

제 3회 KIRI 산학세미나  
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## 최고경영자의 내부부채가 위험추구 행위에 미치는 영향: 미국손해보험회사에 대한 실증분석

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### 미국 보험시장

#### ●보험료 규모

Total direct premiums written for Life and P&C sectors	\$1.41 trillion
- NPW for 709 Life insurers	\$604 billion (31%)
- NPW for 2,602 P&C insurers	\$615 billion (32%)
- NPW for 1,179 health insurers	\$708 billion (37%)

Source: Federal Insurance office (2018)

- 약 2.3 백만 인구가 보험업에 종사
- 보험회사가 기업체, 국가, 주/지역 정부 채권을 가장 많이 보유

## 손해보험회사별 원수보험료 규모

2017 Rank	2018 Rank	Insurance Group	2017 Direct Premiums Written (\$000)	Share of Total (%)	2018 Direct Premiums Written (\$000)	Share of Total (%)
1	1	State Farm Mutual Automobile Insurance Co.	\$ 64,892,583	10.10	\$ 65,849,676	9.77
2	2	Berkshire Hathaway Inc.	38,818,874	6.04	43,869,809	6.51
3	3	Liberty Mutual Holding Co. Inc.	33,831,726	5.27	34,605,081	5.14
5	4	Progressive Corp.	27,862,882	4.34	33,754,923	5.01
4	5	The Allstate Corp.	31,501,664	4.90	33,251,176	4.94
6	6	Travelers Companies, Inc.	24,875,076	3.87	26,244,172	3.90
7	7	Chubb Ltd.	21,266,737	3.31	22,008,957	3.27
8	8	United Services Automobile Association	20,151,368	3.14	21,984,970	3.26
9	9	Farmers Insurance Group of Companies	19,854,803	3.09	20,309,974	3.01
10	10	Nationwide Mutual Group	19,218,907	2.99	18,416,861	2.73
<b>Combined Top 10</b>			\$ 302,274,620	47.05	\$ 320,295,599	47.54
<b>Combined Top 25</b>			\$ 420,929,749	65.51	\$ 442,815,693	65.74
<b>Combined Top 100</b>			\$ 557,160,009	86.72	\$ 587,521,626	87.23
<b>Total U.S. P&amp;C Sector</b>			\$ 642,509,475		\$ 673,781,349	

Source: Annual Report of Federal Insurance Office (includes all lines of business)

## 미국 손해보험회사 사업비 및 손해율

	2014	2015	2016	2017	2018
Loss Ratio	57.21%	57.48%	60.68%	64.15%	60.72%
Loss Adjustment Expense Ratio	11.82%	11.83%	11.61%	11.76%	10.71%
<b>Loss and Loss Adjustment Expense Ratio</b>	<b>69.04%</b>	<b>69.31%</b>	<b>72.29%</b>	<b>75.91%</b>	<b>71.44%</b>
Net Commission Ratio	10.38%	10.55%	10.41%	10.29%	11.25%
Salaries & Benefits Ratio	8.14%	8.24%	8.32%	7.91%	7.38%
Tax, License & Fees Ratio	2.51%	2.55%	2.51%	2.47%	2.40%
Administrative & Other Expense Ratio	6.55%	6.72%	6.68%	6.67%	6.25%
<b>Expense Ratio</b>	<b>27.58%</b>	<b>28.05%</b>	<b>27.92%</b>	<b>27.34%</b>	<b>27.27%</b>
Policyholder Dividend Ratio	0.60%	0.59%	0.56%	0.61%	0.55%
<b>Combined Ratio</b>	<b>97.21%</b>	<b>97.95%</b>	<b>100.76%</b>	<b>103.85%</b>	<b>99.26%</b>

