P/C Insurance Industry Outlook

Focus on Claims Trends

March 23, 2018

Robert P. Hartwig, Ph.D., CPCU
Clinical Associate Professor of Finance, Risk Management & Insurance
Darla Moore School of Business ♦ University of South Carolina
Robert.Hartwig@moore.sc.edu ♦ 803.777.6782
P/C Insurance Industry
Financial Overview

CATS Claims, Non-CAT Underwriting
Losses in Personal and Commercial Auto
Impacted Insurer Balance Sheets

Industry Remains Strong, But Major Differences Between Personal and Commercial Lines Growth Prospects
P/C Industry Net Income After Taxes
1991–2017E

Net income fell sharply in 2017 as high CAT losses took their toll

- ROE figures are GAAP;
- 'Return on avg. surplus. Excluding Mortgage & Financial Guaranty insurers yields a 8.2% ROAS in 2014, 9.8% ROAS in 2013, 6.2% ROAS in 2012, 4.7% ROAS for 2011, 7.6% for 2010 and 7.4% for 2009; 2016E is annualized figure based actual figure through Q3 of $31.8B.

Sources: A.M. Best, ISO; USC RUM Center estimate (2017 based on actual NIAT of $22.352 though Q3 and ROAS of 4.2%).
Profitability Peaks & Troughs in the P/C Insurance Industry, 1975 – 2017:Q3

ROEs in 2017 plunged to their lowest levels since 2001 and 9/11. This creates extreme pricing pressure.

*Est. for 2017 based on actual ROAS of 4.45 through Q2; Profitability = P/C insurer ROEs. 2011-16 figures are estimates based on ROAS data. Note: Data for 2008-2014 exclude mortgage and financial guaranty insurers.
Source: NAIC, ISO, A.M. Best, Conning, USC RUM Center estimates.
P/C Profitability Is Influenced Both by Cyclicality and Volatility

*2017 Estimate based on actual ROAS through Q3 of 4.2% with USC Center for Risk and Uncertainty Management estimate for the full year.
Sources: ISO, Fortune; USC RUM Center.
As Recently as 2001, Insurers Paid Out Nearly $1.16 for Every $1 in Earned Premiums

Heavy Use of Reinsurance Lowered Net Losses

Relatively Low CAT Losses, Reserve Releases

Higher CAT Losses, Shrinking Reserve Releases, Toll of Soft Market

Sharply higher CATs are driving large underwriting losses and pricing pressure

Best Combined Ratio Since 1949 (87.6)

Cyclical Deterioration

Sandy Impacts

Lower CAT Losses

115.8
107.5
100.1
100.8
98.4
92.6
95.7
99.3
101.0
101.1
102.5
106.5
96.4
97.0
97.8
100.7
104.1
100
110
120
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17E


Sources: A.M. Best, ISO (2014-2015); Figure for 2010-2013 is from A.M. Best P&C Review and Preview, Feb. 16, 2016.
Personal Lines Combined Ratio: 2006–2017E

Personal Lines Underwriting Losses Rose in 2017 Due to Record CATs and Adverse Auto Severity

Source: A.M. Best (2006-2016); USC RUM (2017E using actual 9 mo. YTD combined ratio of 102.8).
Commercial lines underwriting performance deteriorated materially in 2017 as record CATs, diminishing prior year reserves, rising loss cost trends and pricing pressure in some lines are pushing combined ratios higher.


($ Billions)

Surplus (Capacity) as of 9/30/17 reached a new record of $719.4B despite record CAT losses.

Financial Crisis

Drop due to near-record 2011 CAT losses

2010:Q1 data includes $22.5B of paid-in capital from a holding company parent for one insurer’s investment in a non-insurance business.

Capacity/Capital “shocks” typically do not on their own drive a sustained firming of the pricing environment.

Sources: ISO, A.M. Best; 2018 estimate from the Center for Risk and Uncertainty Management, University of South Carolina.
Catastrophe Loss Update: 
Major Driver of Rate Pressure

2017 Was One of the Costliest Years Ever for US Insurers

Hurricanes Harvey, Irma and Maria, California Wildfires Exact a Huge Toll
U.S. Insured Catastrophe Losses, 1989 – 2017 YTD*

($ Billions, $ 2015)

2017 is likely to become the second costliest year ever for insured CAT losses in the US


Note: 2001 figure includes $20.3B for 9/11 losses reported through 12/31/01 ($25.9B 2011 dollars). Includes only business and personal property claims, business interruption and auto claims. Non-prop/BI losses = $12.2B ($15.6B in 2011 dollars.)

Sources: Property Claims Service/ISO; Insurance Information Institute.
Top 10 US Catastrophe Losses of 2017, by Insured Loss

(Insured Losses, 2017 Dollars, $ Billions)*

YTD insured CAT losses in the US totaled $72 billion by late 2017, the second costliest year on record, led by Hurricanes Maria, Irma and Harvey.

Not all insured losses in 2017 were due to hurricanes. More than $15B in other losses occurred from coast-to-coast.

