Table of Contents / Agenda

- Global economic outlook
- Insurance market outlook
- W/C claims drivers
- W/C demand drivers
- Technology issues affecting W/C insurance
- Conclusions
Global economic outlook
Where has all the growth gone?

IMF forecasts of world GDP growth vs actual growth, 2011 to 2016

Source: International Monetary Fund.
Why has growth disappointed consistently over the last few years?

Factors contributing to slower growth → What can we expect?

- Commodity price bust
- Slowdown in productivity growth
- Slowdown in trade growth

- Worst seems to be over
- Unlikely to improve anytime soon
- Facing headwinds, no longer a growth driver

➢ Moderate growth likely to be the “new normal”
Recovery at different speeds

Real GDP of selected Western European countries and the US (indexed Q1 2008 = 100)

Source: Datastream
Manufacturing PMIs imply a robust manufacturing expansion in 2017

Purchasing Managers Indices, monthly data

Latest values as of Apr 17:
- USA: 54.8
- Euro area: 56.7
- UK: 57.3
- Japan: 52.7
- China: 51.2

Sources: Datastream, Bloomberg

PMIs are survey based indicators. Values above 50 indicate economic expansion, values below 50 contraction. However, the China PMI is not calibrated accurately – industrial production is up 6% y-o-y currently. The other indicators are calibrated more accurately, with below 50 consistent with industrial production declines.
Global growth expected to pick up moderately this year and next year, driven by US and emerging markets

Real GDP growth, selected regions, 2015-2018

Source: Swiss Re Institute
Monetary policy divergence continues

10y government bond yields
US, Germany (%)

• US Fed to continue gradually raising its policy rate and this will lift long-term government bond yields

• Bank of England needs to find a balance between expected growth slowdown and rising inflation, keeping rates on hold for now

• ECB and Bank of Japan retain their monetary easing bias

• Long-term interest rates to increase moderately, except for Japan

Source: Datastream, Swiss Re Institute
What are the central banks doing?

- The Fed remains dovish, but is aware that the risk of inflation has risen, so will keep raising interest rates unless the economy stalls.
- Most likely, growth and inflation will be moderate, Fed will raise rates gradually and long term yields will rise also to 3.4% by end-2018.
- The European Central Bank and the Bank of Japan will continue with easy monetary policy in an attempt to lift inflation.
- However, this is not working well and inflation remains firmly under its target of 2%, especially in Japan.
- There has been some inflation in the UK, from the pound depreciation, but the Bank of England believes it will be temporary.
  - BoE also on hold and maintaining monetary easing stance.
- US and other Central banks thus have divergent monetary policies.
  - Long-term yields in US will be constrained from rising, due to “carry trade” from Europe and Japan.
- Risk of inflation is rising.
Potential economic impact of US Administration’s policy proposals, but with a great deal of uncertainty.

<table>
<thead>
<tr>
<th>Policy proposal during campaign</th>
<th>Short-term growth</th>
<th>Long-term growth</th>
<th>Inflation</th>
<th>Interest rates</th>
<th>Alignment with Republican Congress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal spending</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑/☑/☑</td>
</tr>
<tr>
<td>Increase infrastructure spending / increase military spending / reform or repeal ACA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taxes</td>
<td>☑</td>
<td>?</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Lower personal taxes, cut corporate tax to 15% to 20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deregulation</td>
<td>☑</td>
<td>?</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Dodd-Frank, SIFI for non-banks, FIO etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trade</td>
<td>?</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
</tr>
<tr>
<td>Withdraw from TPP, renegotiate or exit NAFTA, raise tariffs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immigration</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑</td>
<td>☑/☑</td>
</tr>
<tr>
<td>Build wall on Mexican border / ban Muslims, end birthright citizenship, etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security issues</td>
<td>?</td>
<td>☑</td>
<td>?</td>
<td>?</td>
<td>☑</td>
</tr>
<tr>
<td>Anti-Nato?, pro-Russia? Antagonize China? Undermine European Union?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Budget deficit</td>
<td>☑</td>
<td></td>
<td></td>
<td>☑</td>
<td>☑</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute
China: Assertive on rights in South China Sea; subsidies to state owned enterprises; purchasing assets overseas to gain greater access to minerals: etc.

Euro area risk: Post-Brexit, Marine Le Pen in France, Grillo in Italy both propose referendums on staying in the EU. These countries are both part of euro area – exits would disrupt financial markets extensively.

