



Insurance Risk Study | Fourteenth Edition

Global Risk, Profitability, and Growth Metrics

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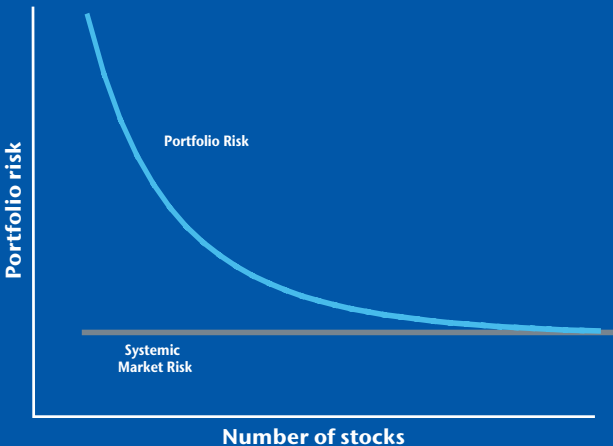
About the Study

Rating agencies, regulators, and investors today are demanding that insurers provide detailed assessments of their risk tolerance and quantify the adequacy of their economic capital. To complete such assessments requires a credible baseline for underwriting volatility. The Insurance Risk Study provides our clients with an objective and data-driven set of underwriting volatility benchmarks by line of business and country as well as correlations by line and country. These benchmarks are a valuable resource to CROs, actuaries, and other economic capital modeling professionals who seek reliable parameters for their models.

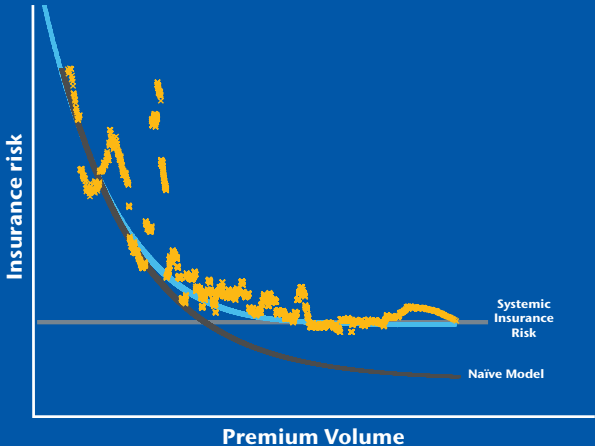
Modern portfolio theory for assets teaches that increasing the number of stocks in a portfolio will diversify and reduce the portfolio’s risk, but will not eliminate risk completely; the systemic

market risk remains. This is illustrated in the left chart below. In the same way, insurers can reduce underwriting volatility by increasing account volume, but they cannot reduce their volatility to zero. A certain level of systemic insurance risk will always remain, due to factors such as the underwriting cycle, macroeconomic trends, legal changes and weather (right chart below). This study calculates this systemic risk by line of business and country. The Naïve Model on the right chart shows the relationship between risk and volume using a Poisson assumption for claim count—a textbook actuarial approach. The study clearly shows that this assumption does not fit with empirical data for any line of business in any country. It will underestimate underwriting risk if used in an ERM model.

Asset portfolio risk



Insurance portfolio risk



Introduction

The Insurance Risk Study, now in its 14th year, has evolved from its beginnings as a quantification study for enterprise risk management. We now take an expansive view of many issues related to risk, encompassing the growth dynamics, emerging risks, and operational challenges for insurers globally.

Analytics remains at the core of this report, and indeed in Aon's offerings as a global professional services firm. In this regard, the Insurance Risk Study continues to provide the insurance industry's leading set of risk parameters for modeling and benchmarking underwriting risk and global profitability. This volume includes critical metrics and parameters that insurers can use to advance their decision making in areas ranging from growth strategy to performance benchmarking, risk tolerance, and capital management. All parameters are produced using a consistent methodology that we have employed since the first edition.

The 14th Study begins with a review of the insurance industry's performance globally: premium and capital levels, areas of growth, and profitability. Since the 8th edition, industry combined ratios are calculated across the top 50 countries. Beginning with Aon's Country Opportunity Index on page five, we turn from numerical highlights to strategic considerations that identify the countries showing an attractive mix of growth and profitability with limited political risk. Page eight focuses on the risk parameters that can be used to model underwriting volatility and insurance capital. Below are just a few of the key findings of this year's report:

Using the study

Beyond risk modeling, we provide our clients with very granular, customized market intelligence to create business plans that are realistic, fact-based, and achievable. With access to global resources and capabilities, and a broad network of local market practitioners, we are equipped to provide insight across a spectrum of lines, products, and geographies. Inpoint, the consulting division of Aon, helps insurers and reinsurers address challenges, from sizing market opportunities to identifying distribution channel dynamics, assessing competitor behavior, and understanding what it takes to compete and win. Our approach leverages Aon's USD350 million annual investment in analytics, data, and modeling to help our clients grow profitably. If you have any questions or suggestions for items we could explore in future editions of the Insurance Risk Study, please contact us through your local Aon broker or one of the contacts listed on the last page.



Global P&C business again produced an **underwriting profit in 2018, with a combined ratio of 98.9%** – slightly worse than last year's 98.8% combined ratio.



Motor insurance is the fastest growing line of business, with 6.8% annual growth over the past five years, driven by strong growth in China, Brazil, and the U.S.



For the fourth year in a row, Malaysia, Indonesia, and Singapore are **ranked within the top five positions in Aon's Country Opportunity Index**. All three of these countries have shown low combined ratios, healthy premium and GDP growth, and a stable political environment.

Global Premium, Capital, Profitability, and Opportunity

Globally, property casualty business again produced an underwriting profit in 2018 with a combined ratio of 98.9 percent, an increase over last year's 98.8 percent combined ratio. Europe averaged a 96.0 percent combined ratio, while Asia Pacific averaged 100.8 percent and the Americas were 97.9 percent.

In 24 of the top 50 markets, combined ratios were below 95 percent, and 10 countries were below 90 percent, compared to 24 and 9 countries last year. Seven countries showed five-year premium growth of more than 10 percent, led by very strong growth in China. The overall global combined ratio result, and the variation in results by country, demonstrates there are many desirable areas for profitable growth in the market today.

At year end 2018, global premium stands at an all-time high of USD5.5 trillion, an increase of 5.1 percent over the prior year. Property-casualty premium increased by 3.4 percent, life & health premium increased by 6.0 percent, and reinsurance premiums grew by 2.9 percent.

Global insurance premium and capital, USD trillions

	Premium	Capital
Property & Casualty	1.52	1.32
Life & Health	3.77	2.52
Reinsurance	0.18	0.59
Total	5.48	4.43

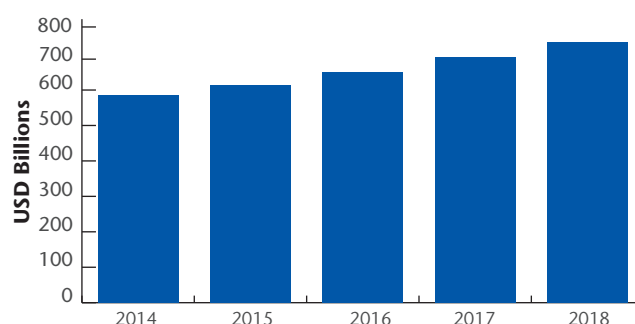
Global capital increased 1.3 percent year on year to USD4.4 trillion, and reinsurance capital fell 3.3%, as we discuss at greater length in Aon's Reinsurance Market Outlook.

Property casualty penetration is 1.9 percent of GDP, flat from last year based on 50 of the largest countries. Auto insurance accounts for 49 percent of property casualty premium, while property accounts for 31 percent and liability for 20 percent.

Motor insurance is also the fastest growing line of business, with 6.8 percent annual growth over the last five years, driven by strong growth in Brazil, U.S., and China. Liability is growing at an annual rate of 4.6 percent and property at 2.9 percent.

