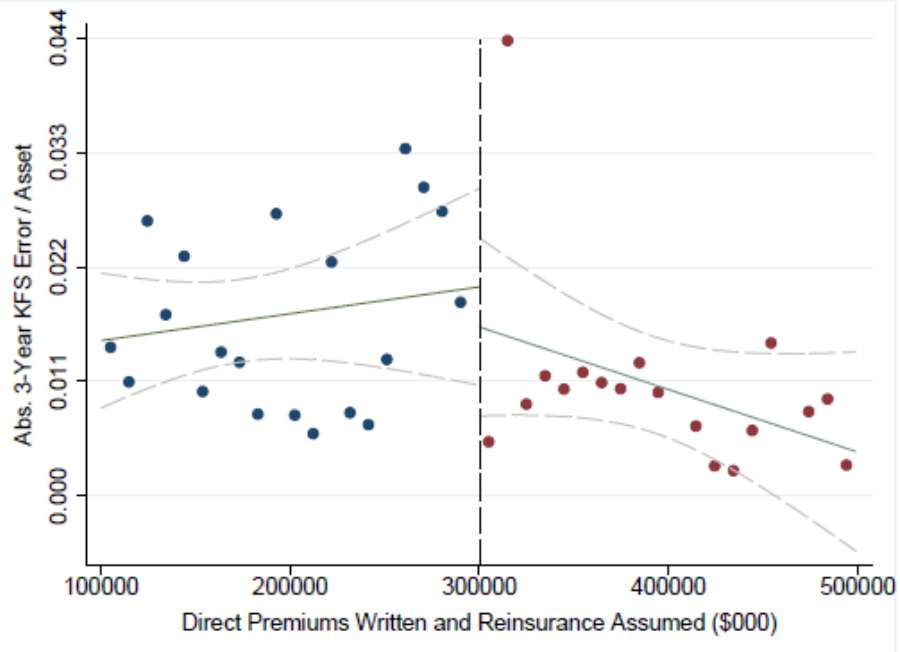


(c) Error Measure: 300 Million

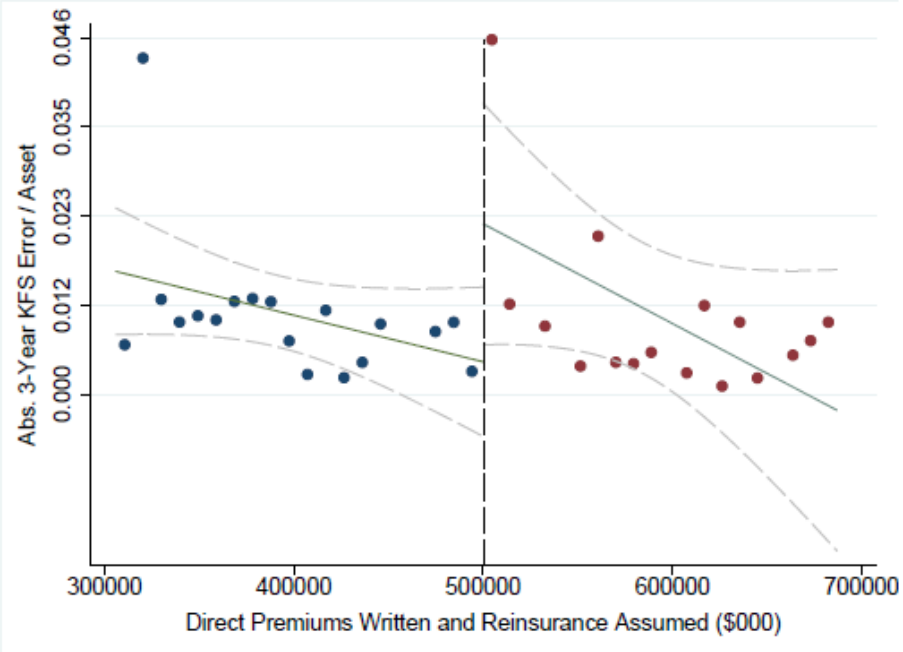


(d) Error Measure: 500 Million

KFS Consistency Measure

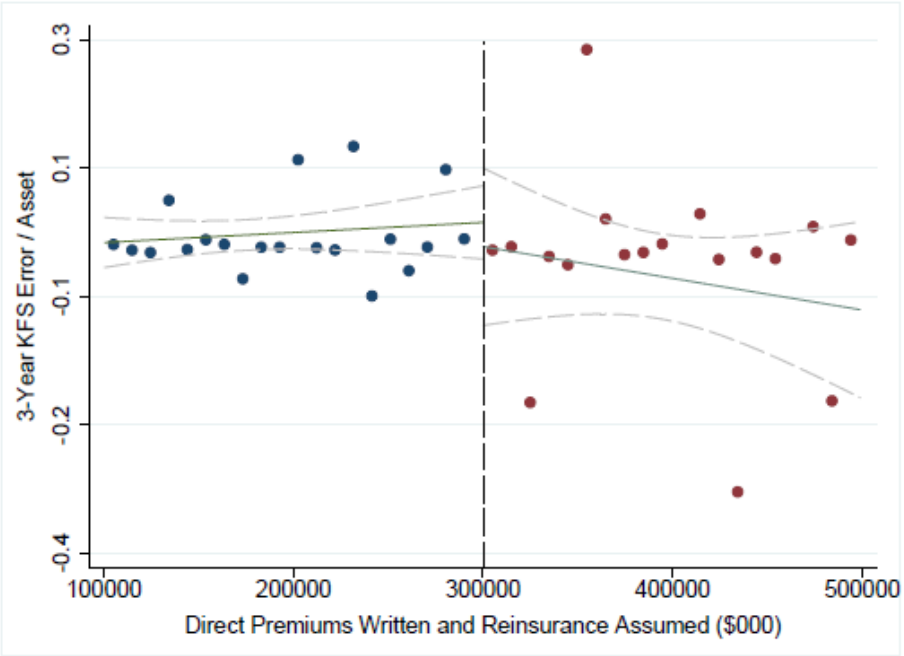


(e) Consistency Measure: 300 Million

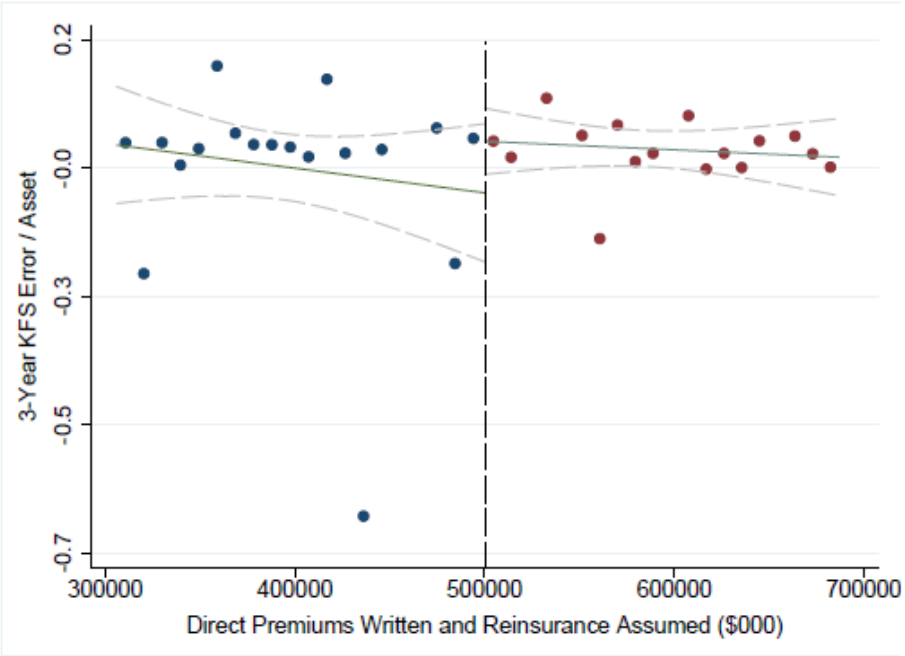


(f) Consistency Measure: 500 Million

Full Information Bias Measure

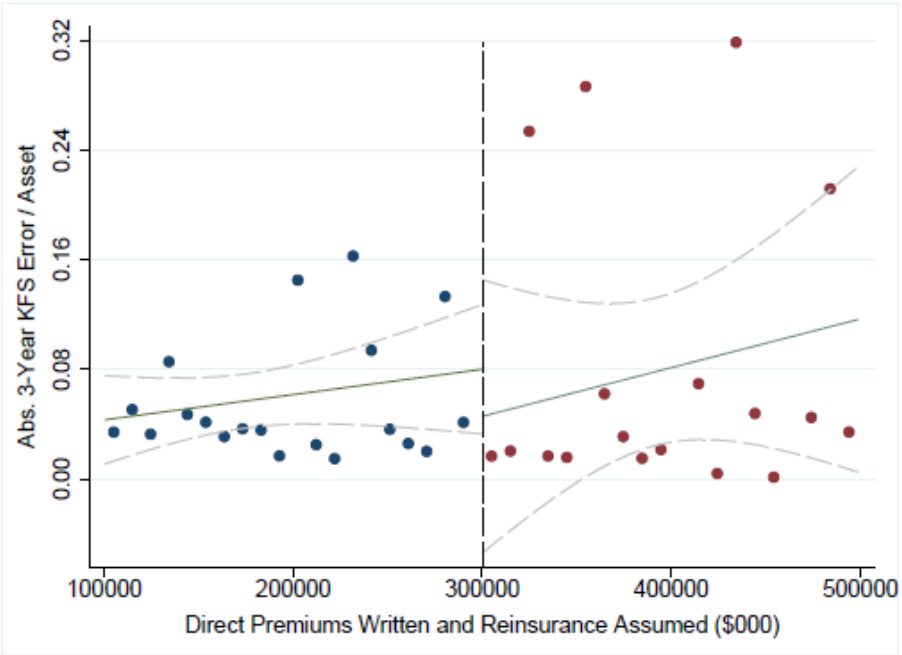


(a) Bias Measure: 300 Million

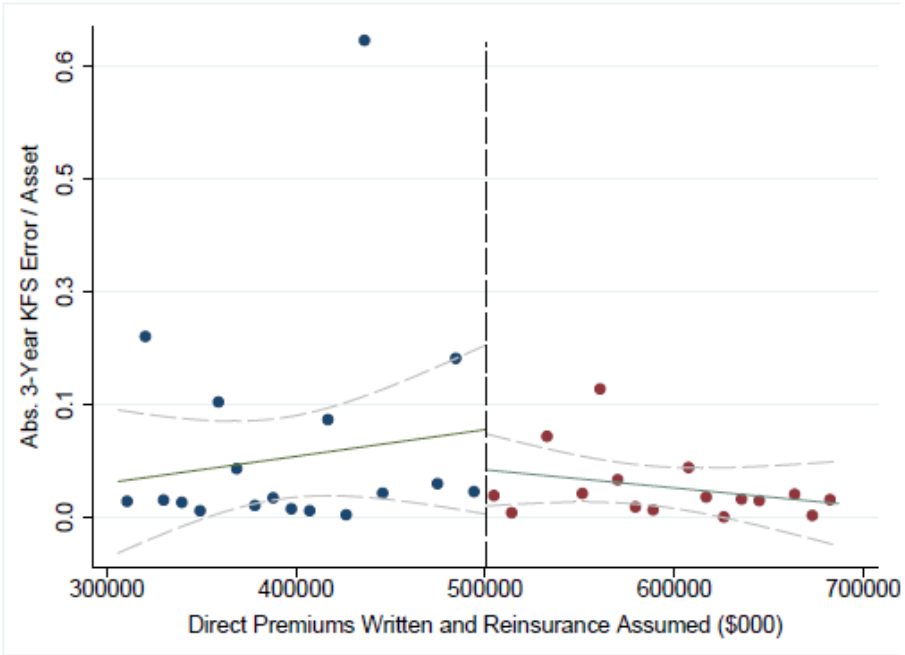


(b) Bias Measure: 500 Million

Full Information Error Measure

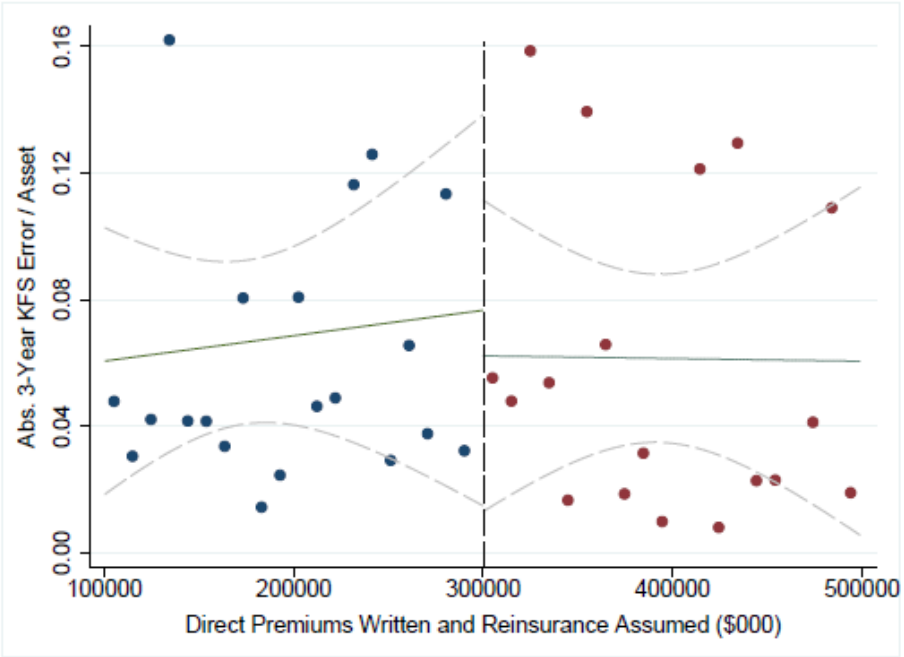


(c) Error Measure: 300 Million

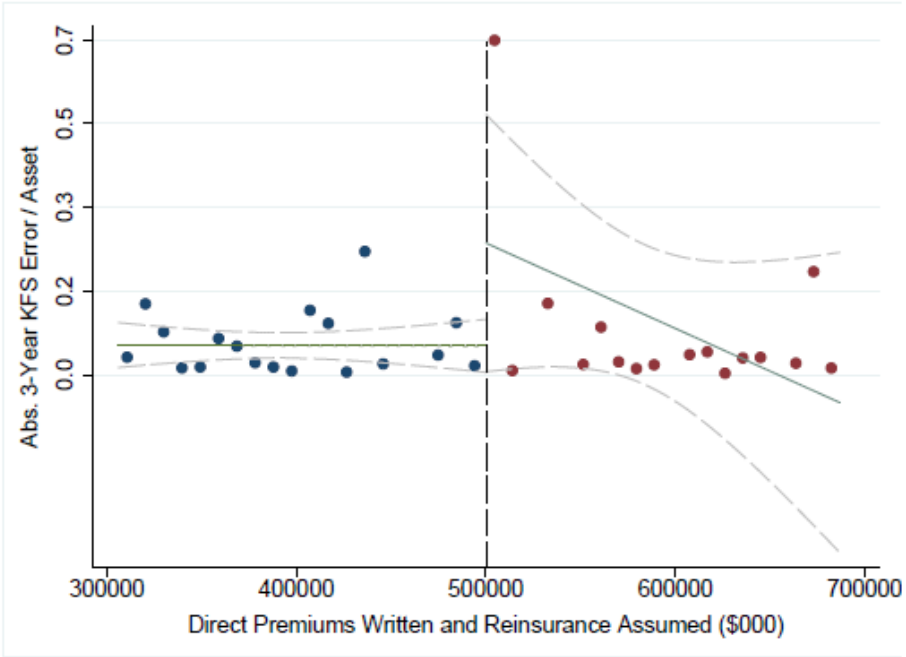


(d) Error Measure: 500 Million

Full Information Consistency Measure



(e) Consistency Measure: 300 Million



(f) Consistency Measure: 500 Million

SOX-lite → Loss Reserve Estimation

Table 2: Effect of SOX-lite on KFS Measures: Regression Discontinuity Design

	Bias				Error				Consistency			
	OLS		IV		OLS		IV		OLS		IV	
	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M
Above \$300M	0.153		-0.072		0.336		-0.041		-0.137		1.435	
	(0.441)		(0.081)		(0.585)		(0.056)		(0.591)		(2.936)	
Above \$500M		0.102		0.142		0.256		-0.001		-0.091		0.030
		(0.353)		(0.250)		(0.487)		(0.105)		(0.217)		(0.062)
R^2	0.009	0.010	0.145	0.401	0.012	0.011	0.891	0.318	0.004	0.006	0.056	0.398
Observations	243	78	211	67	243	78	211	67	239	78	211	67
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SOX-lite → Loss Reserve Estimation

Table 3: Effect of SOX-lite on Full Information Measures: Regression Discontinuity Design

	Bias				Error				Consistency			
	OLS		IV		OLS		IV		OLS		IV	
	$100M-$500M	$300M-$700M	$100M-$500M	$300M-$700M	$100M-$500M	$300M-$700M	$100M-$500M	$300M-$700M	$100M-$500M	$300M-$700M	$100M-$500M	$300M-$700M
Above $300M	1.557		1.025		-1.612		-0.304		-0.814		0.375	
	(2.548)		(1.626)		(2.454)		(0.217)		(1.476)		(2.179)	
Above $500M		0.985		0.600		-0.842		-0.244		-1.833		-0.159
		(1.804)		(0.845)		(1.636)		(0.570)		(4.124)		(0.744)
R^2	0.005	0.006	0.081	0.094	0.012	0.010	0.078	0.279	0.008	0.007	0.105	0.290