*As of Nov. 14, 2017.
Inflation Adjusted U.S. Catastrophe Losses by Cause of Loss, 1997–2016

- **Wind losses**, by far, cause the most catastrophe losses, even if hurricanes/TS are excluded.
- **Insured cat losses** from 1997-2016 totaled $421.2B, an average of $21.1B per year or $1.76B per month.
- **Winter storm losses** were much above average in 2014/15 pushing this share up.

**Tornado share of CAT losses is rising:**
- Events Involving Tornadoes (2), $168.1
- Winter Storms, $28.2
- Other (5), $0.8

**Fires (4), $8.4**
- Terrorism, $25.0
- Other Wind/Hail/Flood (3), $29.7

1. Catastrophes are defined as events causing direct insured losses to property of $25 million or more in 2016 dollars.
2. Excludes snow.
3. Does not include NFIP flood losses
4. Includes wildland fires
5. Includes civil disorders, water damage, utility disruptions and non-property losses such as those covered by workers compensation.

Source: ISO’s Property Claim Services Unit.
Origins of Pricing Pressure Arising from (Near) Record CAT Activity

Retrocessional Reinsurance markets (reinsurance for reinsurance companies) are pushing pressure through the reinsurance markets and into both commercial and personal lines.

- Non-Loss Affected: +5%
- Loss-Affected: +10% to +15%
- 0% to +5%

*Some programs above and below this range.
**Higher end of range applies to loss-affected accounts.
Sources: Adapted from Barclay’s Capital research.
US Property Catastrophe Rate-on-Line Index: 1990 – 2018*

US Reinsurance Pricing Is Sensitive to CAT Activity and Ultimately Impacts Primary Insurance Pricing, Terms and Conditions

*As of January 1 each year. 2018 is a full-year estimate (Barclay’s Capital).
Investment Performance is a Key Driver of Insurer Profitability

The “Trump Bump” Has Lifted Stock Markets and Interest Rates

Will the Gains Help Insurers?
Due to persistently low interest rates, investment income fell in 2012, 2013 and 2014 but showed a small (1.7%) increase in 2015—though 2016 experienced another decline. Up ~2% in 2017.

Investment earnings in 2017E were still ~14% below their 2007 pre-crisis peak.

---

1 Investment gains consist primarily of interest and stock dividends. Sources: ISO; Insurance Information Institute.

*2017 estimate based on annualized $35.4B actual figure through Q3 2017.
The yield on invested assets remains low relative to pre-crisis yields. Fed rate increases beginning in late 2015 have pushed up some yields, albeit quite modestly. Shrinking of Fed’s balance sheet should help too in 2018 and beyond.

Investment yield in 2017 were down about 160 BP from pre-crisis levels.

Sources: NAIC data, sourced from S&P Global Market Intelligence; 2017 estimate is based on ISO data through Q3 2017.
Brief P/C Insurance Growth Overview and Outlook

Drivers of Growth in 2018

Economic Growth Fuels Exposure & Record CAT Losses Are Pressuring Rates

Price Competition Remains Rational While Others Look Towards M&A

Net Written Premiums Fell 0.7% in 2007 (First Decline Since 1943) by 2.0% in 2008, and 4.2% in 2009, the First 3-Year Decline Since 1930-33.

Outlook
2017E: 4.1%
2018F: 4.5%

*Q3:2017 over Q3:2016. Shaded areas denote “hard market” periods
Since 2014, personal lines Direct Premiums Written have generally grown faster than commercial lines DPW, and that growth has been less volatile.

Sources: NAIC, via SNL Financial; ISO; Insurance Information Institute calculations.
2016: Components of Commercial DWP Growth

- Direct Written Premium (DWP) in US lines covered by ISO MarketStance grew 3.1 percent in 2016.
- Soft market conditions counteracted moderate 4.1 percent exposure growth.

Source: Verisk Insurance Solutions.

AXA its acquisition of XL Ltd. on 3/5/19 for $15.3B

(1) Includes transactions where a U.S. company was the acquirer and/or the target.

Source: Conning proprietary database.
The Strength of the Economy Will Greatly Influence Growth in Insurers’ Exposure Base Across Most Lines

Claiming Behavior Is Influenced by the Economy as Well
US Real GDP Growth*

The Q4:2008 decline was the steepest since the Q1:1982 drop of 6.8%

Recession began in Dec, 2007

Demand for Insurance Should Increase in 2018-19 as GDP Growth Continues at a Steady and Perhaps Accelerating Pace and Gradually Benefits the Economy Broadly

2018 GDP forecasts were revised upwards by ~0.4% due to tax reform, but effects may wane in 2019

First consecutive quarters of 3%+ GDP growth since 2014

* Estimates/Forecasts from Blue Chip Economic Indicators.

Source: US Department of Commerce, Blue Economic Indicators 3/18; Insurance Information Institute.
Direct Written Premiums track Nominal GDP—not quarter by quarter but overall fairly well.
Outlook: Consumers are optimistic about the future, which is consistent with expectations for stronger economic growth (consumers account for nearly 70% of all spending in the economy). Should positively influence growth of insurable exposures.