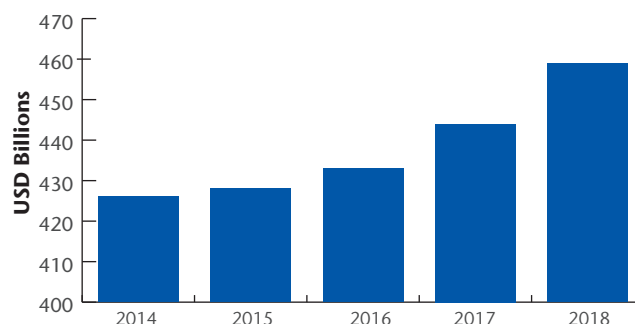
Global premium for motor

Motor: 6.8% average annual growth



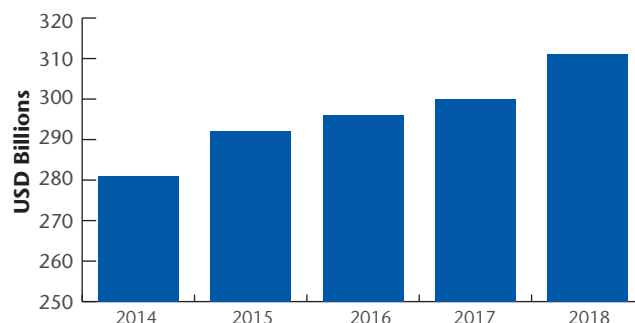
Global premium for property

Property: 2.9% average annual growth



Global premium for liability

Liability: 4.6% average annual growth

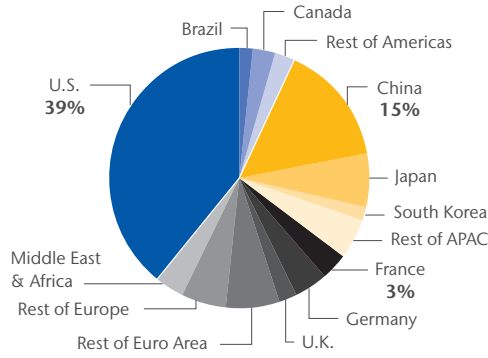


Note: Historical premium reported in local currency is converted to US dollars using the latest foreign exchange rate for that currency. This removes the effect of changes in foreign exchange rates over time.

Global P&C gross written premium and growth rates by product line

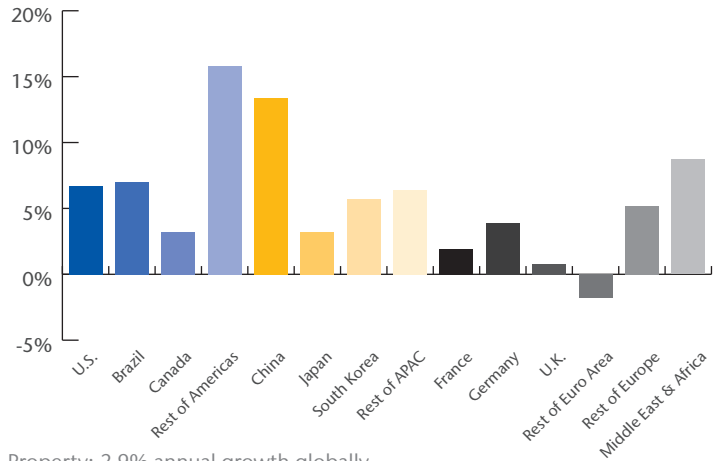
Premium by product line

Motor: USD 734 billion

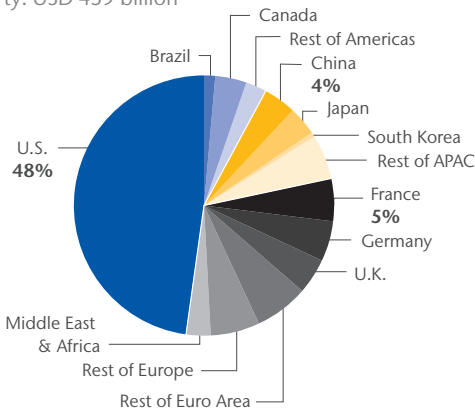


Five-year average annual growth rate

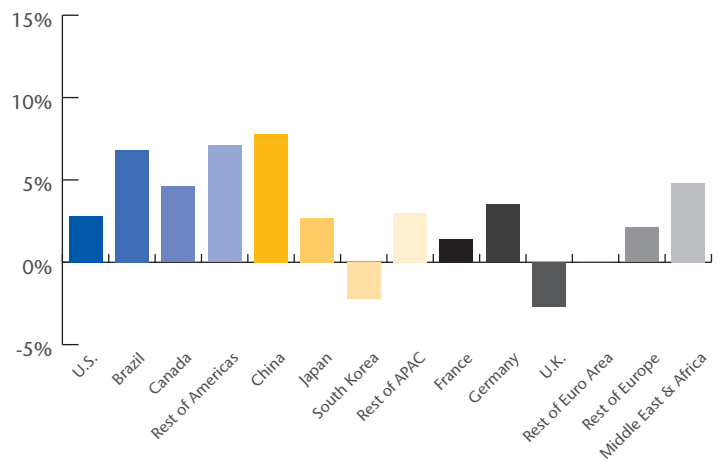
Motor: 6.8% annual growth globally



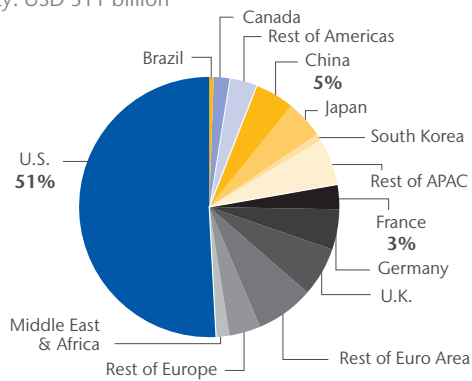
Property: USD 459 billion



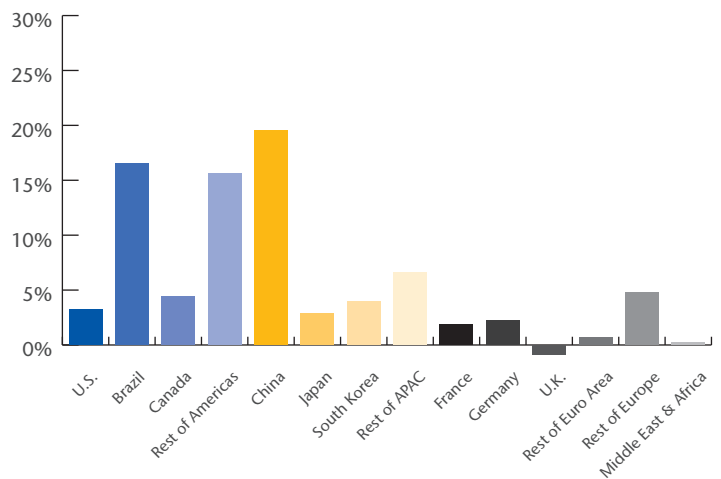
Property: 2.9% annual growth globally



Liability: USD 311 billion



Liability: 4.6% annual growth globally



Notes: All statistics are the latest available. "Motor" includes all motor insurance coverages. "Property" includes construction, engineering, marine, aviation, and transit insurance as well as property. "Liability" includes general liability, workers' compensation, surety, bonds, credit, and miscellaneous coverages.