Source: Annual Report of Federal Insurance Office

## 미국 손해보험회사 손익계산서

	2014	2015	2016	2017	2018
Net Premiums Earned	\$493,730,916	\$512,110,041	\$529,183,745	\$546,332,732	\$596,453,729
Losses and Loss Adjustment Expense					
Incurred	340,855,210	354,958,963	382,522,916	414,726,222	426,079,081
Other Underwriting Expense Incurred	139,137,758	145,136,437	148,009,926	151,073,309	166,661,523
Other Underwriting Deductions	<u>(475,218)</u>	<u>857,268</u>	<u>1,073,235</u>	<u>1,572,203</u>	<u>1,020,794</u>
<b>Net Underwriting Gain (Loss)</b>	<b>14,213,165</b>	<b>11,157,373</b>	<b>(2,422,331)</b>	<b>(20,799,063)</b>	<b>2,692,631</b>
Policyholder Dividends	2,943,412	3,016,579	2,943,624	3,308,785	3,272,394
Net Investment Income	54,904,547	48,765,011	47,461,805	49,707,155	56,646,731
Net Realized Capital Gains (Losses)	11,789,595	10,073,274	8,484,994	19,639,559	10,696,720
Finance Service Charges	3,271,709	3,333,008	3,452,738	3,648,039	3,735,628
All Other Income	<u>(6,158,765)</u>	<u>(1,808,648)</u>	<u>(2,410,912)</u>	<u>(9,026,283)</u>	<u>(2,376,962)</u>
<b>Net Income After Capital Gain (Loss) Before Tax</b>	<b>75,076,697</b>	<b>68,503,439</b>	<b>51,622,428</b>	<b>39,860,623</b>	<b>68,122,353</b>
Federal Income Tax	10,318,207	10,188,539	7,314,767	(784,844)	6,998,027
<b>Net Income</b>	<b>\$64,757,509</b>	<b>\$58,314,974</b>	<b>\$44,307,882</b>	<b>\$40,645,466</b>	<b>\$61,124,326</b>

Source: Annual Report of Federal Insurance Office (\$'000)

## 내부부채(What is inside debt?)

- 확정급여형연금제도(defined benefit pension plan)나 급여와 보너스의 수령을 연기하는 이연보상(deferred compensation)의 형태
- 기업이 기업내부자(executives)에게 퇴직시 또는 퇴직이후에 정해진 금액을 지불해야하는 의무
- Typically unfunded, unsecured, and not guaranteed by the Pension Benefit Guaranty Corporation (PBGC)
- The value of CEO inside debt holdings is sensitive to the default risk similar to that of external creditors
- Thus, executives with inside debt holdings behave like the firm's bondholders

## 이론적 배경 (Theoretical Predictions)

- Agency theory suggests that executive compensation structure can be designed to diminish agency costs
- Granting equity-based compensation to the CEO incentivizes more risk-taking
- Inside debt contracts closely align managerial interests with those of debt holders and induce CEOs to manage their firms more conservatively (Jensen and Meckling 1976; Edmans and Liu 2011)
- If CEO's inside debt-to-equity ratio exceeds firm's debt-to-equity ratio, CEOs make decisions that decrease the overall risk of the firm

## Empirical Literature

- The relationship between CEO inside debt holdings and managerial risk-taking behavior/financial policies
  - Firm default risk (Sundaram and Yermack, 2007)
  - Stock and bond market reactions (Wei and Yermack, 2011)
  - Stock return volatility, R&D expenditure and financial leverage (Cassell et al., 2012)
  - Degree of diversification and asset liquidity (Cassell et al., 2012)
  - Firm cash holdings (Liu et al., 2014)
- Recent banking studies (Bennett et al., 2015; Van Bakkum, 2016)
  - Banks have a lower default risk during a crisis period when their CEOs hold more inside debt before the crisis.