Source: The Conference Board; Wells Fargo Research.
Auto/Light Truck Sales, 1999-2023F

New auto/light truck sales fell to the lowest level since the late 1960s. Forecast for 2014-15 is still below 1999-2007 average of 17 million units, but a robust recovery is well underway.

Job growth and improved credit market conditions boosted auto sales to near record levels in recent years.

Sales have returned to pre-crisis levels.

Truck, SUV purchases remain strong but have slumped a bit.

Yearly car/light truck sales are slowing slightly, as demand tapers following the recovery from the recession. PP Auto premium might grow by 3.5% - 5%.

Insurers Are Continue to See Meaningful Exposure Growth in the Wake of the “Great Recession” Associated with Home Construction: Construction Risk Exposure, Surety, Commercial Auto; Potent Driver of Workers Comp Exposure

US Unemployment Rate Forecast

Rising unemployment eroded payrolls and WC’s exposure base.

Unemployment peaked at 10% in late 2009.

Jobless figures have been revised downwards for 2018/19

Unemployment forecasts have been revised modestly downwards. Optimistic scenarios put the unemployment as low as 3.6 by Q4 2018.

The Feb. 2018 unemployment rate was 4.1%, a 17-year low

Sources: US Bureau of Labor Statistics; Blue Chip Economic Indicators (3/18 edition); Insurance Information Institute.
Personal Lines
Growth Drivers

Rate and Exposure are Both Presently Important Growth Drivers
Monthly Change in Auto Insurance Prices, 1991–2018*

Cyclical peaks in PP Auto tend to occur roughly every 7-10 years (early 1990s, early 2000s, early and late 2010s)

Last pricing peak occurred in late 2010 at 5.3%, falling to 2.8% by Mar. 2012

“Hard” markets often tend to occur during recessionary periods

Feb. 2018 reading of 9.7% is up from 7.6% a year earlier. Current rate trend is strongest since 2002-2003.

*Percentage change from same month in prior year; through Feb. 2018; seasonally adjusted
Note: Recessions indicated by gray shaded columns.
Sources: US Bureau of Labor Statistics; National Bureau of Economic Research (recession dates); Insurance Information Institutes.
Personal Auto Insurance: Key CPI Cost Component Changes: 2018 vs. 2017*

Percentage Change (%)

- Overall CPI: 2.2%
- Motor Vehicle Insurance: 9.7%
- Motor Vehicle Body Work: 2.7%
- Motor Vehicle Repairs: 0.1%
- Motor Vehicle Parts: 0.1%
- Outpatient Hospitalization: 4.9%
- Inpatient Hospitalization: 4.4%
- Prescription Drugs: 2.1%

Feb. 2018 reading of 9.7% is up from 7.6% a year earlier. Current rate trend is strongest since 2002-2003.

Hospitalization costs continue to drive severity.

Private Passenger Auto Insurance
Net Written Premium, 2000–2018F

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Written Premium ($ Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>$119.7</td>
</tr>
<tr>
<td>01</td>
<td>$128.0</td>
</tr>
<tr>
<td>02</td>
<td>$139.7</td>
</tr>
<tr>
<td>03</td>
<td>$151.2</td>
</tr>
<tr>
<td>04</td>
<td>$157.3</td>
</tr>
<tr>
<td>05</td>
<td>$159.6</td>
</tr>
<tr>
<td>06</td>
<td>$160.3</td>
</tr>
<tr>
<td>07</td>
<td>$159.6</td>
</tr>
<tr>
<td>08</td>
<td>$158.5</td>
</tr>
<tr>
<td>09</td>
<td>$157.2</td>
</tr>
<tr>
<td>10</td>
<td>$160.1</td>
</tr>
<tr>
<td>11</td>
<td>$163.3</td>
</tr>
<tr>
<td>12</td>
<td>$168.1</td>
</tr>
<tr>
<td>13</td>
<td>$174.9</td>
</tr>
<tr>
<td>14</td>
<td>$183.5</td>
</tr>
<tr>
<td>15</td>
<td>$192.5</td>
</tr>
<tr>
<td>16</td>
<td>$206.6</td>
</tr>
<tr>
<td>17E</td>
<td>$220.0</td>
</tr>
<tr>
<td>18F</td>
<td>$234.0</td>
</tr>
</tbody>
</table>

PP Auto premiums written continue to recover from a period of flat growth attributable to the weak economy impacting new vehicle sales, car choice, and increased price sensitivity among consumers.

PPA NWP volume in 2017 was up an estimated $62.8B or 39.9% since the 2009 trough; By 2017 the gain is expected to be $76.8B or 48.9%.

Sources: A.M. Best (1990-2016); USC RUM (2017F-2018F).
Homeowners insurance NWP continues to rise (up 152% 2000-2017E) despite very little unit growth during the real estate crash. Reasons include rate increases, especially in coastal zones, ITV endorsements (e.g., “inflation guards”), compulsory for mortgaged properties and resumption of home building activity.