Observations	243	78	211	67	243	78	211	67	242	78	211	67
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SOX-lite → Loss Reserve Estimation: Under-reserving Insurers

Table 4: Effect of SOX-lite on KFS Measures using the Under-reserving Insurers Subgroup: Regression Discontinuity Design

	Bias				Error				Consistency			
	OLS		IV		OLS		IV		OLS		IV	
	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M
Above $300M	-0.310		0.764		-0.149		-0.121		0.285		-5.311	
	(0.298)		(1.040)		(0.169)		(0.492)		(0.538)		(8.353)	
Above $500M		0.969		-0.114		0.471		0.085		-0.232		0.056
		(6.791)		(0.204)		(3.417)		(0.231)		(1.642)		(0.096)
R^2	0.009	0.010	0.145	0.401	0.012	0.011	0.891	0.318	0.004	0.006	0.056	0.398
Observations	173	101	155	85	173	101	155	85	172	100	155	85
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SOX-lite → Loss Reserve Estimation: Under-reserving Insurers

Table 5: Effect of SOX-lite on Full Information Measures using the Under-reserving Insurers Subgroup: Regression Discontinuity Design

	Bias				Error				Consistency			
	OLS		IV		OLS		IV		OLS		IV	
	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M	$100M-$500M	$300M-$800M
Above $300M	-1.002		-0.635		0.382		0.719		0.437		-3.797	
	(1.007)		(0.942)		(0.600)		(1.054)		(0.669)		(6.557)	
Above $500M		0.697		-0.569		-2.200		0.557		-0.667		-0.002
		(5.116)		(1.524)		(15.261)		(1.538)		(4.865)		(0.578)
R^2	0.005	0.006	0.081	0.094	0.012	0.010	0.078	0.279	0.008	0.007	0.105	0.290
Observations	173	101	155	85	173	101	155	85	172	100	155	85
Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SOX-lite → Audit Fee

Table 6: Effect of SOX-lite on Direct Cost of Compliance: Audit Fees

	OLS		IV	
	\$100M-\$500M	\$300M-\$700M	\$100M-\$500M	\$300M-\$700M
Above \$300M	0.472		0.273	
	(8.898)		(0.429)	
Above \$500M		0.166		0.160
		(1.154)		(0.845)
R^2	0.314	0.366	0.300	0.464
Observations	215	67	215	67

Overall Effect of SOX-lite → Loss Reserve Estimation

Table 7: Total Effect of SOX-lite on Various Measures: Fixed Effect Model

	All Sample	Under-reserving	Over-reserving