Top 50 P&C markets ranked by gross written premium by region

	P&C GWP (USD M)	Premium/GDP Ratio	Annualized Premium Growth			Cumulative Net Loss Ratio			Cumulative Net Expense Ratio			Cumulative Net Combined Ratio		
			1yr	3yr	5yr	1yr	3yr	5yr	1yr	3yr	5yr	1yr	3yr	5yr
Americas														
U.S.	660,617	3.2%	5.2%	4.6%	4.5%	72.5%	71.7%	71.3%	25.7%	25.0%	25.7%	98.2%	96.7%	97.0%
Canada	45,463	2.7%	3.1%	3.7%	3.9%	68.5%	67.9%	67.5%	29.2%	30.3%	30.2%	97.7%	98.3%	97.7%
Brazil	21,215	1.0%	1.3%	2.2%	7.6%	50.5%	54.0%	55.1%	32.6%	34.1%	33.9%	83.1%	88.2%	89.0%
Mexico	10,904	0.9%	0.2%	8.6%	7.6%	66.1%	65.2%	64.7%	26.0%	26.9%	28.1%	92.1%	92.1%	92.8%
Argentina	9,830	1.9%	24.5%	30.8%	34.0%	79.2%	78.4%	77.7%	34.2%	33.7%	33.4%	113.4%	112.1%	111.1%
Colombia	3,956	1.3%	5.9%	8.6%	8.1%	56.5%	57.4%	58.3%	48.3%	49.6%	49.8%	104.8%	107.0%	108.1%
Chile	3,690	1.3%	2.3%	5.9%	5.8%	52.5%	55.1%	56.1%	43.1%	43.2%	43.5%	95.6%	98.3%	99.6%
Ecuador	1,412	1.4%	-8.4%	-8.0%	1.2%	49.7%	48.7%	50.2%	44.0%	42.8%	39.8%	93.7%	91.5%	90.0%
Venezuela	1,032	0.7%	317.7%	199.8%	136.5%	39.1%	39.1%	39.1%	49.2%	49.2%	49.0%	88.3%	88.3%	88.1%
Subtotal	758,118	2.8%	5.5%	5.2%	5.2%	71.4%	70.7%	70.4%	26.4%	26.0%	26.6%	97.9%	96.7%	97.0%
Europe, Middle East & Africa														
Germany	69,347	1.9%	3.6%	3.4%	3.4%	71.2%	72.5%	72.1%	26.2%	26.1%	25.9%	97.4%	98.6%	97.9%
France	57,584	2.2%	3.8%	2.3%	1.7%	75.9%	77.1%	77.7%	20.3%	20.5%	20.6%	96.3%	97.6%	98.3%
U.K.	54,913	2.1%	8.2%	-2.4%	-1.1%	66.8%	68.0%	64.0%	35.1%	35.8%	36.3%	101.9%	103.8%	100.4%
Italy	29,295	1.5%	0.9%	-1.3%	-2.7%	63.0%	63.6%	63.8%	27.1%	27.1%	26.9%	90.1%	90.7%	90.7%
Spain	27,508	2.2%	11.1%	4.1%	1.3%	70.7%	70.5%	70.5%	21.9%	21.7%	21.6%	92.6%	92.1%	92.2%
Switzerland	14,585	2.1%	-0.4%	0.4%	0.6%	80.2%	77.8%	77.1%	23.8%	24.8%	24.3%	104.0%	102.6%	101.4%
Russia	12,931	0.8%	-4.5%	1.3%	3.8%	53.4%	58.3%	59.7%	34.4%	33.0%	32.8%	87.8%	91.3%	92.5%
Netherlands	10,899	1.3%	1.8%	-4.7%	-4.8%	89.6%	91.3%	90.3%	9.8%	9.2%	9.6%	99.3%	100.4%	99.8%
Belgium	10,068	2.0%	1.9%	0.7%	1.1%	63.1%	63.7%	64.2%	30.4%	30.5%	29.7%	93.5%	94.2%	94.0%
Austria	8,944	2.2%	3.8%	2.3%	2.1%	68.3%	68.7%	69.0%	27.7%	28.0%	27.6%	96.0%	96.6%	96.6%
South Africa	8,941	2.6%	6.9%	8.2%	7.8%	56.9%	58.5%	58.9%	34.2%	33.2%	33.4%	91.1%	91.7%	92.2%
Poland	8,635	1.6%	19.2%	12.2%	6.9%	61.4%	62.5%	62.6%	27.0%	27.4%	28.8%	88.4%	89.9%	91.4%
Turkey	8,157	1.0%	6.7%	18.7%	17.0%	80.2%	76.7%	76.7%	23.4%	23.4%	24.0%	103.6%	100.1%	100.7%
Sweden	8,153	1.5%	3.6%	3.9%	4.1%	73.0%	73.5%	73.3%	19.8%	19.6%	19.6%	92.7%	93.1%	92.9%
Denmark	8,028	2.3%	-5.4%	-1.2%	1.2%	75.8%	74.8%	74.7%	15.9%	16.5%	16.8%	91.7%	91.3%	91.5%
Norway	7,325	1.7%	4.2%	1.3%	2.5%	71.1%	70.0%	69.7%	17.4%	16.8%	16.3%	88.5%	86.8%	86.0%
Israel	6,125	1.8%	3.4%	4.6%	4.0%	76.2%	76.7%	75.6%	23.4%	23.1%	22.4%	99.6%	99.8%	98.0%
Saudi Arabia	4,354	0.6%	-4.9%	5.6%	12.7%	83.2%	81.5%	81.3%	15.6%	14.7%	14.3%	98.8%	96.1%	95.6%
U.A.E.	4,269	1.1%	10.0%	4.7%	2.3%	60.2%	65.2%	67.5%	30.6%	26.7%	25.8%	90.8%	91.9%	93.3%
Finland	4,098	1.6%	-2.6%	-2.2%	1.9%	65.8%	66.9%	68.7%	23.1%	22.1%	21.2%	88.9%	89.0%	89.9%
Portugal	3,840	1.8%	16.9%	7.0%	3.1%	73.8%	74.8%	75.0%	30.4%	30.4%	31.1%	104.2%	105.2%	106.1%
Czech Republic	3,485	1.6%	6.1%	0.4%	1.6%	64.3%	66.5%	67.4%	28.4%	29.1%	29.2%	92.7%	95.6%	96.6%
Ireland	3,156	0.9%	9.3%	1.7%	0.3%	67.0%	66.5%	65.5%	29.5%	29.8%	31.2%	96.6%	96.3%	96.7%
Greece	1,896	0.9%	-3.9%	-5.7%	-6.9%	41.1%	38.7%	40.4%	43.7%	43.6%	42.6%	84.9%	82.3%	83.0%
Romania	1,826	0.9%	-0.9%	5.9%	3.8%	60.5%	60.2%	61.2%	39.0%	38.8%	39.0%	99.5%	98.9%	100.2%
Morocco	1,737	1.7%	4.2%	4.2%	5.1%	65.1%	65.4%	65.4%	34.1%	33.9%	34.2%	99.2%	99.3%	99.6%
Luxembourg	959	1.5%	5.1%	2.2%	3.0%	61.8%	63.4%	63.0%	27.0%	27.0%	27.0%	88.8%	90.5%	90.0%
Bulgaria	944	1.7%	7.6%	6.9%	4.9%	52.1%	52.3%	53.3%	32.4%	32.1%	31.4%	84.5%	84.4%	84.7%
Nigeria	665	0.2%	9.8%	3.4%	2.1%	56.9%	54.6%	51.2%	44.6%	44.9%	44.4%	101.5%	99.6%	95.5%
Subtotal	382,664	1.7%	4.5%	2.1%	1.9%	70.0%	70.8%	70.3%	26.0%	26.0%	26.0%	96.0%	96.8%	96.3%
Asia Pacific														
China	146,014	1.2%	12.8%	11.1%	13.1%	59.3%	59.8%	60.4%	40.8%	40.9%	39.2%	100.1%	100.7%	99.5%
Japan	78,689	1.6%	-0.7%	1.8%	3.0%	87.0%	86.2%	86.1%	14.3%	14.3%	14.4%	101.3%	100.5%	100.5%
Australia	30,116	2.1%	3.6%	3.3%	2.4%	73.1%	73.3%	74.8%	22.3%	22.2%	22.5%	95.4%	95.6%	97.3%
S. Korea	18,756	1.2%	3.5%	6.0%	4.3%	82.2%	82.7%	83.6%	21.8%	20.9%	20.4%	104.0%	103.7%	104.0%
India	16,276	0.6%	14.6%	19.7%	15.4%	90.0%	88.1%	86.9%	24.4%	25.0%	26.6%	114.4%	113.0%	113.4%
Thailand	5,918	1.2%	4.6%	2.2%	1.5%	56.3%	56.2%	55.0%	36.9%	37.0%	37.3%	93.2%	93.2%	92.2%
Taiwan	4,866	0.8%	6.8%	4.6%	5.5%	54.6%	55.3%	55.2%	36.6%	36.9%	37.1%	91.2%	92.3%	92.3%
New Zealand	4,325	2.1%	9.5%	7.4%	5.8%	117.6%	111.5%	122.0%	18.6%	18.8%	18.8%	136.2%	130.3%	140.8%
Indonesia	4,072	0.4%	5.9%	6.2%	11.3%	52.5%	51.6%	51.7%	38.6%	38.2%	36.1%	91.1%	89.8%	87.8%
Malaysia	3,585	1.1%	0.4%	1.3%	3.3%	59.6%	58.6%	58.8%	31.7%	31.7%	30.7%	91.3%	90.3%	89.5%
Hong Kong	2,789	0.8%	-0.6%	0.8%	2.6%	61.5%	57.2%	57.0%	37.9%	36.1%	35.6%	99.5%	93.3%	92.6%
Singapore	2,283	0.7%	-0.3%	-0.2%	0.6%	52.5%	52.5%	56.0%	35.6%	35.2%	34.8%	88.1%	87.7%	90.8%
Subtotal	317,690	1.2%	7.4%	7.5%	8.5%	70.9%	70.8%	71.3%	29.9%	29.9%	29.2%	100.8%	100.7%	100.5%
Grand Total	1,458,472	1.9%	5.7%	4.9%	5.0%	73.6%	73.7%	73.4%	25.3%	25.0%	25.1%	98.9%	98.7%	98.5%