US Administration: US Admin has mentioned many protectionist policies and has killed TPP and TTIP. If these policies are pursued vigorously a disastrous trade war could ensue.

Latin America: Unlike much of the world, LatAm is becoming more liberal on trade: Pacific Alliance, Argentina and Brazil

Source: Swiss Re Institute
Labor force growth is slowing, unemployment falling, wages rising and this is pushing up inflation expectations.

Population aged 15-64, % change, five-year annual average

10y market inflation expectations (break-even rates)

Latest values as of 02/05/2017:
- US: 1.9%
- Germany: 1.2%
- UK: 3.1%

Employment growth in US and Germany is fairly robust, implying a recession is unlikely this year.

Source: Bureau of Labor Statistics, Federal Reserve, NBER, Bureau of Economic Analysis
Conclusions

• Global growth likely to remain moderate

• Some upside risk to US growth from possible federal spending, tax cuts and deregulation

• Gradual increase in US interest rates to push global yields moderately higher – 2.7% end-2017, 3.4% end-2018, 3.8% end-2019 and onwards

• Inflation risks are contained, but rising (especially in US and UK)

• Brexit is likely to dampen UK growth, but uncertainty is high

• Political contagion from Brexit is a key risk for Europe

• US Administration also adds to uncertainty, but consensus of forecasters think a mild, one-time boost to growth next year of 0.3% is likely, 0.0% extra inflation

• The risk of a hard landing in China remains elevated
Insurance market outlook
# Key macro drivers of the P&C market

<table>
<thead>
<tr>
<th>Macro drivers</th>
<th>trend</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low interest rates</td>
<td></td>
<td>Very slow increases in long term-rates: ~ 2.7% by end 2017 and ~ 3.4% by end 2018</td>
</tr>
<tr>
<td>Weak growth</td>
<td></td>
<td>Moderate growth is expected in the US in 2017, acceleration in energy and infrastructure spending?</td>
</tr>
<tr>
<td>Natural catastrophes</td>
<td></td>
<td>Above-average cat losses in 1H16, below-average in 3Q16, ~ average in 4Q16</td>
</tr>
<tr>
<td>Reserve releases</td>
<td></td>
<td>Reserve releases are fading; adverse development for commercial lines in 9M16</td>
</tr>
<tr>
<td>Low inflation</td>
<td></td>
<td>Gradual acceleration of general and healthcare inflation</td>
</tr>
<tr>
<td>Industry capitalisation</td>
<td></td>
<td>Low interest rates drive excess capacity and alternative capital; continuous competitive pressure</td>
</tr>
</tbody>
</table>
Rate declines ease for GL and Umbrella, stable for D&O and EPLI, up for Commercial Auto.

Aggregate US commercial rate changes remain below even the currently low loss trend levels and below any longer term loss trend.

Sources: CIAB, Economic Research & Consulting
Soft market conditions resulting in stagnation of commercial premium growth

![Graph showing commercial lines and personal lines premium growth from 1996 to 2016 with peaks and troughs.]

Sources: A.M. Best; Insurance Information Institute.
The US industry’s reserve position continues to erode

- The US industry loss reserve position continued to weaken in 2016.
- Other liability occurrence (OLO), personal auto liability and commercial auto liability were the largest contributors to adverse development.
- The line with the most significant increase in favourable development was workers’ compensation.

Source: A.M. Best, Swiss Re Institute
US Combined Ratio: Elevated recently, beginning of a trend?

Source: A.M. Best, Swiss Re Institute
Composition of insurers’ profits as a % of net premiums earned and ROE: Recovering, after this year

Note: Aggregate of eight major markets
Source: Swiss Re Institute
Emerging markets growth in nominal premium volume terms will still be less than Advanced markets through 2027

Origin of additional nominal P&C premiums, in USD billion in years to 2027

Absolute premium growth by origin (total: USD 1207 bn)

- **Advanced, excl. US**: USD 360 bn (30%)
- **US**: USD 332 bn (28%)
- **Emerging, excl. China**: USD 250 bn (21%)
- **China**: USD 265 bn (22%)

In 2016, the US had 38% of the total premiums, while China had only 9%. By 2027 the US is still way ahead with 34%, but China up to 15%

Source: Swiss Re Institute
### Non-life real premium growth expected to be aligned with real GDP growth in most countries