The Homeowners line will generate about $1.5B in new premiums annually through 2018.

Sources: A.M. Best; USC RUM Center.

Average RNW: 1990-2016*

All P-C Lines: 7.7%
PP Auto: 7.6%
Homeowners: 4.9%**

Homeowners is Now Outperforming Pvt.Pass. Auto and P-C Industry as a Whole. HO Volatility is Associated Primarily With Coastal Exposure Issues

*Latest available.
**Excludes 1992, the year of Hurricane Andrew. If 1992 is included the resulting homeowners RNW is 2.2%
Sources: NAIC; Insurance Information Institute.
Private Passenger Auto Underwriting Performance Is Showing the Strains of Rising Frequency (and Severity) Trends in Many States

Sources: A.M. Best (1990-2016); USC RUM Center (2017E).
Homeowners Performance Had Improved Markedly Since 2011/12’s Large Cat Losses...until 2017’s Record Catastrophe Loss Activity.

Sources: A.M. Best (1990-2016); USC RUM Center (2017E).
Commercial Auto Combined Ratio: 1993–2017F

Commercial Auto Results Are Challenged as Rate Gains Have Yet to Fully Offset Adverse Frequency and Severity Trends

Sources: A.M. Best (1990-2016); USC RUM Center (2017E).
Change in Commercial Rate Renewals, by Line: 2017:Q3

Percentage Change (%)

-2.3%  -0.8%  -0.7%  -0.4%  0.1%  0.1%  0.4%  0.4%  0.7%  0.9%  7.3%

Workers Comp  General Liability  Cyber  Umbrella  Surety  Business Interruption  Construction  D&O  EPL  Commercial Property  Commercial Auto

Note: CIAB data cited here are based on a survey. Rate changes earned by individual insurers can and do vary, potentially substantially.

Source: Council of Insurance Agents and Brokers; USC Center for Risk and Uncertainty Management.

Commercial Auto was only major line with materially positive renewals in 2017.

Commercial Property, Business Interruption will need to reflect record CAT losses and pressure from reinsurance markets.

Note: Commercial Auto was the only major line with materially positive renewals in 2017.
Claim Trends in Private Passenger Auto Insurance

Rising Frequencies and Severities in Many Coverages

Will that Pattern Be Sustained?
Bodily Injury: Severity Trend Is Up, Frequency Decline Returning?

Annual Change, 2005 through 2017*

Severity Frequency

2.9% 4.7% 5.7% 5.9% 2.0% 3.0% 2.1% 1.1% 1.7% 0.0% 0.0% 0.0% 4.3% 3.4% 5.6% 0.0% -2.2%


BI Severity Trend is a Major Cost Driver

*2017 figure is for the 4 quarters ending 2017:Q3.
Source: ISO/PCI Fast Track data; Insurance Information Institute
Severity/Frequency Trends Have Been Volatile, But Rising Severity since 2011 Is a Concern

*2017 figure is for the 4 quarters ending 2017:Q3.
Source: ISO/PCI Fast Track data; Insurance Information Institute
PIP: Severity Trend Is Up, Frequency Decline Returning?

Annual Change, 2013 through 2017*

No-Fault (PIP) Trends Have Been Volatile

*2017 figure is for the 4 quarters ending 2017:Q3.
Source: ISO/PCI Fast Track data; Insurance Information Institute
Collision Coverage: Severity & Frequency Trends Are Both Higher in 2017*

The Recession, High Fuel Prices Helped Temper Frequency and Severity, But this Trend Has Clearly Reversed, Consistent with Experience from Past Recoveries

*Four quarters ending with 2017 Q3.
Source: ISO/PCI Fast Track data; Insurance Information Institute
Comprehensive Coverage: Frequency and Severity Trends Are Volatile

Annual Change, 2005 through 2017*

Severe weather is a principal cause of the spikes in both frequency and severity.

Weather Creates Volatility for Comprehensive Coverage. Comprehensive Losses Were Up 24.9% in Q3:2017 Due Largely to Hurricanes Harvey and Irma

*2017 figure is for the 4 quarters ending with 2017:Q3.
Source: ISO/PCI Fast Track data; Insurance Information Institute
Passenger Vehicle Collision Coverage Insurance Losses by Vehicle Type, 2014-2016 Model Years

Cars and minivans have the highest collision claim frequencies and severities.