Geographic Opportunities

Aon's Reinsurance Solutions business created the Country Opportunity Index to identify countries with a desirable mix of profitability, growth potential, and a relatively stable political environment. The table below displays the 50 property casualty markets ranked by this Index and divided into quartiles.

Ten of the 13 countries in Quartile 1 were also in the top quartile last year, and six have been in Quartile 1 for all six years of this Index. Asian countries dominate the top positions, but Quartile 1 also includes countries in Latin America, Scandinavia, and the Middle East.

For the fourth year in a row, Malaysia, Indonesia, and Singapore are ranked within the top five positions. All three of these countries have shown low combined ratios, healthy premium and GDP growth, and a stable political environment.

Finland entered the top quartile this year due to an increase in its real GDP 5 year growth. Ecuador and Norway fell out as their average GDP and premium growth did not keep pace with the other countries in the top quartile.

Note that the U.S., Japan, and most of Western Europe are in Quartiles 3 and 4. This Index suggests that to achieve strong insurance growth, it is best for insurers to look beyond the developed economies.

Aon's Country Opportunity Index

Rank	Country	Syr Cumulative Net Combined Ratio	Syr Annualized Premium Growth	Real GDP Syr Growth	Population Syr Annualized Growth	Political Risk Assessment
Quartile 1						
1	Indonesia**	88.8%	12.3%	6.8%	1.2%	Medium
1	New Zealand*	96.2%	6.1%	5.1%	1.9%	Low
3	Malaysia**	87.7%	3.3%	6.9%	1.4%	Medium Low
4	Mexico*	91.2%	10.0%	4.3%	1.0%	Medium
4	Singapore**	80.6%	1.4%	5.0%	0.9%	Low
6	Sweden*	92.2%	4.1%	4.5%	1.2%	Low
6	Australia*	93.6%	3.1%	4.3%	1.6%	Low
8	Luxembourg*	93.4%	2.9%	4.7%	2.3%	Low
8	Saudi Arabia**	96.1%	12.7%	3.8%	2.1%	Medium
8	Hong Kong*	91.1%	5.3%	4.5%	0.7%	Medium
8	Finland	90.9%	3.8%	3.1%	0.4%	Low
8	Denmark*	91.2%	2.3%	3.6%	0.6%	Low
Quartile 2						
13	Brazil	91.3%	7.6%	0.8%	0.8%	Medium
13	Ecuador	86.7%	5.2%	2.9%	1.5%	Medium High
13	Poland	91.8%	3.8%	5.7%	0.0%	Medium Low
13	Bulgaria	84.7%	2.8%	4.9%	-0.7%	Medium
13	Norway	83.9%	2.2%	3.4%	0.9%	Low
18	Turkey	100.6%	19.7%	6.6%	1.4%	Medium
18	India	113.2%	16.4%	9.3%	1.3%	Medium
18	China	97.7%	15.5%	8.6%	0.5%	Medium
18	Canada	98.3%	4.4%	3.6%	1.1%	Low
18	Israel	105.9%	3.9%	5.1%	2.0%	Medium Low
23	Taiwan	93.8%	5.6%	4.1%	0.2%	Medium
23	Morocco	98.9%	3.7%	4.8%	1.1%	Medium
23	Nigeria	95.4%	2.8%	3.7%	2.8%	Very High
Quartile 3						
23	Czech Republic	94.6%	1.6%	5.2%	0.1%	Medium Low
23	Spain	91.2%	1.3%	4.4%	-0.1%	Medium
23	U.A.E.	97.9%	-0.3%	4.7%	2.9%	Medium Low
29	Colombia	105.4%	8.1%	4.4%	1.1%	Medium
29	Chile	99.1%	5.8%	3.9%	1.0%	Medium Low
29	Germany	96.4%	3.5%	3.6%	0.5%	Low
29	U.S.	98.6%	3.0%	4.1%	0.7%	Low
29	Austria	97.9%	2.0%	3.5%	0.9%	Low
29	Switzerland	97.3%	0.6%	3.6%	1.1%	Low
35	Venezuela	95.6%	86.4%	-9.8%	-0.4%	Very High
35	South Africa	101.5%	8.4%	2.8%	1.7%	Medium
35	South Korea	103.2%	4.3%	4.6%	0.5%	Medium Low
35	Ireland	102.2%	2.6%	12.1%	1.1%	Medium
Quartile 4						
39	Russia	94.2%	3.8%	2.1%	0.1%	Medium High
39	Greece	85.7%	-4.0%	2.4%	-0.5%	High
41	Argentina	109.5%	36.6%	1.3%	1.1%	Medium High
41	Romania	114.6%	3.8%	6.3%	-0.5%	Medium High
41	Thailand	98.9%	3.1%	4.8%	0.3%	Medium High
41	U.K.	99.7%	2.3%	3.7%	0.7%	Medium Low
41	France	98.8%	1.8%	3.0%	0.3%	Medium Low
41	Belgium	98.1%	1.5%	3.2%	0.5%	Medium Low
41	Italy	92.9%	-2.7%	2.6%	0.0%	Medium
41	Netherlands	99.2%	-5.3%	3.9%	0.5%	Low
49	Portugal	98.9%	-0.7%	3.6%	-0.3%	Medium
50	Japan	99.8%	3.0%	2.6%	-0.1%	Medium Low

*Indicates top quartile performer in 2018.

**Indicates top quartile performer in each year since 2013. Index methodology explained in Sources and Notes.

Growth markets and out/underperformers

To determine expansion opportunities we examined premium growth and loss ratio performance by country across motor, property, and liability lines of business as well as premium growth and combined ratio performance by country for all lines. The quadrant plots below identify countries as either low growth or high growth, and as either out performers or under performers.