3-Year KFS: Bias	0.005	0.006	0.001
	(0.006)	(0.005)	(0.014)
R^2	0.023	0.062	0.000
Observations	2275	1549	726
	All Sample	Under-reserving	Over-reserving
3-Year KFS: Error	-0.010*	-0.007	-0.014
	(0.005)	(0.005)	(0.012)
R^2	0.024	0.038	0.012
Observations	2275	1549	726
	All Sample	Under-reserving	Over-reserving
1-Year KFS: Consistency	-0.006**	-0.007*	-0.005
	(0.003)	(0.004)	(0.005)
R^2	0.017	0.025	0.009
Observations	2261	1541	720

Overall Effect of SOX-lite → Loss Reserve Estimation & Audit Fee

Table 7: Total Effect of SOX-lite on Various Measures: Fixed Effect Model

	All Sample	Under-reserving	Over-reserving
1-Year Full Info: Bias	0.033*	0.016	0.050
	(0.019)	(0.011)	(0.047)
R^2	0.003	0.011	0.014
Observations	2275	1549	726
	All Sample	Under-reserving	Over-reserving
1-Year Full Info: Error	-0.020	0.000	-0.053
	(0.015)	(0.012)	(0.033)
R^2	0.001	0.002	0.008
Observations	2275	1549	726
	All Sample	Under-reserving	Over-reserving
1-Year Full Info: Consistency	-0.043*	-0.018	-0.107
	(0.023)	(0.012)	(0.069)
R^2	0.007	0.011	0.014
Observations	2275	1549	726
	All Sample	Under-reserving	Over-reserving
Audit Fee/Asset	0.152	0.189	0.085
	(0.105)	(0.126)	(0.188)
R^2	0.087	0.083	0.095
Observations	2097	1443	654

Paper Conclusion

- I have found no evidence that *separate provisions* of SOX-lite increase the cost of compliance or could improve the loss reserving estimation
- *Overall* SOX-lite might be able to reduce loss reserving estimation error in some identifications, could improve loss reserving estimation consistency, while did not significantly increase the audit fee.

Agenda

1. Essay 1: SOX & Insurers
   - Introduction
   - Research Findings
2. Essay 2: SOX-lite & Insurers
   - Introduction
   - Research Findings
3. Essay 3: SOX & Insurers ICM
   - Introduction
   - Research Findings

Research Question

- How corporate governance affect internal capital transaction among insurance affiliated companies?
- Utilize SOX as a shock that improve corporate governance within insurance group

Why is the question interesting?