Real direct P&C premiums in USD billion in 2016; and growth 2007 to 2019

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced</td>
<td>1259</td>
<td>0.7</td>
<td>1.3</td>
<td>1.7</td>
<td>2.3</td>
</tr>
<tr>
<td>US</td>
<td>606</td>
<td>0.3</td>
<td>1.3</td>
<td>1.3</td>
<td>2.4</td>
</tr>
<tr>
<td>Emerging markets</td>
<td>333</td>
<td>6.9</td>
<td>5.1</td>
<td>5.5</td>
<td>6.1</td>
</tr>
<tr>
<td>EMs, x China</td>
<td>191</td>
<td>3.9</td>
<td>4.0</td>
<td>4.7</td>
<td>5.2</td>
</tr>
<tr>
<td>China</td>
<td>134</td>
<td>16.0</td>
<td>7.6</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

* Advanced markets include North America, Western Europe, Israel, Oceania, Japan, Korea, Hong Kong, Singapore, and Taiwan.

Source: Swiss Re Institute; E = Estimate; F = Forecast
W/C claims drivers
Liability claims are expected to accelerate
This will erode reserves and boost demand for re/insurance

- Traditionally, liability claims grow faster than GDP.
- The decline in claims began in 2004 and was revealed by a turn in the reserves cycle. Improved safety reduced the frequency of claims.
- After 2008, underlying claims trends slowed down due to the global recession.
- Economic drivers of claims costs have begun to accelerate in the US and some other countries.
- Claims trends are likely to rise with stronger economic growth pushing up medical and wage inflation.

Source: Swiss Re, *sigma 4/2014, updated*
Inflation and wages gains are gradually accelerating and the US Federal Reserve is responding.

Source: Datastream, Swiss Re Institute
Wage gains are subdued for now, but expected to get to about 3.5% over next few years

Source: Datastream, Swiss Re Institute.
Medical expenditure escalations: 2% in 2013, but rose to 6% in 2015 and 2016. They are expected to stay there.

Source: Datastream, Swiss Re Institute.
Rate of fatal work injuries per 100,000 full-time equivalent workers by employee status, 2006 - 2015

Fatal occupational injuries by major event, 2015

- Transportation incidents: 2,054 incidents (42%)
  - Roadway incidents: 1,264
  - Falls to lower level: 800 (17%)
  - Falls, slips, trips: 648
  - Contact with objects and equipment: 722
  - Violence and other injuries by persons or animals: 703
  - Homicides: 286
  - Exposure to harmful substances or environments: 424
  - Fires and explosions: 121

Total incidents: 4,836

There is a strong increase in the frequency of motor vehicle injuries / fatalities – especially in trucking

Overall traffic deaths are up 14 percent from 2014 to 2016 – more accidents involved distracted driving, higher speeds; more miles driven

Sources: US Department of Transportation, Swiss Re Institute
W/C demand drivers
US Light vehicle sales – no more support for GDP growth expected

Blue Chip Consensus
2016: 17.5
2017: 17.3
2018: 17.1

Recessions

Source: Datastream, Swiss Re Institute; Blue Chip Economic Indicators, Apr’17
Housing starts – a glacially slow recovery, but still room to grow!

Source: Datastream, Swiss Re Institute; Blue Chip Economic Indicators, Apr’17
Manufacturing employment continues to recover from the recession, but is in a long-term secular decline.
Construction employment is growing at a healthy pace and expected to continue to expand.

Source: Datastream, Swiss Re Institute
Mining employment was continually declining until the fracking boom started in 2004.
Goods producing employment is flat over next decade, according to BLS, with mining and construction gains fully offset by declines in manufacturing.

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Thousands of Jobs</th>
<th>Percent Distribution</th>
<th>Compound Annual Rate of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total(1)</td>
<td>150,539.9</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Nonagriculture wage and salary(2)</td>
<td>139,811.5</td>
<td>92.0</td>
<td>92.9</td>
</tr>
<tr>
<td>Goods-producing, excluding agriculture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>843.8</td>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>Construction</td>
<td>6,138.4</td>
<td>4.8</td>
<td>4.1</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>12,188.3</td>
<td>9.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Services-providing</td>
<td>120,641.0</td>
<td>76.8</td>
<td>80.1</td>
</tr>
</tbody>
</table>

Source: Bureau of Labor Statistics
Value of construction put in place has recovered for private non-residential, but residential still lower than prior peak.