## 주요 가설 (Main Hypothesis)

- Insurers are more likely to exhibit lower levels of risk-taking behavior when their CEOs are compensated with more pensions and deferred compensation

## 위험 측정 (Risk Measures)

- Value at Risk: Maximum expected loss that could occur on a portfolio of assets over a given time period at a specified confidence level

$$VaR_{\alpha}(R) = \inf\{r : F(r) \geq \alpha\}$$

- Expected Shortfall: Conditional expected loss given that the loss is beyond the VaR level

$$ES_{\alpha}(R) = \frac{1}{\alpha} \int_0^{\alpha} VaR_u(R) du.$$

## 상대적 부채 (Relative Debt)

### ●Relative debt

$$= \frac{CEO \text{ Inside Debt} / CEO \text{ Equity}}{Firm \text{ Debt} / Firm \text{ Equity}}$$

CEO inside debt	PV of accumulated pension benefits and the balance of deferred compensation
CEO equity	Values of stocks and option holdings
Firm debt	Long-term debt and debt in current liabilities
Firm equity	The number of shares outstanding x Share price

## Other Control Variables

CEO delta	Sensitivity of the CEO's stock and option portfolios to 1% change in stock price
CEO vega	Sensitivity of the CEO's stock and option portfolios to 1% change in the standard deviation of the firms return
Total compensation	Sum of salary, bonus, equity awards, option awards, non-equity incentive compensation
Firm size	Natural logarithm of market capitalization of equity
Product HHI	Herfindahl index of DPW across product lines
Geographic HHI	Herfindahl Index of DPW across 50 states
Premium growth	Percentage change in DPW
ROA	Net income after tax divided by net admitted assets
Long tail	Proportion of NPW in long-tailed lines of insurance
Reinsurance	Reinsurance ceded to nonaffiliates
Restatement	1 if the firm experiences restatements
Board size	The number of board of directors
Independent director	The ratio of independent director to the board size

## Data

- Sample period: 2007 - 2013
- Annual CEO compensation information
  - Execucomp
- Daily stock returns of the U.S. publicly traded property-liability insurers
  - Center for Research in Security Price (CRSP)
- Firm leverage ratio
  - Compustat
- Insurer's accounting restatement
  - AuditAnalytics
- Annual financial statement data for insurers
  - National Association of Insurance Commissioners (NAIC) and SNL

## CEO inside debt and debt-to-equity ratio

### CEO's inside debt holdings

	Mean	Median	Industry
Our Sample	\$9.14 mil.	\$3.24 mil.	Insurance
Van Bekkum (2015)	\$4.28 mil.	\$0.94 mil.	Banking
Cassell et al. (2012)	\$7.05 mil.	\$2.87 mil.	S&P 1500 firms

### CEO's debt-to-equity ratio

			Industry
Our Sample	0.34	0.12	Insurance
Van Bekkum (2015)	0.25	0.12	Banking
Cassell et al. (2012)	0.40	0.15	S&P 1500 firms

## Descriptive statistics

	Mean	St Dev.	Min	25th Quartile	Median	75th Quartile	Max
Panel A: CEO Compensation							
Pension and deferred balance (\$000s)	9,139.81	16,824	0	331.02	3,244.80	7,752.33	112,756
CEO delta (\$000s)	712.15	1,639	5.25	71.01	201.09	580.14	10,250
CEO vega (\$000s)	116.51	220.37	0	2.84	28.4	102.6	1,171.02
CEO total compensation (\$000s)	6,646.36	5,993	613.55	2,068.92	4,264.76	9,650.54	28,340
Inside debt	0.341	0.481	0	0.025	0.118	0.503	2.421
Relative debt	1.7	3.128	0	0.038	0.474	1.884	23.13
Panel B: Risk Measures							
VAR(99.5)	0.074	0.058	0.019	0.035	0.058	0.088	0.326
VAR(99)	0.066	0.051	0.017	0.032	0.05	0.08	0.277
VAR(95)	0.038	0.028	0.009	0.02	0.029	0.045	0.182
ES(99.5)	0.087	0.071	0.02	0.042	0.063	0.102	0.432
ES(99)	0.08	0.063	0.019	0.039	0.06	0.092	0.38
ES(95)	0.054	0.041	0.016	0.028	0.041	0.063	0.231
Panel C: Firm Characteristics							
Firm size	7.888	1.344	4.966	6.741	7.787	8.882	10.468
Product HHI	0.476	0.345	0.135	0.181	0.274	0.869	1
Geographic HHI	0.165	0.222	0.035	0.045	0.065	0.014	0.979
Premium growth	0.04	0.203	-0.738	-0.047	0.016	0.081	1.282
Investment	0.178	0.102	0.027	0.096	0.165	0.239	0.503
ROA	0.025	0.045	-0.265	0.012	0.027	0.049	0.178
Long tail	0.507	0.286	0	0.417	0.517	0.652	1
Reinsurance	0.146	0.139	0	0.051	0.109	0.219	0.792
Firm leverage	0.696	2.225	0	0.127	0.216	0.352	18.904
5-year average size	15.209	1.855	2.1	14.34	15.303	16.18	18.279
Firm age	57.73	34.66	9	32	50	79	161
Panel D: CEO/Governance Characteristics							
CEO tenure	8.618	8.496	0	4	7	10	46
Board size	10.38	1.72	6	9	11	12	15
Independent director	8.4	2.02	3	7	9	10	13