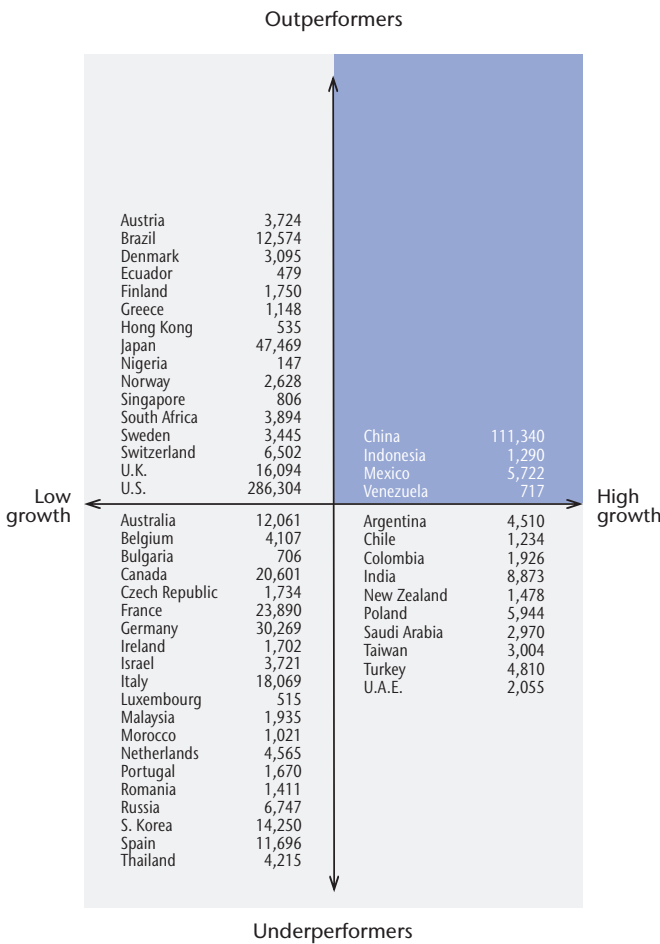
To measure performance, the first three quadrant plots use loss ratio for each line of business while the fourth plot shows combined ratio for all lines of business. Each plot also provides the gross written premium size, in USD millions, of each country.

For all quadrant plots, growth is determined based on five-year annualized premium growth. Countries with values greater than 7.5 percent are classified as high growth.

Loss ratio and combined ratio performance is determined based on five-year cumulative loss ratio and five-year net cumulative combined ratio, respectively. Each country's loss ratio performance is compared against its income level peers, using a USD 30,000 GDP per capita split between high income and low income countries; whereas, combined ratio performance is compared against the global combined ratio. Countries with five-year loss ratios lower than the average of their income peers, or combined ratios below the global combined ratio, are classified as outperformers.

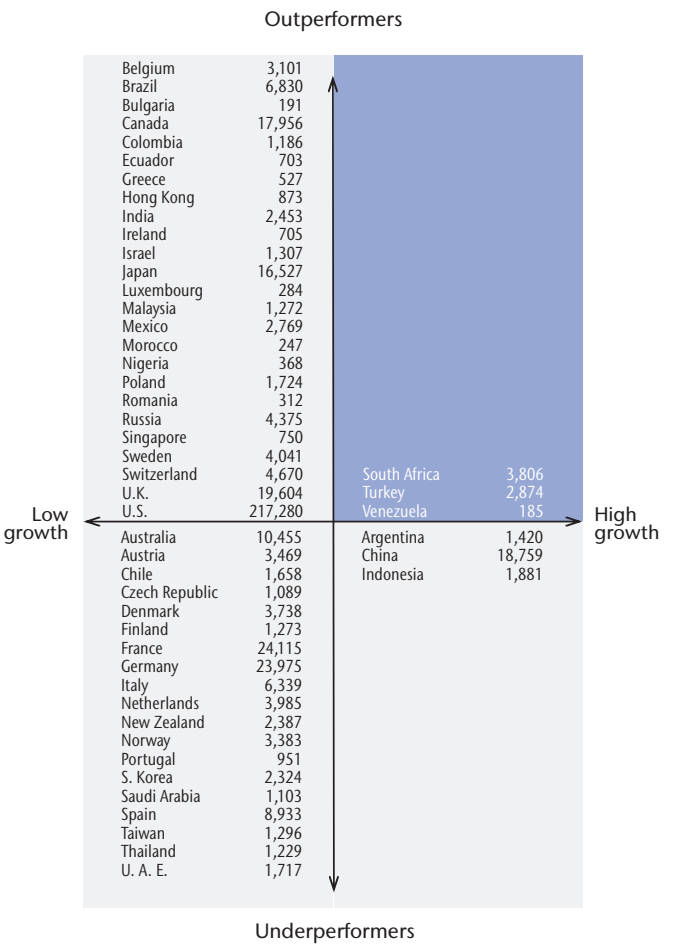
Motor

Loss ratio performance



Property

Loss ratio performance



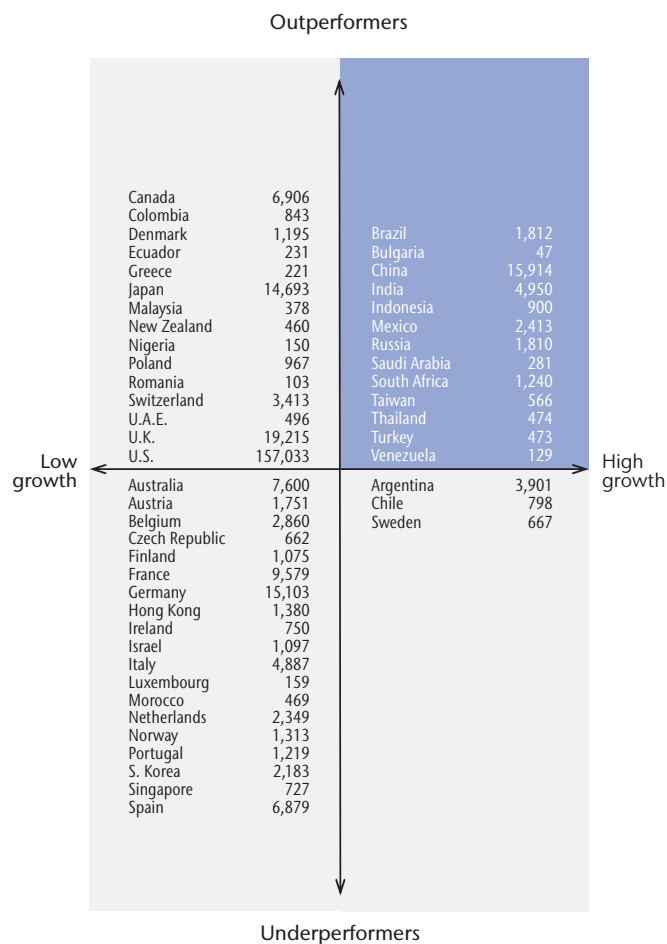
Nineteen countries are high growth, loss ratio outperformers in at least one line of business. Of these nineteen countries, five appear in two of three lines of business analyzed as high growth outperformers: China, Indonesia, Mexico, South Africa, and Turkey.

If we compare these countries based on overall combined ratio, Indonesia, Mexico, and South Africa are outperformers globally. The exceptions are China and Turkey, which underperform their peers with a five-year net combined ratio of 99.5 and 100.7 percent respectively, driven by high expense ratios of 39 percent and higher than average loss ratios. In addition to the five outperforming countries

mentioned above, two additional countries outperform the global averages for both growth and profitability. Brazil, for instance, outperforms for liability insurance, and its five-year combined ratio of 89.0 percent is better than both the global average and the average among its Americas peers. See the Top 50 P&C Markets table for more details on page four. Using combined ratio in addition to loss history allows us to further analyze and target high growth opportunities.