1. Transactions among affiliated insurers are significant yet under studied.
   - 2007 JFSR Powell and Somner - Intragroup Reinsurance Transactions
   - 2008 JRI Powell, Sommer and Eckles - Winner Picking and P&C Insurers
   - 2013 JBF Fier, McCullough and Carson - Target Leverage
2. First to investigate the role of corporate governance on insurers intragroup transactions
   - SOX & transactions within group
   - Transactions among life and health insurers, and property & casualty insurer
   - Rich set of data (standardized internal capital transactions reporting among public and private firms)

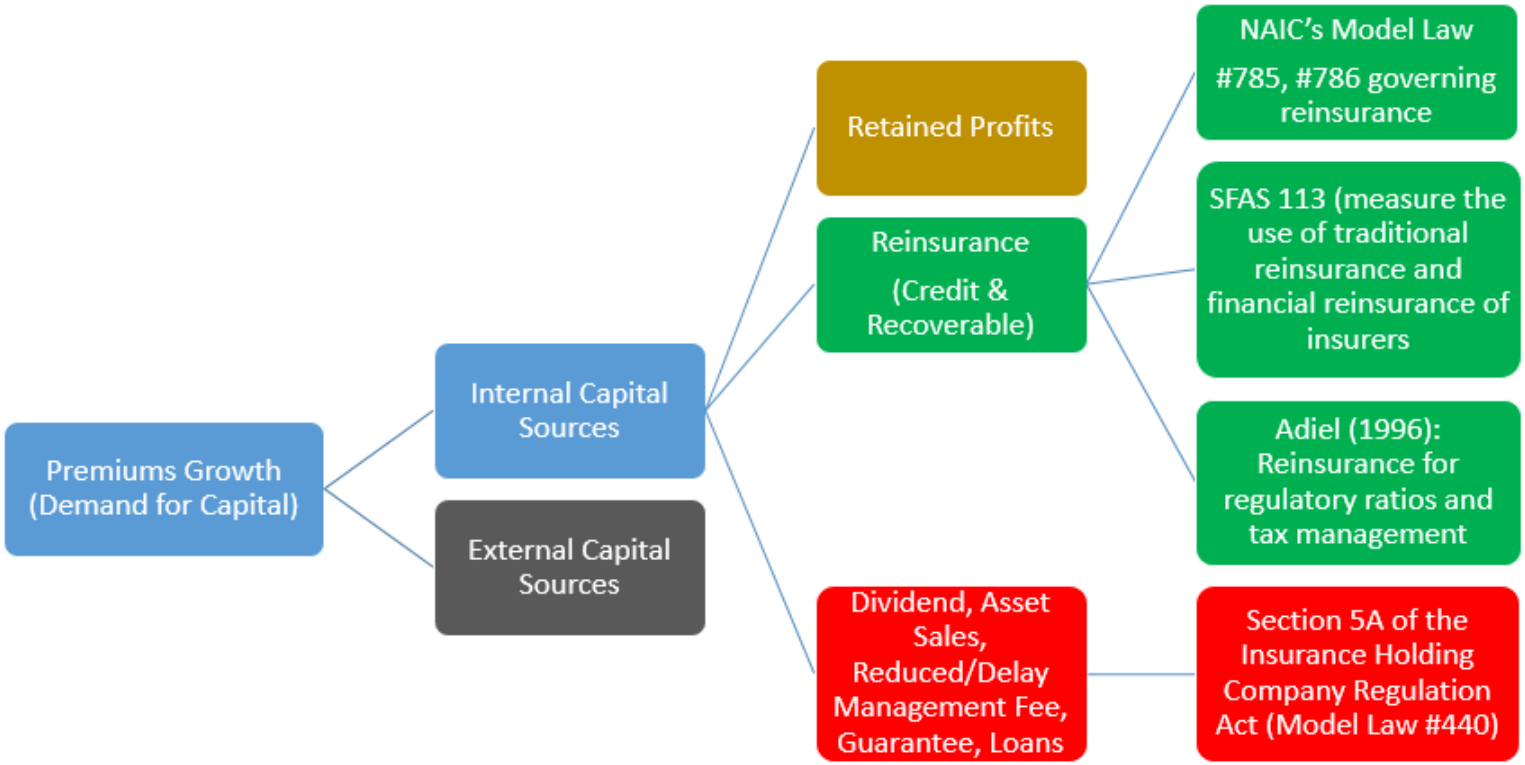
Literature Review

- Theoretical Studies: Bright Side vs Dark Side of ICM
  - 1994 QJE Gertner et al - Internal vs External Capital Market
  - 1997 JF Stein - Winner Picking
  - 1998 JEP Bolton and Sharfstein Corporate Finance, Theory of the Firm and Organizations
  - 2000 JF Scharfstein and Stein - Dark Side of Internal Capital Market