SOURCE: Highway Loss Data Institute.
A Half Century-Plus of Auto Insurance: Frequency vs. Severity

In the Long Run, Frequency Falls. Severity Increases.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Damage</td>
<td>7.92</td>
<td>$183</td>
</tr>
<tr>
<td>Bodily Injury</td>
<td>4.22</td>
<td>$1,288</td>
</tr>
<tr>
<td></td>
<td>3.57</td>
<td>$3,673</td>
</tr>
<tr>
<td></td>
<td>2.61</td>
<td>$7,553</td>
</tr>
<tr>
<td></td>
<td>1.23</td>
<td>$16,007</td>
</tr>
<tr>
<td></td>
<td>0.91</td>
<td></td>
</tr>
</tbody>
</table>

*Four quarters ending in Q3:2017
Sources: Insurance Institute for Highway Safety, Insurance Services Office, Insurance Information Institute.
A Few Factors Driving Adverse Private Passenger Auto Loss Trends

More Jobs, Better Economy, More People Driving, More Expensive Cars, Higher Speed Limits…
Tremendous Growth In Miles Driven. The More People Drive, the More Frequently They Get Into Accidents.

*Moving 12-month total vs. prior year through December.
Sources: Federal Highway Administration; Insurance Information Institute.
More People Working and Driving

When People are Out of Work, They Drive Less. When They Get Jobs, They Drive to Work, Helping Drive Claim Frequency Higher.

Sources: Seasonally Adjusted Employed from Bureau of Labor Statistics; Rolling four-quarter average frequency from Fast Track Monitoring System; Insurance Information Institute.
As the Economy Has Gotten Better, People Are Spending More on Vehicles – When Those Cars Are in Accidents, Severity Increases.

A Few Factors Driving Adverse Private Passenger Auto Loss Trends

More Jobs, Better Economy, More People Driving, Lower Gas Prices, More Expensive Cars, Higher Speed Limits…
Driving Has Been Getting Safer For Decades, But Recent Trend Is Discouraging—40,200 Deaths in 2016—Little Improvement in 2017

*2017 estimate from NSC data.
The First Human to Be Killed by an Autonomous Vehicle...And It Appears the Human Was at Fault...Maybe

On the night of March 18, 2018 in Tempe, AZ, 49-year old Elaine Herzberg was struck and killed by a self-driving Uber vehicle while crossing the road pushing a bicycle. She is believed to be the first human to be killed by an autonomous vehicle.

Claims Quandary?

Tempe Police Chief Sylvia Moir: “I suspect preliminarily it appears that the Uber would likely not be at fault in this accident.” But then Moir added: “I won’t rule out the potential to file charges against the [backup driver] in the Uber vehicle.”

Collision Repair Cost Drivers

The Bottom Line:
High Tech Vehicles Are Expensive to Repair
“Key to Key”: Vehicle Repair Times Are Increasing, 2013-2017

<table>
<thead>
<tr>
<th>Driveable Flag</th>
<th>CY</th>
<th>Vehicle In to Repairs Started Days Avg</th>
<th>Repairs Started to Repairs Completed Days Avg</th>
<th>Repairs Completed to Vehicle Out Days Avg</th>
<th>Vehicle In to Vehicle Out Days Avg</th>
<th>Shop Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driveable</td>
<td>CY2013</td>
<td>0.6</td>
<td>5.3</td>
<td>0.8</td>
<td>6.7</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>CY2014</td>
<td>0.7</td>
<td>5.7</td>
<td>0.8</td>
<td>7.2</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>CY2015</td>
<td>0.6</td>
<td>5.8</td>
<td>0.9</td>
<td>7.3</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>CY2016</td>
<td>0.6</td>
<td>6.3</td>
<td>0.9</td>
<td>7.8</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>CY2017</td>
<td>0.6</td>
<td>6.3</td>
<td>0.9</td>
<td>7.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Non-Driveable</td>
<td>CY2013</td>
<td>2.5</td>
<td>11.3</td>
<td>1.4</td>
<td>15.2</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>CY2014</td>
<td>3.2</td>
<td>12.7</td>
<td>1.2</td>
<td>17.0</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>CY2015</td>
<td>2.9</td>
<td>13.3</td>
<td>1.3</td>
<td>17.4</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>CY2016</td>
<td>2.7</td>
<td>13.9</td>
<td>1.4</td>
<td>18.1</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>CY2017</td>
<td>2.5</td>
<td>13.6</td>
<td>1.3</td>
<td>17.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>CY2013</td>
<td>1.0</td>
<td>6.6</td>
<td>0.9</td>
<td>8.5</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>CY2014</td>
<td>1.2</td>
<td>7.1</td>
<td>0.8</td>
<td>9.1</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>CY2015</td>
<td>1.0</td>
<td>7.2</td>
<td>0.9</td>
<td>9.2</td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td>CY2016</td>
<td>1.0</td>
<td>7.7</td>
<td>1.0</td>
<td>9.7</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>CY2017</td>
<td>0.9</td>
<td>7.6</td>
<td>1.0</td>
<td>9.5</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: CCC accessed via PropertyCasualty360.com at:
https://www.propertycasualty360.com/native/?mvi=204cd819dffd479f9551e33dc691c4a8&mvpf=e9c65c7f741c449bb8c0ebe08e5a1c9&mvpflabel=&et=editorial&bu=PC360&cn=20180305&src=EMC-Email&pt=Daily&slreturn=20180205153245
### Direct Repair Program Vehicle Volume by Repair Cost Range and Drivability, 2013-2017