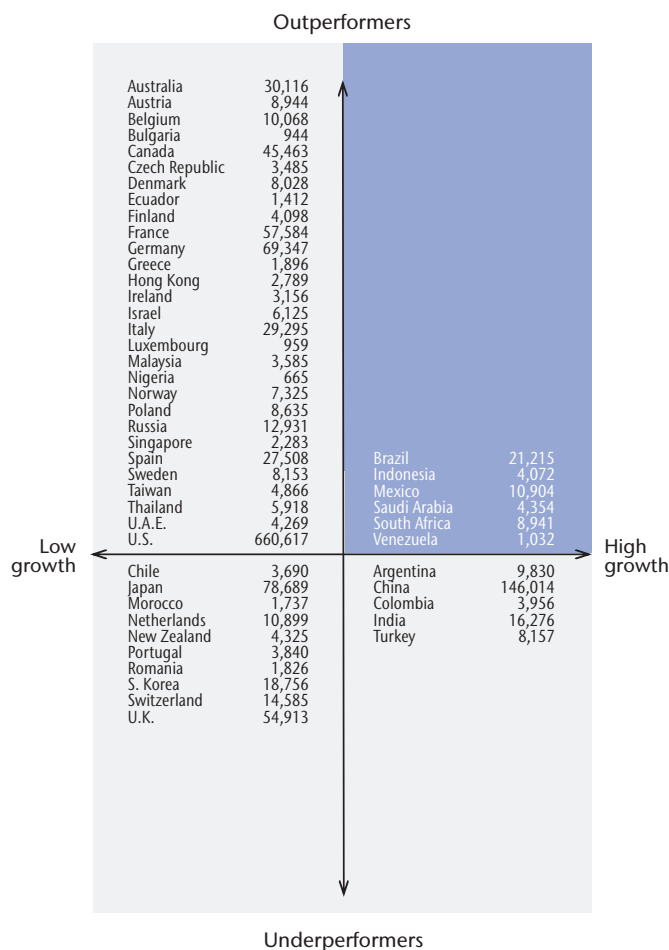
Liability

Loss ratio performance



All Lines

Combined ratio performance



Global Risk Parameters

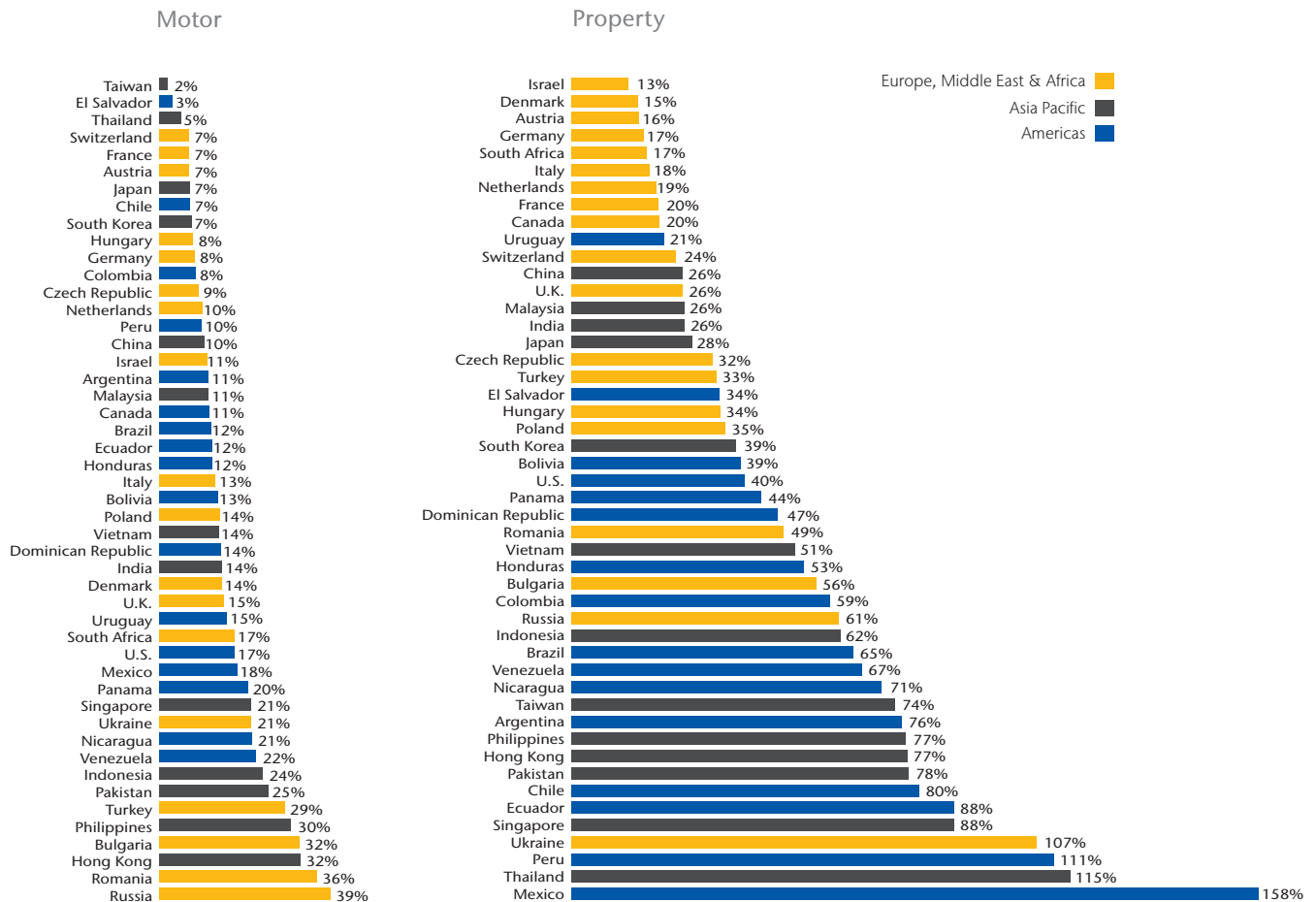
The insurance business is always a tradeoff of assuming risk in exchange for potential—presumed—return. We now turn to the “risk” side of the risk and return equation. Measuring the volatility and correlation of risk has long been the hallmark of the Study.

The 2019 edition of the Study quantifies the systemic risk by line for 48 countries worldwide. By systemic risk, or volatility, we mean the coefficient of variation of loss ratio for a large book of business. Coefficient of variation (CV) is a commonly used normalized measure of risk defined as the standard deviation divided by the mean. Systemic risk typically comes from non-diversifiable risk sources such as changing market rate adequacy, unknown prospective frequency and severity trends, weather-related losses, legal reforms and court decisions, the level of economic activity, and other

macroeconomic factors. It also includes the risk to smaller and specialty lines of business caused by a lack of credible data. For many lines of business systemic risk is the major component of underwriting volatility.

The systemic risk factors for major lines by region appear on the next page. Detailed charts comparing motor and property risk by country appear below. The factors measure the volatility of gross loss ratios. If gross loss ratios are not available the net loss ratio is used.