## Results for primary specification: 2SLS

### • First stage regression

	Log relative debt
5-year average firm size	-0.475*** (0.000)
Log of firm age	0.265** (0.032)
LM Underidentification test	12.94***
J-test (p-value)	0.73
Observations	177

### • Second state regression

	VAR(99.5)	ES(99.5)	VAR(99)	ES(99)	VAR(95)	ES(95)
E(Log relative debt <sub>t-1</sub> )	-0.043*** (0.001)	-0.048*** (0.001)	-0.034*** (0.001)	-0.044*** (0.001)	-0.016*** (0.003)	-0.026*** (0.001)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted-R <sup>2</sup>	0.72	0.70	0.76	0.73	0.82	0.81
F-statistics	19.83	16.07	20.63	18.13	27.11	26.04
Observations	177	177	177	177	177	177



## Robustness Tests

Panel A: Alternative specification for relative debt						
	VAR(99.5)	ES(99.5)	VAR(99)	ES(99)	VAR(95)	ES(95)
E(Log inside debt <sub>t-1</sub> )	-0.119*** (0.006)	-0.138*** (0.008)	-0.090*** (0.010)	-0.122*** (0.008)	-0.041** (0.026)	-0.068** (0.012)
Log firm leverage <sub>t-1</sub>	0.009** (0.013)	0.008* (0.082)	0.009*** (0.003)	0.008** (0.037)	0.005*** (0.001)	0.007*** (0.002)

  

Panel B: VAR and ES based on Historical Simulation				
	VAR2(99.5)	ES2(99.5)	VAR2(95)	ES2(95)
E(Log relative debt <sub>t-1</sub> )	-0.038*** (0.000)	-0.032* (0.058)	-0.016*** (0.000)	-0.024*** (0.000)

  

Panel C: Stock Return Volatility			
	Total Volatility	Systematic Volatility	Idiosyncratic Volatility
E(Log relative debt <sub>t-1</sub> )	-0.165* (0.092)	-0.212*** (0.009)	-0.155 (0.174)

## Default risk and insurance-related risk

	Distance- to-default	Z-score	Leverage Risk	Total Insurance Risk	Underwriting Risk	Investment Risk
	1	2	3	4	5	6
E(Log relative debt <sub>t-1</sub> )	8.862*** (0.001)	27.273** (0.040)	-0.060*** (0.002)	-0.015*** (0.002)	-0.130*** (0.002)	-0.001 (0.898)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted-R <sup>2</sup>	0.56	0.44	0.22	0.74	0.65	0.43
F-statistics	7.37	4.47	4.50	13.80	10.33	3.01
Observations	157	177	177	177	177	177

## 결론

- We present that the use of inside debt is prevalent and significant in the insurance industry
- There is a significant and negative relationship between CEO inside debt and managerial risk-taking
- Our results suggest that the structure of executive debt-like compensation could be a potential method of reducing managers' risk-taking incentives.