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$0.01 to $500.00</td>
<td>3.5%</td>
<td>3.2%</td>
<td>3.0%</td>
<td>2.6%</td>
<td>2.4%</td>
</tr>
<tr>
<td>$500.01 to $1,000.00</td>
<td>16.5%</td>
<td>15.8%</td>
<td>15.4%</td>
<td>14.3%</td>
<td>13.5%</td>
</tr>
<tr>
<td>$1,000.01 to $2,000.00</td>
<td>29.8%</td>
<td>29.5%</td>
<td>29.5%</td>
<td>28.9%</td>
<td>28.7%</td>
</tr>
<tr>
<td>$2,000.01 to $3,000.00</td>
<td>18.6%</td>
<td>18.9%</td>
<td>19.2%</td>
<td>19.5%</td>
<td>19.8%</td>
</tr>
<tr>
<td>$3,000.01 to $4,000.00</td>
<td>11.2%</td>
<td>11.5%</td>
<td>11.7%</td>
<td>12.1%</td>
<td>12.4%</td>
</tr>
<tr>
<td>$4,000.01 to $5,000.00</td>
<td>7.1%</td>
<td>7.3%</td>
<td>7.3%</td>
<td>7.7%</td>
<td>7.9%</td>
</tr>
<tr>
<td>$5,000.01 to $6,000.00</td>
<td>4.5%</td>
<td>4.7%</td>
<td>4.7%</td>
<td>5.0%</td>
<td>5.1%</td>
</tr>
<tr>
<td>$6,000.01 to $10,000.00</td>
<td>6.8%</td>
<td>7.1%</td>
<td>7.1%</td>
<td>7.7%</td>
<td>7.8%</td>
</tr>
<tr>
<td>$10,000.01 to $15,000.00</td>
<td>1.6%</td>
<td>1.7%</td>
<td>1.7%</td>
<td>1.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>$15,000.01 to $20,000.00</td>
<td>0.30%</td>
<td>0.31%</td>
<td>0.34%</td>
<td>0.38%</td>
<td>0.37%</td>
</tr>
<tr>
<td>$20,000.01 &amp; Up</td>
<td>0.10%</td>
<td>0.10%</td>
<td>0.11%</td>
<td>0.14%</td>
<td>0.13%</td>
</tr>
<tr>
<td><strong>Non-Driveable %</strong></td>
<td><strong>22.1%</strong></td>
<td><strong>19.5%</strong></td>
<td><strong>18.2%</strong></td>
<td><strong>18.1%</strong></td>
<td><strong>17.3%</strong></td>
</tr>
</tbody>
</table>

Source: CCC accessed via PropertyCasualty360.com at: [https://www.propertycasualty360.com/native/?mvi=204cd819dffd479f9551e33dc691c4a8&mpf=e9c65c7f741c449bbb8c0ebe08e5a1c9&mvpflabel=&et=editorial&bu=PC360&cn=20180305&src=EMC-Email&pt=Daily&slreturn=20180205153245](https://www.propertycasualty360.com/native/?mvi=204cd819dffd479f9551e33dc691c4a8&mpf=e9c65c7f741c449bbb8c0ebe08e5a1c9&mvpflabel=&et=editorial&bu=PC360&cn=20180305&src=EMC-Email&pt=Daily&slreturn=20180205153245)

- Repair costs have been drifting upward
- Non-drivable share has been declining

(Thousands of Cars)

The number of EVs in the US is increasing exponentially

EV Sales Remain Strong but Total Just 1% of the US Stock of Cars

*Includes plug-in vehicles and hybrids.
Commercial Lines Growth, Underwriting Performance & Pricing Cyclicality

Cyclicality in Growth, Price Are the Norm

*Rising Rates Are a Normal Part of Adjustment Process*

- Economic Shocks, Inflation: 1976: 22.2%
- Tort Crisis 1986: 30.5%
- Post-Hurricane Andrew Bump: 1993: 6.3%
- Post-9/11 2002: 22.4%
- Post Katrina Bump: 2006: 7.7%
- Recessions: 1982: 1.1%
- Great Recession: 2009: -9.0%
- Post-Hurricane Andrew Bump: 1993: 6.3%
- 2016: -1.3%
- 2017: +1.8%

Note: Data include state funds beginning in 1998.
Source: A.M. Best; Insurance Information Institute. 2017 estimate: Univ. of South Carolina Center for Risk and Uncertainty Management, ISO.

Smallest Decrease in 11 Quarters

Commercial programs have generally renewed downwards since late 2014, but will need to move to positive renewals in 2018, just as they did following large CAT losses in 2011-2012.

Renewals turned positive in late 2011 in the wake of record tornado losses and Hurricane Sandy.

2017’s results may exert enough pressure on markets to push overall rates up by 1+% in 2018.

*Latest available.

Note: CIAB data cited here are based on a survey. Rate changes earned by individual insurers can and do vary, potentially substantially.