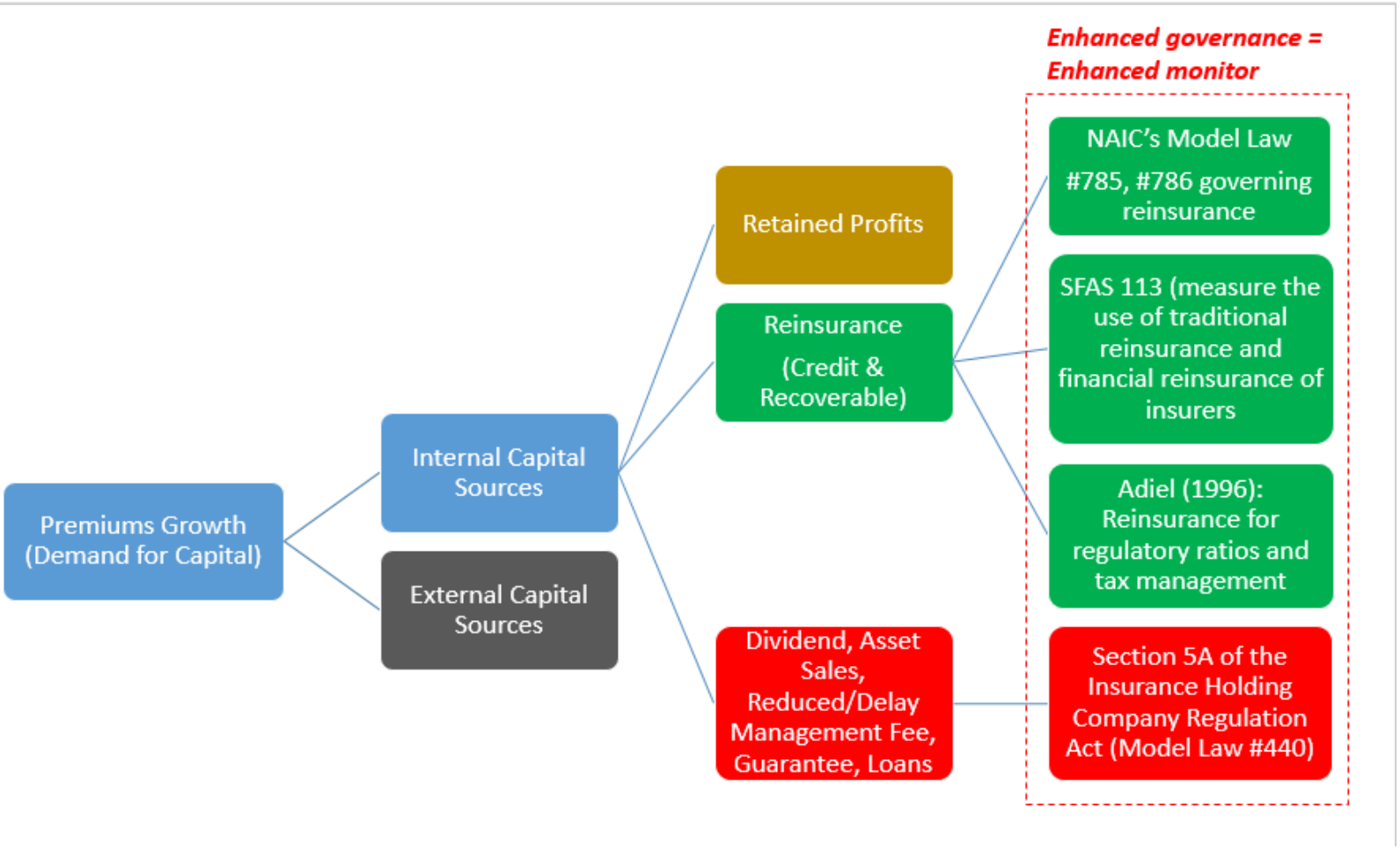
Literature Review

- ICM Empirical Studies in Finance
  - 1997 Lamont Oil & Gas Companies
  - 2013 JF Duchin and Sosyura - Divisional Manager and ICM
  - 2014 AEJ Egger et al - Tax and Internal Borrowing
  - 2014 JBF Cline et al - Avoiding Outside Monitoring
  - 2014 JFE Buchuk et al - Intra Group Loan
  - 2014 RFS Gopalan - ICM and Dividend
  - 2014 RMS Stagliano et al - Free Cash Flow & Agency Problem
  - 2015 JBF Frey and Kerl - Multinational Bank
  - 2015 JBF Graham et al - Decision Making
  - 2016 JFQA KIM - Fin Weakness and Prod Mkt Performance
- ICM Empirical Studies in Insurance
  - 2007 J Finan Serv Res Powell and Somner Reinsurance
  - 2008 JRI Powell, Sommer and Eckles - Insurance winner picking
  - 2013 JBF Fier, McCullough and Carson - Target Leverage
- ICM Empirical Studies in Accounting and Others
  - 2015 JAR Cho - SFAS 131
  - 2015 RFS Tate and Yang - Internal Labor Market

How can corporate governance affect capital transactions among affiliated insurers?



How can corporate governance affect capital transactions among affiliated insurers?



Methodology

- Two stage regression; Wurgler (2000), Morck et al. (2011):
- Stage 1: For each insurance group g and internal capital channel c, measure the sensitivity of premiums growth and internal capital growth pre- and post-SOX η^*_{gcs}:

$$log\left(\frac{S_{it-1}+C_{igct}}{S_{it-1}}\right)=\alpha_{gc}+\eta_{1,gc}log\left(\frac{P_{it}}{P_{it-1}}\right)+\eta_{2,gc}D_{post}log\left(\frac{P_{it}}{P_{it-1}}\right)+\epsilon_{igct} \quad (3)$$

- Stage 2: Use the DID approach to find the effect of SOX on the sentivity measure obtained from the first stage:

$$\begin{aligned}\hat{\eta}^*_{gcs} =&\beta_0+\beta_1 Post_s+\beta_2 Treated_g+\beta_3(Post_s x Treated_g)+\Sigma_k\beta_k X_{gs}+\gamma_g\\ &\beta_4 Actuary_{gs}+\beta_5(Actuary_{gs}xPost_s)+\beta_6(Actuary_{gs}xTreated_g)+\\ &\beta_7(Actuary_{gs}xPost_s xTreated_g)+\\ &\beta_8 Auditor_{gs}+\beta_9(Auditor_{gs}xPost_s)+\beta_{10}(Auditor_{gs}xTreated_g)+\\ &\beta_{11}(Auditor_{gs}xPost_s xTreated_g)+\epsilon_{gcs}\\ &\forall c\in\{\text{Rein.Recov, Rein.Credit, Total Rein., Total Other Capital, Total Capital}\}\end{aligned} \quad (4)$$

Research Findings

- SOX *decreased* the sensitivity of internal capital transaction growth to premiums growths among smaller insurers.
- Cross-sectional analysis suggest that quality actuary and auditor reduced such sensitivies.
- Among under-reserving insurers, SOX *increased* the sensitivity of internal capital transaction growth to premiums growths.

Summary Statistics

Table 1: Summary Statistics

	Mean	Std.Dev.	Min	Max	Obs.
Dependent Variables (η^*)					
(1) Reinsurance Recoverable	0.05	0.22	-0.64	2.34	286
(2) Reinsurance Credit	0.02	0.24	-1.37	1.36	286
(3) Total Reinsurance (1)+(2)	0.03	0.21	-0.54	1.48	286
(4) Total Other Capital	-0.01	0.26	-1.22	2.95	286
(5) Total Capital (3)+(4)	0.02	0.30	-1.31	2.63	286
Control Variables					
(6) Actuary	0.80	0.16	0.15	0.99	281
(7) Auditor	0.97	0.05	0.56	0.99	286
(8) Mutual	0.23	0.35	0.00	1.00	286
(9) Bank Affliated	0.39	0.49	0.00	1.00	286
(10) CEO/President Herfindahl	7817.78	2548.03	1573.93	10000.00	286
(11) CEO/President Dualilty	0.17	0.38	0.00	1.00	286
(12) Access to Capital Market	0.44	0.50	0.00	1.00	286
(13) Log of Group Asset	7.14	0.84	5.08	9.43	286
(14) Vol. of Net Income/Asset: Life/Health	0.02	0.15	0.00	2.48	286
(15) Vol. of Net Income/Asset: Property/Casualty	0.04	0.06	0.00	0.42	286
(16) Property/Casualty	0.78	0.32	0.00	1.00	286
(17) Investment in Affiliates	0.05	0.05	0.00	0.38	286
(18) Reinsurance with Affliates	0.65	0.31	0.00	1.00	286

Summary Statistics: Control & Treated; Pre- & Post-SOX

Table 2: Summary Statistics of Insurance Holding Company Characteristics

	Pre-SOX					Post-SOX					Difference
	Control	Obs	Treated	Obs	Control - Treated (1)	Control	Obs	Treated	Obs	Control - Treated (2)	(2) - (1)
Dependent Variables (η^*)											
(1) Reinsurance Recoverable	0.01	77	0.08	66	-0.06	0.06	77	0.06	66	0.00***	0.06
(2) Reinsurance Credit	-0.01	77	0.05	66	-0.06	0.01	77	0.01	66	0.00*	0.06
(3) Total Reinsurance (1)+(2)	0.05	77	0.04	66	0.01	0.01	77	0.01	66	0.00**	-0.01
(4) Total Other Capital	0.02	77	-0.04	66	0.06	-0.01	77	-0.01	66	0.00	0.06
(5) Total Capital	0.07	77	0.02	66	0.05	-0.00	77	-0.00	66	0.00***	0.06
Control Variables											
(6) Actuary	0.77	75	0.81	65	-0.04	0.79	76	0.82	65	-0.03	
(7) Auditor	0.97	77	0.98	66	-0.01	0.97	77	0.98	66	-0.02	
(8) Mutual	0.37	77	0.06	66	0.31***	0.39	77	0.07	66	0.32***	
(9) Bank Affliated	0.19	77	0.53	66	-0.34***	0.25	77	0.65	66	-0.40***	
(10) CEO/President Herfindahl	8909.86	77	6563.37	66	2346.49***	8883.98	77	6554.20	66	2329.77***	
(11) CEO/President Dualilty	0.09	77	0.23	66	-0.14*	0.16	77	0.24	66	-0.09	
(12) Access to Capital Market	0.00	77	1.00	66	-1.00	0.09	77	0.79	66	-0.70***	
(13) Log of Group Asset	6.64	77	7.48	66	-0.83***	6.89	77	7.69	66	-0.80***	
(14) Vol. of Net Income/Asset: Life/Health	0.01	77	0.01	66	-0.00	0.00	77	0.04	66	-0.04	
(15) Vol. of Net Income/Asset: Property/Casualty	0.05	77	0.06	66	-0.01	0.02	77	0.02	66	-0.00	
(16) Property/Casualty	0.84	77	0.70	66	0.15**	0.85	77	0.71	66	0.14*	
(17) Investment in Affiliates	0.05	77	0.05	66	0.00	0.05	77	0.04	66	0.01	
(18) Reinsurance with Affliates	0.60	77	0.61	66	-0.01	0.69	77	0.69	66	-0.00	