Source: US Census Bureau, Construction Spending; Swiss Re Institute, split estimated for 1990 - 1992
Technology and W/C issues
The challenges and opportunities of technology

• “Advances in IT and automation will present opportunities to boost America’s overall income and wealth, improve health care, shorten the work week, develop new goods and services, and increase product safety and reliability.” – Information Technology and the U.S. Workforce, www.nap.edu

• “After a Chinese factory replaced 90% of its human workforce with automated machines, it experienced a 250% increase in productivity and an 80% reduction in defects.” https://futurism.com/2-production-soars-for-chinese-factory-who-replaced-90-of-employees-with-robots/
Technologies coming into W/C space

- Use cases for application of technology in W/C
  - Robots reduce workforce and/or increase safety
  - Behavior modification, real time alerts supported by Internet of Things (IoT)
  - Monitor incidents via posture devices, wearables, etc
  - Telemedicine; lower time to return to work

- Challenges commercial customers could face in implementing technology
  - Data privacy and security risk
  - Potential health risks, eg, headaches, double vision and dizziness from wearing devices
  - Cyber risk – physical damage

- Companies involved: Human Condition (wearables, teamed with AIG), Argo Risk Tech (app coupled with monitoring devices) and Safety Compass (app with Augmented Reality and IoT for improving work site safety.)
Supply of robots has increased substantially since 2009…

Worldwide annual supply of industrial robots
2001 - 2019*

Source: IFR World Robotics 2016

*forecast

so stock of robots in operation climbing rapidly

Estimated worldwide operational stock of industrial robots at year-end by main industries 2013 - 2015

- Automotive: 623,100 units (2015), 328,600 units (2014), 160,900 units (2013), +10%
- Metal: 150,900 units (2015), 150,900 units (2014), 61,200 units (2013), +16%
- Chemical and plastics: 150,900 units (2015), 150,900 units (2014), 61,200 units (2013), +11%
- Food: 51,200 units (2015), 51,200 units (2014), 91,600 units (2013), +13%

Source: IFR World Robotics 2016

Will robots replace most workers? Not according to International Federation of Robotics!

Robots create jobs!

- ZEW Study*: Automation has a positive net effect on labour demand in Europe.
  - Automation reduces production costs
  - Reduced product costs reduce product prices
  - Reduced product prices increase demand for products
  - Increased product demand increases employment

*Study of Mannheim Centre for European Economic Research (ZEW) and the University of Utrecht, 2016
Some industrial examples of robotics creating jobs...

- Example automotive industry **United States 2010-2015**:
  - 80,000 new industrial robots installed
  - 230,000 more employees

- Example automotive industry **Germany 2010-2015**:
  - Operational stock increased by 3% on average per year (+13,000 units)
  - Increase of employees: +2.5% on average per year (+93,000 employees)

Many of the jobs with highest workers compensation claims can ultimately be replaced by automation – McKinsey research

The technical potential for automation in the US

Many types of activities in industry sectors have the technical potential to be automated, but that potential varies significantly across activities.

- Only about 9% of the Managers can be replaced, but 78% of the workers in predictable physical work can be replaced.

Source: McKinsey & Company
Technology is advancing rapidly and the insurance industry is adapting, e.g., through investments.

Explosion of devices relative to size of population

Venture capital investment in InsurTech

Source: “Living in a hyperconnected world”, Swiss Re

Source: CB Insights data
Advances in technology will change the insurance business model in the future

Value propositions offered by emerging technology

- **Marketing & Product Development**
  - Gamification for needs analysis
  - AI/virtual assistants for direct sales

- **Distribution Mgmt / Sales**
  - Health wearables for policy discounts
  - Loss control, proactive alerts based on IoT
  - Semantic tech for self-service

- **Underwriting/ New Business**
  - AI-diagnosis of diseases
  - AI-based rules engines

- **Policy Servicing**
  - Wearables monitor treatment
  - AI for fraud detection
  - Augmented reality for damage assessment
  - VR for training
  - Drones/robots for CATs

- **Billing & Collections**
  - Mobile payments - Square, Apple, Android, Samsung Pay, Bitcoin

- **Claims/ Payout**
  - Robo-advisors for investment advice

- **Asset/ Investment Management**
  - Robotics supporting patients in home
  - IoT for Facilities/ Asset Management

Source: Insurance and the Connected World, Mark Breading (Strategy Meets Action), May 17 2016
The IoT can have broad and deep applications in a number of areas

Augmented Reality is being used in Oil and Gas for Training and Monitoring, having detected and stopped a leak in Singapore - Maersk

Church insurer GuideOne uses smart devices to secure the Churches.