Source: Council of Insurance Agents & Brokers; Center for Risk and Uncertainty Management, Univ. of South Carolina.
Change in Commercial Rate Renewals, by Line: 2017:Q3

Percentage Change (%)

- Workers Comp: -2.3%
- General Liability: -0.8%
- Cyber: -0.7%
- Umbrella: -0.4%
- Surety: 0.1%
- Business Interruption: 0.1%
- Construction: 0.4%
- D&O: 0.4%
- EPL: 0.7%
- Commercial Property: 0.9%
- Commercial Auto: 7.3%

Commercial Auto was only major line with materially positive renewals in 2017.

Commercial Property, Business Interruption will need to reflect record CAT losses and pressure from reinsurance markets.

Note: CIAB data cited here are based on a survey. Rate changes earned by individual insurers can and do vary, potentially substantially.
Source: Council of Insurance Agents and Brokers; USC Center for Risk and Uncertainty Management.
The number of securities class actions is rising sharply, putting pressure on D&O coverage.

As of Nov. 16, 2017.
Source: Stanford University Law School: http://securities.stanford.edu/
Workers Comp Spotlight

Underwriting Results Remain Strong

Exposure Outlook Is Outstanding as Job Growth Continues and Wage Gains Accelerate
Workers Compensation Combined Ratio: 1994–2016P

Workers Comp is an example of a line that was recently restored to health through the return of rate adequacy.

Sources: A.M. Best (1994-2009); NCCI (2010-2016P) and are for private carriers only.
Workers Compensation Premium: Flat in 2016 After 5 Years of Increase

Net Written Premium

$ Billions

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>State Funds ($ B)</th>
<th>Private Carriers ($ B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
<td>31.0</td>
<td>33.6</td>
</tr>
<tr>
<td>91</td>
<td>34.3</td>
<td>33.6</td>
</tr>
<tr>
<td>92</td>
<td>34.3</td>
<td>33.6</td>
</tr>
<tr>
<td>93</td>
<td>35.7</td>
<td>33.6</td>
</tr>
<tr>
<td>94</td>
<td>35.7</td>
<td>33.6</td>
</tr>
<tr>
<td>95</td>
<td>34.3</td>
<td>33.6</td>
</tr>
<tr>
<td>96</td>
<td>33.6</td>
<td>33.6</td>
</tr>
<tr>
<td>97</td>
<td>30.1</td>
<td>33.6</td>
</tr>
<tr>
<td>98</td>
<td>28.5</td>
<td>33.6</td>
</tr>
<tr>
<td>99</td>
<td>26.9</td>
<td>33.6</td>
</tr>
<tr>
<td>00</td>
<td>25.9</td>
<td>33.6</td>
</tr>
<tr>
<td>01</td>
<td>25.0</td>
<td>33.6</td>
</tr>
<tr>
<td>02</td>
<td>28.6</td>
<td>33.6</td>
</tr>
<tr>
<td>03</td>
<td>32.1</td>
<td>33.6</td>
</tr>
<tr>
<td>04</td>
<td>37.7</td>
<td>33.6</td>
</tr>
<tr>
<td>05</td>
<td>42.3</td>
<td>33.6</td>
</tr>
<tr>
<td>06</td>
<td>46.5</td>
<td>33.6</td>
</tr>
<tr>
<td>07</td>
<td>47.8</td>
<td>33.6</td>
</tr>
<tr>
<td>08</td>
<td>46.5</td>
<td>33.6</td>
</tr>
<tr>
<td>09</td>
<td>46.5</td>
<td>33.6</td>
</tr>
<tr>
<td>10</td>
<td>39.3</td>
<td>33.6</td>
</tr>
<tr>
<td>11</td>
<td>34.6</td>
<td>33.8</td>
</tr>
<tr>
<td>12</td>
<td>39.3</td>
<td>33.8</td>
</tr>
<tr>
<td>13</td>
<td>36.4</td>
<td>33.8</td>
</tr>
<tr>
<td>14</td>
<td>39.5</td>
<td>33.8</td>
</tr>
<tr>
<td>15</td>
<td>41.8</td>
<td>33.8</td>
</tr>
<tr>
<td>16</td>
<td>44.2</td>
<td>33.8</td>
</tr>
<tr>
<td>17</td>
<td>45.5</td>
<td>33.8</td>
</tr>
<tr>
<td>18</td>
<td>45.5</td>
<td>33.8</td>
</tr>
<tr>
<td>19</td>
<td>46.5</td>
<td>33.8</td>
</tr>
<tr>
<td>20</td>
<td>44.3</td>
<td>33.8</td>
</tr>
<tr>
<td>21</td>
<td>42.3</td>
<td>33.8</td>
</tr>
<tr>
<td>22</td>
<td>40.1</td>
<td>33.8</td>
</tr>
</tbody>
</table>

Pvt. Carrier NWP growth was 0% in 2016, +2.9% in 2015, +4.3% in 2014, +5.1% in 2013 and 8.7% in 2012