SOX → Internal Capital Transaction Sensitivities

Table 4: SOX & Intragroup Transactions Growth Sensitivity

	Rein. Recoverable			Rein. Credit			Total Reinsurance			Other Capital			Total Capital		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Post	0.060		0.432	0.051**		-0.046	0.046**		-0.082	0.033		-0.443	-0.012		-0.443**
	(0.111)		(0.605)	(0.020)		(0.213)	(0.023)		(0.219)	(0.054)		(0.711)	(0.036)		(0.216)
Treated	0.131		0.322	0.051		0.758	0.062		1.026	-0.302		-1.626	-0.173		-1.202
	(0.129)		(1.468)	(0.053)		(1.652)	(0.050)		(1.812)	(0.244)		(1.511)	(0.153)		(2.174)
Post x Treated	-0.113		-0.029	-0.068***		0.092	-0.058**		0.094	-0.071		1.923	-0.045		1.801
	(0.147)		(2.128)	(0.024)		(0.311)	(0.026)		(0.337)	(0.066)		(1.332)	(0.037)		(1.132)
Actuary		-0.355**	-0.415**		-0.298***	-0.117*		-0.237**	-0.083		0.973**	0.324*		0.847***	0.340***
		(0.176)	(0.178)		(0.103)	(0.070)		(0.106)	(0.071)		(0.489)	(0.173)		(0.314)	(0.127)
Post x Actuary			-0.359			0.114			0.099			-0.054			-0.314*
			(0.714)			(0.115)			(0.118)			(0.328)			(0.185)
Treated x Actuary			0.118			-0.434***			-0.370**			1.637**			1.455***
			(0.131)			(0.134)			(0.160)			(0.818)			(0.395)
Post x Treated x Actuary			-0.023			-0.040			0.078			-0.238			-0.271
			(0.781)			(0.187)			(0.198)			(0.992)			(0.448)
Auditor		0.721***	0.840***		0.399**	0.264**		0.387**	0.277**		-1.514**	-1.060**		-1.520***	-0.866***
		(0.236)	(0.262)		(0.175)	(0.115)		(0.183)	(0.138)		(0.706)	(0.477)		(0.507)	(0.290)
Post x Auditor			-0.043			-0.007			0.041			0.501			0.724**
			(0.992)			(0.251)			(0.246)			(0.826)			(0.285)
Treated x Auditor			-0.203			-0.354			-0.671			0.178			-0.068
			(1.502)			(1.678)			(1.848)			(1.255)			(2.108)
Post x Treated x Auditor			-0.080			-0.109			-0.208			-1.939			-1.696
			(2.370)			(0.340)			(0.343)			(1.420)			(1.228)
Constant	0.367	0.131	-0.115	0.232	0.159	-0.134	-0.053	-0.011	-0.287	0.100	0.833	1.563	0.210	0.513	1.115***
	(0.478)	(0.580)	(0.607)	(0.208)	(0.139)	(0.190)	(0.251)	(0.154)	(0.224)	(0.850)	(0.799)	(1.093)	(0.473)	(0.423)	(0.411)
R^2	0.051	0.182	0.192	0.268	0.393	0.503	0.175	0.293	0.385	0.329	0.512	0.592	0.409	0.634	0.766
Observations	286	281	281	286	281	281	286	281	281	286	281	281	286	281	281

SOX → Internal Capital Transaction Sensitivities: Large Asset

Table 5: SOX & Intragroup Transactions: Groups with Large Asset

	Rein. Recoverable			Rein. Credit			Total Reinsurance			Other Capital			Total Capital		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Post	0.157*		1.010	0.018		-0.283	-0.009		-5.029*	-0.088		-5.769*	0.008		-0.095
	(0.089)		(1.331)	(0.037)		(0.481)	(0.037)		(2.694)	(0.097)		(3.311)	(0.043)		(0.468)
Treated	0.094		1.837	0.042		-0.210	0.032		1.990	0.049		4.388**	0.067		2.388*
	(0.095)		(2.704)	(0.049)		(1.112)	(0.047)		(2.299)	(0.040)		(1.777)	(0.041)		(1.243)
Post x Treated	-0.300**		3.102	-0.044		-1.802	-0.015		0.342	0.089		0.267	-0.035		-3.473
	(0.128)		(10.604)	(0.041)		(1.983)	(0.041)		(0.520)	(0.101)		(1.129)	(0.048)		(2.347)
Actuary		-0.059	-0.184**		-0.061	0.030		-0.045	0.010		-0.117	-0.151		-0.113	-0.111
		(0.075)	(0.078)		(0.082)	(0.120)		(0.078)	(0.134)		(0.119)	(0.211)		(0.099)	(0.151)
Post x Actuary			-0.969			0.349			0.275			0.317			0.114
			(1.444)			(0.523)			(0.559)			(1.224)			(0.506)
Treated x Actuary			0.190**			-0.156			-0.013			0.103			0.050
			(0.081)			(0.185)			(0.188)			(0.225)			(0.213)
Post x Treated x Actuary			1.058			-0.428			-0.406			-0.180			-0.078
			(1.461)			(0.533)			(0.564)			(1.179)			(0.522)
Auditor		0.217	0.388		0.004	-0.083		-0.090	-0.178		0.206	0.168		0.123	0.061
		(0.352)	(0.390)		(0.165)	(0.189)		(0.144)	(0.196)		(0.261)	(0.225)		(0.206)	(0.245)
Post x Auditor			-0.394			0.202			4.821*			5.450*			0.059
			(0.533)			(0.824)			(2.663)			(3.033)			(0.098)
Treated x Auditor			-1.904			0.398			-1.960			-4.502**			-2.391*
			(2.623)			(1.151)			(2.343)			(1.786)			(1.232)
Post x Treated x Auditor			-4.378			2.156			-0.679			0.712			3.557
			(10.781)			(2.018)			(1.492)			(0.901)			(2.351)
Constant	1.090***	0.754***	1.005**	0.406**	0.285**	0.412	0.469***	0.301***	0.577**	0.416*	0.222***	0.387	0.066	-0.090	0.013
	(0.403)	(0.121)	(0.482)	(0.177)	(0.116)	(0.274)	(0.175)	(0.095)	(0.269)	(0.243)	(0.067)	(0.455)	(0.171)	(0.065)	(0.274)
R^2	0.176	0.146	0.232	0.368	0.355	0.399	0.315	0.317	0.366	0.313	0.292	0.351	0.623	0.616	0.635
Observations	142	142	142	142	142	142	142	142	142	142	142	142	142	142	142