Coefficient of variation of gross loss ratio by country



Coefficient of variation of loss ratio for major lines by country

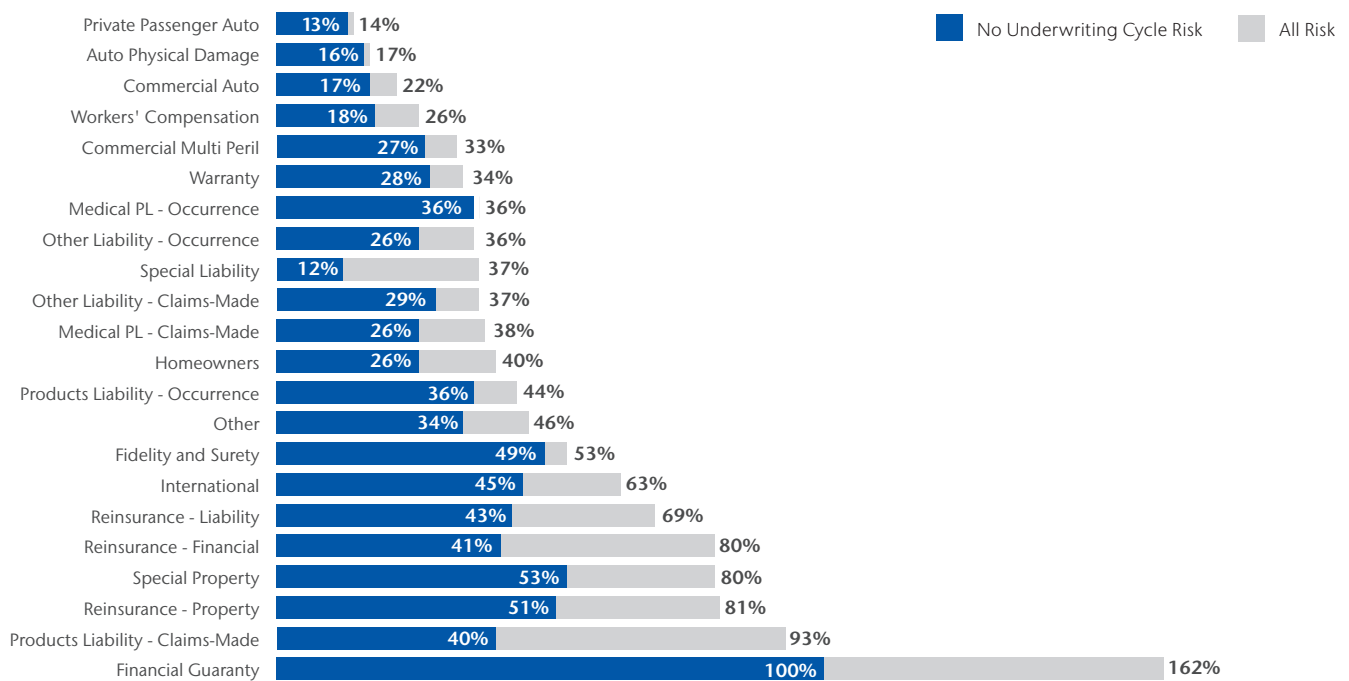
	Motor	Motor— Personal	Motor— Commercial	Property	Property— Personal	Property— Commercial	General Liability	Accident & Health	Marine, Aviation & Transit	Workers Compensation	Credit	Fidelity & Surety	
Americas	Argentina	11%		76%			136%	76%	88%			173%	
	Bolivia	13%		39%				7%				90%	
	Brazil	12%		65%			89%	97%	37%		96%		
	Canada	11%		20%	19%	32%	35%	34%	59%		71%	122%	
	Chile	7%		80%			71%	48%	68%			67%	
	Colombia	8%		59%		69%	39%	44%	73%			57%	
	Dominican Republic	14%		47%				38%				223%	
	Ecuador	12%		88%			109%	54%	69%			83%	
	El Salvador	3%		34%				12%				137%	
	Honduras	12%		53%				13%				220%	
	Mexico	17%		159%			85%	7%					
	Nicaragua	21%		71%				75%				205%	
	Panama	20%		44%				33%				177%	
	Peru	10%		111%			64%	22%	35%			101%	
	Uruguay	15%		21%							14%		41%
	U.S.	17%	14%	22%	40%	40%	33%	36%	46%	37%	26%		53%
Venezuela	22%		67%					28%				151%	
Asia Pacific	China	10%		26%			18%	32%	26%		36%		
	Hong Kong	32%		77%			77%	22%	59%	64%			
	India	14%		26%				11%	25%				
	Indonesia	24%		62%			122%	39%	86%		51%	114%	
	Japan	7%		28%			13%	8%	16%	19%			
	Malaysia	11%		26%			90%	35%	36%	95%			
	Pakistan	25%		78%					61%				
	Philippines	30%		77%				74%	97%			128%	
	Singapore	21%		88%				39%	66%	29%			
	South Korea	7%		38%			22%		57%			177%	
	Taiwan	2%	2%	74%			29%	11%	58%		104%		
	Thailand	5%		115%		140%		17%	34%				
	Vietnam	14%		51%			43%	55%	41%				
Europe, Middle East & Africa	Austria	7%		16%	13%	47%	19%	8%	25%		44%		
	Bulgaria	32%		56%									
	Czech Republic	9%		32%			22%						
	Denmark	14%		15%	14%	20%	23%	14%	21%	58%			
	France	7%		20%	22%	23%	29%	17%	38%			46%	
	Germany	8%		17%	18%	31%	25%	21%	21%		48%		
	Hungary	8%		34%									
	Israel	11%		13%			14%						
	Italy	13%		18%			29%	20%	44%		41%	71%	
	Netherlands	10%		19%			22%	41%	31%				
	Poland	14%		35%									
	Romania	36%		49%			100%						
	Russia	39%		61%									
	South Africa	17%		17%			55%	38%	42%				
	Switzerland	7%		24%			13%	10%	46%		89%		
	Turkey	29%		8%	33%		26%	87%	12%	57%		61%	123%
Ukraine	21%		107%										
U.K.	15%	13%	16%	26%	22%	25%	34%	15%					

U.S. Risk Parameters

For the U.S. risk parameters of the Study, we use data from 23 years of NAIC annual statements for over 2,890 individual groups and companies. Our database covers all 22 Schedule P lines of business and contains more than five million records of individual company observations from accident years 1987-2018.

The chart below shows the loss ratio volatility for each Schedule P line, with and without the effect of the underwriting cycle. The underwriting cycle effect is removed by normalizing loss ratios by accident year prior to computing volatility. This adjustment decomposes loss ratio volatility into its loss and premium components.

Coefficient of variation of gross loss ratio (1987-2018)



The underwriting cycle acts simultaneously across many lines of business, driving correlation between the results of different lines and amplifying the effect of underwriting risk to primary insurers and reinsurers. Our analysis demonstrates that the cycle increases volatility substantially for all major commercial lines, as shown in the table. For example, the underwriting volatility of reinsurance liability increases by 59 percent and commercial auto liability by 29 percent. Personal lines are more formula-rated and thus show a lower cycle effect, with private passenger auto volatility only increasing by 11 percent because of the cycle.

See page 58 of the [2015 Insurance Risk Study](#) for a detailed description of how the underwriting cycle input is calculated.

U.S. underwriting cycle impact on volatility

Line of Business	Impact
Reinsurance - Liability	59%
Other Liability - Claims-Made	50%
Other Liability - Occurrence	43%
Medical PL - Claims-Made	40%
Workers' Compensation	40%
Special Liability	29%
Commercial Auto	29%
Homeowners	22%
Commercial Multi Peril	21%
Private Passenger Auto	11%