Source: NCCI from Annual Statement Data.
Includes state insurance fund data for the following states: AZ, CA, CO, HI, ID, KY, LA, MD, MO, MT, NM, OK, OR, RI, TX, UT.
Each calendar year total for State Funds includes all funds operating as a state fund that year.
Workers Compensation Lost-Time Claim Frequency Declined in 2016

Average Annual Change = –3.5%
(1994–2016)

*Adjustments primarily due to significant audit activity.
Source: NCCI Financial Call data, developed to ultimate and adjusted to current wage and voluntary loss cost level; Excludes high deductible policies; 1994-2014: Based on data through 12/31/14. Data for all states where NCCI provides ratemaking services, excluding WV.
Frequency is the number of lost-time claims per $1M pure premium at current wage and voluntary loss cost level.
Workers Comp Indemnity Claim Costs: Sharper Increase in 2016

Average Indemnity Cost per Lost-Time Claim

Average indemnity costs per claim were up 3% in 2016 to $23,900, the largest increase since 2008.

Cumulative Change = 144% (1991-2016p)

1991-2015: Based on data through 12/31/2015, developed to ultimate
Based on the states where NCCI provides ratemaking services including state funds, excluding WV; Excludes high deductible policies.
Workers Comp Medical Claim Costs: 2016 Was Sharpest Increase Since 2007

Average Medical Cost per Lost-Time Claim

Average indemnity costs per claim were up 5% in 2016 to $29,100, the largest increase since 2007

Cumulative Change = 259% (1991-2016p)

1991-2015: Based on data through 12/31/2015, developed to ultimate
Based on the states where NCCI provides ratemaking services including state funds, excluding WV; Excludes high deductible policies.
Average annual increase in WC medical severity from 1995 through 2016 was well above the medical CPI (5.8% vs. 3.7%), but the gap has narrowed. Lost-time medical severities appear to on the rise again.

INDUSTRY DISRUPTORS

Technology, Society and the Economy Are All Changing at a Rapid Pace

*Reality vs. Drinking the Silicon Valley Kool Aid*
The Internet of Things and the Insurance Industry Value Chain

Possibly including:
- GM
- Apple
- Zipcar

Possibly including:
- Quindell
- Google
- Verisk Analytics

Possibly including:
- Mercedes-Benz
- Home icon

Who owns the data? Where does it flow? Who does the analytics? Who is the capital provider?

The Sharing Economy Has Grown—and Attracted Political Scrutiny

There's no question that the hype around autonomous vehicles far exceeds the reality.
The Internet of Things and the Insurance Industry

- The “Internet of Things” will create trillions in economic value throughout the global economy by 2025
- What opportunities, challenges will this create for insurers?
- What are the impact on the insurance industry “value chain”?

Sources: McKinsey Global Institute, The Internet of Things: Mapping the Value Beyond the Hype, June 2015; Insurance Information Institute.
Car Subscription Services: A Threat to Personal Auto?

- Liberty Mutual, Assurant, Chubb have struck multiple deals
- Volvo, Ford, Cadillac, Porsche, BMW and Mercedes-Benz have either launched or announced plans to launch car subscription models

Source: CB Insights accessed 3/14/18 at: https://www.cbinsights.com/research/insurance-car-subscription-partnerships/
Car Subscription Services: A Threat to Personal Auto?

- Ford’s Canvas programs states that it provides: BI & PD Liability $300K combined single limit), PIP, Med Pay, UI/UIM, Collision & Comprehensive ($500 deductible), Roadside Assistance, Rental Reimbursement

- No flexibility in coverage but can use own auto insurance as primary and Canvas as excess

Number and Value of Deals Is Increasing

An Industry that Has Always Been Accepting of Change and Innovation
Insurance tech deals reached a new record in 2016 but funding was higher in 2015.

2 out of every 3 InsurTech deals in 2016 was at the early stage!

Source: CB Insights at https://www.cbinsights.com/blog/2016-insurance-tech-funding/
InsurTechs Are Focusing on Distribution and Pricing

<table>
<thead>
<tr>
<th>Share of innovations in insurtech database</th>
<th>&lt;5%</th>
<th>5–10%</th>
<th>&gt;10%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Property and casualty</strong></td>
<td>8%</td>
<td>17%</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Health</strong></td>
<td>5%</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Life</strong></td>
<td>3%</td>
<td>9%</td>
<td>5%</td>
</tr>
</tbody>
</table>


InsurTech firms across all insurance segments tend to focus on Distribution. It is telling that very few InsurTech firms are actually insurers.
Start-Up InsurTech Investments by Top 25 P/C Insurers, 2015 - 2017*

10 of the Top 25 P/C insurers have made InsureTech start-up investments since 2015.— but there is little correlation between size and number of investments within this group.

USAA and AmFam lead in P/C InsurTech investment

*As of June 23, 2017.
Sources: NAIC from CB Insights at https://www.cbinsights.com/blog/largest-pc-insurers-rank-startup-investments/
Thank you for your time and your attention!

Twitter: twitter.com/bob_hartwig

For a copy of this presentation, email me at robert.hartwig@moore.sc.edu