Beam dental insurance supplies toothbrush with bluetooth® built in

Rail Sensors currently deployed to monitor tracks for conditions and trains.

State Farm and AmFam provide discounts for Nest

The Hartford Steam Boiler was the latest Hartford insurer to get approval from the Federal Aviation Administration (FAA) to fly drones that help customers identify exposure, manage risks and prevent losses.

Source: Swiss Re ImagePlus, Beam, Nest
Medical innovations can transform the healthcare landscape

- Allows better early diagnostics and risk screening
- Increases effectiveness of preventive intervention
- Opens new, but often expensive, treatment options
- Reduces medical errors
- New risks like bio-hacking/ grinders

Source: Molecular You

Swiss Re Institute
Connected cars can generate vast amounts of data, and telematics opens new opportunities for insurers

### Volume of data generated by connected cars (U.S. example)

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Units</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Gigabytes (GB)</td>
<td>Amount of data generated in one hour of driving</td>
</tr>
<tr>
<td>300</td>
<td>Hours</td>
<td>Amount of time in a year spent driving</td>
</tr>
<tr>
<td>9,000</td>
<td>Gigabytes (GB)</td>
<td>Amount of data in bytes generated in one year of driving</td>
</tr>
<tr>
<td>190,000,000</td>
<td>Millions</td>
<td>Number of private passenger auto's in the US</td>
</tr>
<tr>
<td>1.71</td>
<td>Zettabytes*</td>
<td>Data potentially generated by entire US fleet in one year</td>
</tr>
<tr>
<td>9.3%</td>
<td>Percent</td>
<td>Market penetration of connected cars in 2020</td>
</tr>
<tr>
<td>0.16</td>
<td>Zettabytes*</td>
<td>Potential annual data collected in CY 2020</td>
</tr>
</tbody>
</table>

*1 zettabyte is 1 billion terabytes*

- Telematics opens new opportunities for insurers, potentially improving combined ratios, enhancing the customer experience, offering added services like stolen car recovery.

- We expect the demand for usage-based insurance (UBI) to increase in the coming years.

Source: Verisk Analytics, [Sharing Driving Data Has Arrived](http://example.com), April 2016,
Cyber landscape is highly dynamic …

- Rapid speed of development
- Algorithms replace human intervention

Accelerating pace of digital transformation

- Cloud
- Internet of things
- Mobile telecommunications

Widening sources of vulnerability

- States, syndicates
- Social engineering
- Insider threats

Evolution of attacker skills and motivations

Complexity = increased exposure to difficult-to-predict, ever-changing threats

…creating ever-changing sources of security vulnerabilities and threats, including physical damage (Stuxnet, German steel plant*.)

Source: Swiss Re Institute:*
https://www.wired.com/2015/01/german-steel-mill-hack-destruction/
See also, sigma 1/2017, “Cyber: getting to grips with a complex risk”
Conclusions
Conclusions

- US economic growth is forecast to be moderate, but inflation is rising

- Additional growth and inflation will also lift interest rates, ultimately to 3.8% by end-2019

- Workers’ compensation claims are expected to be affected by rising wages, inflation and medical costs

- Like US economic growth, demand (exposure) for workers’ compensation will rise at a moderate pace driven by growth in employment in construction, mining and services, especially transportation
  - Technology is reducing the number of workers in manufacturing, so this will dampen claims from that sector.

- Technology provides an opportunity to improve safety through risk monitoring
  - It also poses some risks, eg, cyber risks which result in physical damage
Thank you!

to get your copies of *sigma*, go to [www.swissre.com/sigma](http://www.swissre.com/sigma)
request subscription via [sigma@swissre.com](mailto:sigma@swissre.com) (hard or soft copy)
©2017 Swiss Re. All rights reserved. You are not permitted to create any modifications or derivative works of this presentation or to use it for commercial or other public purposes without the prior written permission of Swiss Re.

The information and opinions contained in the presentation are provided as at the date of the presentation and are subject to change without notice. Although the information used was taken from reliable sources, Swiss Re does not accept any responsibility for the accuracy or comprehensiveness of the details given. All liability for the accuracy and completeness thereof or for any damage or loss resulting from the use of the information contained in this presentation is expressly excluded. Under no circumstances shall Swiss Re or its Group companies be liable for any financial or consequential loss relating to this presentation.