SOX → Internal Capital Transaction Sensitivities: Small Asset

Table 6: SOX & Intragroup Transactions: Groups with Small Asset

	Rein. Recoverable			Rein. Credit			Total Reinsurance			Other Capital			Total Capital		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Post	-0.166		-2.723	0.030		-0.311	0.034		-0.547*	0.078*		-0.534	0.037*		-0.143
	(0.229)		(2.276)	(0.019)		(0.279)	(0.020)		(0.293)	(0.043)		(0.504)	(0.021)		(0.217)
Treated	0.493		-7.327	0.129**		3.116**	0.138***		2.610*	-1.203***		2.547	-0.623***		3.421*
	(0.469)		(6.272)	(0.052)		(1.492)	(0.051)		(1.488)	(0.169)		(2.073)	(0.085)		(1.732)
Post x Treated	0.463		-7.543	-0.087*		0.616	-0.096**		0.565	0.321*		0.452	0.225***		-0.459
	(0.309)		(8.271)	(0.044)		(0.494)	(0.046)		(0.379)	(0.189)		(1.312)	(0.083)		(0.976)
Actuary		-0.896**	-0.643*		-0.065	0.043		-0.039	0.087		1.174***	0.483***		0.756***	0.329***
		(0.396)	(0.344)		(0.103)	(0.131)		(0.095)	(0.115)		(0.235)	(0.162)		(0.131)	(0.125)
Post x Actuary			0.093			-0.037			0.199			-0.049			-0.184
			(0.970)			(0.152)			(0.172)			(0.260)			(0.144)
Treated x Actuary			-0.665			-0.600			-0.584			2.556**			0.978**
			(1.125)			(0.650)			(0.352)			(1.072)			(0.446)
Post x Treated x Actuary			-0.703			0.022			-0.038			-2.313*			-1.145**
			(1.528)			(0.488)			(0.332)			(1.369)			(0.566)
Auditor		-0.364	-0.509		-0.023	-0.094		0.173	0.210		-0.401	-0.477		0.198	0.007
		(0.475)	(0.503)		(0.118)	(0.138)		(0.251)	(0.274)		(0.480)	(0.416)		(0.367)	(0.229)
Post x Auditor			2.911			0.378			0.441			0.647			0.317
			(2.299)			(0.315)			(0.319)			(0.591)			(0.284)
Treated x Auditor			8.291			-2.593*			-2.051			-5.208**			-4.621**
			(7.461)			(1.371)			(1.566)			(2.284)			(1.956)
Post x Treated x Auditor			7.959			-0.660*			-0.618*			1.472			1.498
			(7.373)			(0.345)			(0.339)			(1.684)			(1.207)
Constant	-0.095	-0.983	-1.214	-0.015	0.097	-0.147	-0.008	0.115	-0.034	0.689	1.037**	-0.088	0.935***	0.928***	0.662**
	(1.113)	(1.145)	(1.314)	(0.157)	(0.152)	(0.236)	(0.194)	(0.185)	(0.290)	(0.465)	(0.512)	(0.401)	(0.233)	(0.270)	(0.265)
R^2	0.320	0.628	0.684	0.777	0.751	0.805	0.674	0.669	0.745	0.931	0.922	0.965	0.952	0.939	0.972
Observations	144	139	139	144	139	139	144	139	139	144	139	139	144	139	139

SOX → Internal Capital Transaction Sensitivities: Large Reinsurance Transaction

Table 7: SOX & Intragroup Transactions: Groups with Highly-Interconnected Affiliated Reinsurance

	Rein. Recoverable			Rein. Credit			Total Reinsurance			Other Capital			Total Capital		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Post	-0.043		-0.157	0.005		-0.401	-0.007		-0.576	0.022		2.149*	-0.006		-0.148
	(0.145)		(2.562)	(0.025)		(0.690)	(0.029)		(0.731)	(0.064)		(1.124)	(0.021)		(0.301)
Treated	0.132		-0.525	-0.009		1.620	0.025		2.527**	0.019		0.038	0.081		3.896***
	(0.164)		(1.944)	(0.079)		(1.295)	(0.069)		(0.997)	(0.044)		(0.696)	(0.052)		(0.866)
Post x Treated	-0.037		-9.484	-0.023		-0.008	-0.004		7.178	-0.060		5.968	-0.040		-4.778
	(0.223)		(8.114)	(0.037)		(8.952)	(0.041)		(10.189)	(0.081)		(12.478)	(0.039)		(7.512)
Actuary		-1.359**	-1.921**		-0.202*	-0.288**		-0.211	-0.317*		0.028	-0.057		-0.108	-0.112
		(0.595)	(0.782)		(0.116)	(0.113)		(0.158)	(0.168)		(0.130)	(0.123)		(0.076)	(0.073)
Post x Actuary			0.652			0.293			0.414*			0.512			0.239
			(1.428)			(0.184)			(0.228)			(0.389)			(0.168)
Treated x Actuary			0.993			0.297			0.503			0.840*			-0.265
			(0.681)			(0.418)			(0.374)			(0.473)			(0.195)
Post x Treated x Actuary			-2.378			-0.312			-0.407			-0.665			-0.015
			(1.966)			(0.344)			(0.342)			(0.544)			(0.235)
Auditor		0.543	1.473		-0.239	-0.183		0.205	0.390		-0.336	-0.303		-0.386**	-0.531**
		(0.664)	(1.000)		(0.237)	(0.288)		(0.388)	(0.405)		(0.580)	(0.493)		(0.168)	(0.217)
Post x Auditor			-0.218			0.164			0.247			-2.686**			-0.093
			(3.006)			(0.722)			(0.772)			(1.311)			(0.352)
Treated x Auditor			-0.560			-1.908			-2.995***			-0.787			-3.690***
			(2.328)			(1.249)			(0.992)			(0.694)			(0.844)
Post x Treated x Auditor			9.743			0.254			-6.927			-5.469			4.862
			(9.217)			(9.072)			(10.260)			(12.561)			(7.637)
Constant	0.356	-1.842	-1.183	0.476**	0.386**	0.592*	0.371*	0.220	0.405	0.214	0.079	0.808*	0.395**	0.124	0.198
	(1.161)	(1.489)	(1.263)	(0.202)	(0.150)	(0.328)	(0.211)	(0.169)	(0.276)	(0.239)	(0.113)	(0.444)	(0.157)	(0.094)	(0.166)
R^2	0.129	0.565	0.649	0.294	0.277	0.346	0.185	0.232	0.331	0.188	0.219	0.365	0.238	0.299	0.437
Observations	124	123	123	124	123	123	124	123	123	124	123	123	124	123	123

SOX → Internal Capital Transaction Sensitivities: Small Reinsurance Transaction

Table 8: SOX & Intragroup Transactions: Groups with Low-Interconnected Affiliated Reinsurance

	Rein. Recoverable			Rein. Credit			Total Reinsurance			Other Capital			Total Capital		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Post	0.134		-0.846	0.071***		-0.129	0.077***		-0.107	0.246**		-1.676	-0.030		-0.626**
	(0.114)		(0.669)	(0.024)		(0.152)	(0.025)		(0.148)	(0.099)		(1.061)	(0.052)		(0.292)
Treated	0.408**		3.655	0.097		-3.377**	0.125**		-3.321**	-0.459*		5.073	-0.298*		-3.468
	(0.186)		(8.189)	(0.061)		(1.588)	(0.060)		(1.555)	(0.263)		(11.414)	(0.163)		(7.039)
Post x Treated	-0.119		4.349	-0.086***		-0.194	-0.102***		-0.222	-0.198		-1.129	-0.032		2.669
	(0.202)		(9.638)	(0.031)		(0.270)	(0.032)		(0.267)	(0.121)		(5.579)	(0.065)		(3.511)
Actuary		-0.057	0.134		-0.346***	0.097		-0.296**	0.139		1.155***	0.830***		1.107***	0.497***
		(0.093)	(0.164)		(0.132)	(0.119)		(0.126)	(0.097)		(0.372)	(0.299)		(0.243)	(0.157)
Post x Actuary			-0.552			0.005			0.048			-1.374			-0.897***
			(1.019)			(0.142)			(0.139)			(0.854)			(0.224)
Treated x Actuary			-0.241			-0.799***			-0.782***			0.672			0.977***
			(0.201)			(0.187)			(0.168)			(0.811)			(0.257)
Post x Treated x Actuary			0.847			-0.128			-0.198			1.962			0.674
			(1.180)			(0.235)			(0.216)			(1.398)			(0.508)
Auditor		0.749***	0.597		0.576**	0.131		0.559**	0.092		-3.444***	-3.390***		-2.350***	-1.863***
		(0.270)	(0.361)		(0.232)	(0.166)		(0.238)	(0.162)		(1.233)	(1.157)		(0.594)	(0.367)
Post x Auditor			1.476			0.176			0.125			2.891**			1.381***
			(1.196)			(0.226)			(0.215)			(1.352)			(0.397)
Treated x Auditor			-3.096			4.149**			4.096**			-5.857			2.568
			(8.233)			(1.651)			(1.614)			(11.348)			(7.077)
Post x Treated x Auditor			-5.290			0.253			0.317			-0.658			-3.347
			(10.129)			(0.333)			(0.323)			(5.326)			(3.558)
Constant	0.215	0.491*	-0.142	0.106	-0.059	0.107	-0.098	-0.190	0.170	-0.915	0.477	0.376	-0.269	0.550	0.739*
	(0.521)	(0.262)	(0.983)	(0.304)	(0.248)	(0.215)	(0.298)	(0.229)	(0.217)	(0.747)	(0.812)	(0.857)	(0.417)	(0.456)	(0.409)
R^2	0.378	0.444	0.497	0.434	0.540	0.704	0.438	0.508	0.693	0.631	0.780	0.805	0.731	0.872	0.927
Observations	162	158	158	162	158	158	162	158	158	162	158	158	162	158	158

Is There A Substitution between Reinsurance & 'Other' Internal Capital?

- Two stage regression; Wurgler (2000), Morck et al. (2011):
- Stage 1: For each insurance group g and internal capital channel c, measure the sensitivity of premiums growth and internal capital growth pre- and post-SOX η^*_{gcs}:

$$log\left(\frac{S_{it-1}+C_{igct}}{S_{it-1}+C_{igc^*t}}\right)=\alpha_{gc}+\eta_{1,gc}log\left(\frac{P_{it}}{P_{it-1}}\right)+\eta_{2,gc}D_{post}log\left(\frac{P_{it}}{P_{it-1}}\right)+\epsilon_{igct} \quad (5)$$

- Stage 2: Use the DID approach to find the effect of SOX on the sentivity measure obtained from the first stage:

$$\begin{aligned}\hat{\eta}^*_{gcs} =&\beta_0+\beta_1 Post_s+\beta_2 Treated_g+\beta_3(Post_s x Treated_g)+\Sigma_k\beta_k X_{gs}+\gamma_g\\ &\beta_4 Actuary_{gs}+\beta_5(Actuary_{gs}xPost_s)+\beta_6(Actuary_{gs}xTreated_g)+\\ &\beta_7(Actuary_{gs}xPost_sxTreated_g)+\\ &\beta_8 Auditor_{gs}+\beta_9(Auditor_{gs}xPost_s)+\beta_{10}(Auditor_{gs}xTreated_g)+\\ &\beta_{11}(Auditor_{gs}xPost_sxTreated_g)+\epsilon_{gcs}\\ &\forall c\in\{\text{Rein.Recov, Rein.Credit, Total Rein., Total Other Capital, Total Capital}\}\end{aligned} \quad (6)$$

Is There A Substitution between Reinsurance & 'Other' Internal Capital?

Table 9: SOX & Intragroup Transactions: Testing the Substitution Effect Hypothesis

	Rein. Recoverable			Rein. Credit			Total Reinsurance		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post	-0.080***		-0.293	0.396		1.774	0.098***		0.506
	(0.021)		(0.229)	(0.254)		(1.284)	(0.034)		(0.661)
Treated	-0.015		0.814	1.281		-32.446	0.102		-3.016
	(0.040)		(1.439)	(0.982)		(53.080)	(0.083)		(6.566)
Post x Treated	0.043		-0.335	-0.436		20.762	-0.082*		1.325
	(0.034)		(1.127)	(0.323)		(40.634)	(0.044)		(5.132)
Actuary		-0.015	-0.004		-4.694	-1.849*		-0.259	-0.186
		(0.049)	(0.052)		(3.040)	(1.072)		(0.246)	(0.222)
Post x Actuary			-0.023			2.601*			0.339
			(0.140)			(1.427)			(0.244)
Treated x Actuary			0.045			-6.976*			-0.143
			(0.127)			(4.096)			(0.494)
Post x Treated x Actuary			-0.067			4.466			0.185
			(0.240)			(2.951)			(0.352)
Auditor		0.259*	0.196		4.595	2.516		-0.066	0.021
		(0.140)	(0.157)		(3.419)	(2.057)		(0.352)	(0.346)
Post x Auditor			0.241			-3.777*			-0.712
			(0.278)			(1.998)			(0.759)
Treated x Auditor			-0.857			39.540			3.256
			(1.462)			(54.735)			(6.703)
Post x Treated x Auditor			0.433			-24.823			-1.551
			(1.145)			(41.832)			(5.228)
Constant	0.499***	0.112	0.517***	-1.450	-3.700	-4.701	-0.481**	-0.329	-0.603**
	(0.125)	(0.109)	(0.155)	(1.805)	(3.071)	(2.992)	(0.219)	(0.288)	(0.305)
R^2	0.304	0.237	0.310	0.304	0.391	0.530	0.305	0.293	0.369
Observations	286	281	281	286	281	281	286	281	281

SOX → Internal Capital Transaction Sensitivities: Under-reserving Insurers

Table 14: SOX & Intragroup Transactions: Under- vs Over-Reserving P&C Insurers

	Rein. Recoverable		Rein. Credit		Total Reinsurance		Other Capital		Total Capital	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post	0.127**	-0.953	0.027	0.985	0.071***	1.426*	0.058	0.274	0.039	0.933
	(0.060)	(0.665)	(0.034)	(1.020)	(0.027)	(0.728)	(0.048)	(0.500)	(0.030)	(0.726)
Treated	-0.038	21.203**	-0.020	-15.413	-0.022	-9.854	0.000	44.615*	0.077	-6.132
	(0.093)	(9.505)	(0.051)	(23.462)	(0.042)	(26.307)	(0.057)	(25.132)	(0.048)	(25.202)
Post x Treated	-0.168	3.080***	-0.034	-0.724	-0.098**	-0.158	-0.094	2.880*	-0.125**	-0.419
	(0.110)	(0.761)	(0.048)	(1.355)	(0.039)	(1.541)	(0.066)	(1.613)	(0.052)	(1.705)
Post x Treated x UNDER	0.006	-30.575	-0.027	17.834**	0.022	16.083**	0.027	-23.812	0.026	28.557***
	(0.160)	(33.437)	(0.059)	(7.184)	(0.057)	(7.416)	(0.090)	(75.215)	(0.072)	(6.801)
Post x Treated x Actuary		1.280*		-0.938		-1.289		2.609		-0.567
		(0.673)		(1.328)		(1.468)		(1.626)		(1.661)
Post x Treated x Actuary x UNDER		4.257***		-0.465		1.374		5.394***		1.227
		(1.218)		(1.555)		(1.750)		(1.794)		(1.831)
Post x Treated x Auditor		-22.688		16.404		11.095		-47.451*		6.783
		(20.154)		(24.937)		(27.932)		(26.877)		(26.890)
Post x Treated x Auditor x UNDER		-6.478		1.394		5.566**		4.156**		2.739
		(4.176)		(2.105)		(2.768)		(1.734)		(3.012)
Constant	-0.270	-0.189	0.285	0.188	0.177	0.672***	-0.498**	0.326	0.058	0.415*
	(0.221)	(0.323)	(0.189)	(0.267)	(0.167)	(0.222)	(0.237)	(0.282)	(0.166)	(0.243)
R^2	0.396	0.594	0.226	0.382	0.345	0.529	0.311	0.573	0.239	0.454
Observations	130	126	130	126	130	126	130	126	130	126

Paper Conclusion

- SOX *decreased* the sensitivity of internal capital transaction growth to premiums growths among smaller insurers.
- Cross-sectional analysis suggest that quality actuary and auditor reduced such sensitivies.
- Among under-reserving insurers, SOX *increased* the sensitivity of internal capital transaction growth to premiums growths.

Thank you for your attention