Macroeconomic, Demographic, and Social Indicators

Country	GDP—PPP—USD billions	GDP 5yr Annualized real growth	Population—millions	Population 5yr annualized growth	GDP Per Capita—PPP, USD	Government consumption as % of GDP	Actual individual consumption as % of GDP	General government debt as % of GDP	New foreign direct investment—USD billions	Inflation rate	Unemployment rate	Corporate tax rate	Political risk assessment	Aon terrorism risk assessment	World Bank relative ease of doing business
Argentina	915.1	1.3%	44.6	1.1%	18,255	15.3%	72.3%	n/a	11.5	43.7%	9.2%	30.0%	Medium High	Medium	More difficult
Australia	1,318.2	4.3%	25.2	1.6%	46,555	15.8%	57.6%	19.2%	42.6	2.0%	5.3%	30.0%	Low	Low	Easiest
Austria	463.2	3.5%	8.9	0.9%	46,345	15.3%	57.4%	51.0%	15.6	1.8%	4.9%	25.0%	Low	Low	Easiest
Belgium	550.5	3.2%	11.4	0.5%	42,885	18.7%	57.4%	88.5%	-39.5	1.9%	5.9%	29.0%	Medium Low	Medium	Easiest
Brazil	3,365.3	0.8%	208.3	0.8%	14,360	21.6%	61.2%	54.1%	70.7	3.6%	12.3%	34.0%	Medium	Medium	More difficult
Bulgaria	162.3	4.9%	7.0	-0.7%	20,583	20.5%	63.0%	9.2%	2.2	2.4%	5.2%	10.0%	Medium	Low	Easier
Canada	1,836.8	3.6%	37.0	1.1%	44,135	18.7%	58.3%	27.9%	27.5	1.7%	5.8%	26.5%	Low	Low	Easiest
Chile	481.8	3.9%	18.5	1.0%	23,092	15.5%	66.6%	6.1%	6.4	2.3%	6.9%	27.0%	Medium Low	Medium	Easier
China	25,270.1	8.6%	1395.4	0.5%	16,098	13.0%	32.2%	n/a	168.2	2.3%	3.8%	25.0%	Medium	Medium	Easiest
Colombia	744.7	4.4%	49.8	1.1%	13,283	20.0%	64.8%	40.6%	14.0	3.4%	9.7%	33.0%	Medium	High	Easier
Czech Republic	395.9	5.2%	10.6	0.1%	33,219	23.2%	51.9%	n/a	9.2	2.3%	2.5%	19.0%	Medium Low	Low	Easiest
Denmark	301.3	3.6%	5.8	0.6%	46,330	20.4%	49.0%	14.8%	2.4	1.1%	5.0%	22.0%	Low	Low	Easiest
Ecuador	199.5	2.9%	17.0	1.5%	10,416	16.3%	61.8%	n/a	0.6	0.6%	3.7%	25.0%	Medium High	Medium	More difficult
Finland	256.5	3.1%	5.5	0.4%	41,271	20.1%	59.7%	22.3%	14.2	1.3%	7.5%	20.0%	Low	Negligable	Easiest
France	2,962.8	3.0%	64.7	0.3%	40,689	20.1%	57.1%	87.6%	47.3	1.3%	9.1%	31.0%	Medium Low	Medium	Easiest
Germany	4,356.4	3.6%	82.9	0.5%	46,719	15.7%	55.8%	41.0%	78.0	1.3%	3.4%	30.0%	Low	Medium	Easiest
Greece	312.7	2.4%	10.7	-0.5%	25,887	18.9%	72.7%	n/a	3.6	1.1%	19.6%	28.0%	High	Medium	Easier
Hong Kong	480.5	4.5%	7.5	0.7%	57,081	16.7%	29.7%	n/a	122.4	2.4%	2.8%	n/a	Medium	Medium	Easiest
India	10,505.3	9.3%	1334.2	1.3%	6,999	12.1%	59.7%	n/a	40.0	3.9%	n/a	30.0%	Medium	High	Easier
Indonesia	3,494.7	6.8%	264.2	1.2%	11,760	11.5%	55.2%	25.4%	21.5	3.3%	5.3%	25.0%	Medium	High	Easier
Ireland	385.9	12.1%	4.9	1.1%	70,032	8.3%	27.5%	55.7%	-3.4	1.2%	5.7%	12.5%	Medium	Negligable	Easiest
Israel	337.2	5.1%	8.9	2.0%	33,753	22.4%	56.0%	56.4%	18.2	0.9%	4.0%	23.0%	Medium Low	High	Easier
Italy	2,397.4	2.6%	60.5	0.0%	35,233	14.3%	62.0%	120.1%	9.2	0.8%	10.6%	24.0%	Medium	Low	Easier
Japan	5,594.5	2.6%	126.5	-0.1%	39,313	18.4%	57.8%	153.2%	18.8	1.1%	2.4%	30.6%	Medium Low	Low	Easiest
Luxembourg	64.2	4.7%	0.6	2.3%	94,850	12.8%	39.6%	-10.9%	6.6	1.6%	5.0%	26.0%	Low	Negligable	Easier
Malaysia	999.4	6.9%	32.4	1.4%	27,431	17.7%	58.4%	n/a	9.5	2.0%	3.3%	24.0%	Medium Low	Medium	Easiest
Mexico	2,569.8	4.3%	124.7	1.0%	18,313	15.4%	69.3%	45.0%	32.1	3.8%	3.3%	30.0%	Medium	Medium	Easier
Morocco	314.6	4.8%	35.2	1.1%	7,940	21.3%	52.4%	64.9%	2.7	1.4%	9.8%	31.0%	Medium	Medium	Easier
Netherlands	969.2	3.9%	17.2	0.5%	50,119	18.3%	46.7%	44.5%	316.5	2.3%	3.8%	25.0%	Low	Low	Easiest
New Zealand	197.8	5.1%	4.9	1.9%	35,676	17.2%	63.9%	8.8%	2.1	2.0%	4.2%	28.0%	Low	Negligable	Easiest
Nigeria	1,168.5	3.7%	193.9	2.8%	5,358	7.9%	78.7%	24.2%	3.5	11.7%	22.6%	30.0%	Very High	Severe	Most difficult
Norway	395.9	3.4%	5.3	0.9%	66,095	15.8%	41.9%	-79.1%	1.6	1.9%	3.9%	22.0%	Low	Negligable	Easiest
Poland	1,212.9	5.7%	38.0	0.0%	28,390	19.8%	63.1%	43.6%	10.7	2.0%	3.8%	19.0%	Medium Low	Medium	Easiest
Portugal	329.2	3.6%	10.3	-0.3%	28,450	18.2%	70.4%	108.2%	10.0	1.0%	7.1%	21.0%	Medium	Negligable	Easiest
Romania	516.3	6.3%	19.5	-0.5%	23,508	19.0%	62.8%	28.3%	6.0	3.3%	4.2%	16.0%	Medium High	Low	Easier
Russia	4,213.4	2.1%	144.0	0.1%	26,015	16.7%	62.8%	n/a	n/a	5.0%	4.8%	20.0%	Medium High	Medium	Easiest
Saudi Arabia	1,857.5	3.8%	33.2	2.1%	49,728	20.4%	41.5%	-0.1%	1.4	-0.7%	n/a	20.0%	Medium	High	Easier
Singapore	565.8	5.0%	5.6	0.9%	89,196	11.7%	32.1%	n/a	63.6	1.3%	2.1%	17.0%	Low	High	Easiest
South Africa	789.4	2.8%	57.7	1.7%	12,156	20.7%	61.0%	50.3%	1.4	5.0%	27.1%	28.0%	Medium	Medium	Easier
South Korea	2,136.3	4.6%	51.7	0.5%	36,756	16.7%	29.7%	12.6%	n/a	1.4%	3.8%	n/a	Medium Low	Medium	Easiest
Spain	1,864.4	4.4%	46.4	-0.1%	35,679	15.1%	58.7%	84.1%	6.2	1.2%	15.3%	25.0%	Medium	Low	Easiest
Sweden	542.0	4.5%	10.2	1.2%	47,097	21.0%	51.5%	5.9%	31.5	1.9%	6.3%	21.4%	Low	Low	Easiest
Switzerland	548.5	3.6%	8.5	1.1%	57,466	7.2%	48.6%	20.8%	37.9	0.8%	2.6%	18.0%	Low	Low	Easiest
Taiwan	1,251.5	4.1%	23.6	0.2%	47,132	n/a	57.7%	33.1%	n/a	1.1%	3.8%	20.0%	Medium	Medium	Easiest
Thailand	1,320.4	4.8%	67.8	0.3%	17,313	17.8%	53.0%	n/a	8.0	1.0%	1.2%	20.0%	Medium High	High	Easiest
Turkey	2,292.5	6.6%	82.0	1.4%	24,850	19.4%	53.7%	24.9%	10.9	17.5%	11.0%	22.0%	Medium	Severe	Easiest
U.A.E.	723.7	4.7%	10.4	2.9%	61,673	20.7%	64.9%	n/a	10.4	2.1%	n/a	55.0%	Medium Low	Low	Easiest
U.K.	3,037.8	3.7%	66.5	0.7%	40,627	15.7%	68.0%	77.5%	64.7	1.8%	4.1%	19.0%	Medium Low	Medium	Easiest
U.S.	20,494.1	4.1%	327.4	0.7%	55,650	12.0%	71.8%	80.9%	354.8	2.0%	3.9%	27.0%	Low	Medium	Easiest
Venezuela	331.0	-9.8%	29.2	-0.4%	9,487	20.7%	75.5%	n/a	n/a	1000000%	35.0%	34.0%	Very High	Severe	Most difficult

Global Correlation Between Lines

Correlation between lines of business is central to a realistic assessment of aggregate portfolio risk, and in fact becomes increasingly significant for larger companies where there is little idiosyncratic risk to mask correlation. Most modeling exercises are carried out at the product or business unit level and then aggregated to the company level. In many applications, the results are more sensitive to the correlation and dependency assumptions made when aggregating results than to all the detailed assumptions made at the business unit level.

The Study determines correlations between lines within each country. Correlation between lines is computed by examining the results from larger companies that write pairs of lines in the same country.

Aon's Reinsurance Analytics team has correlation tables for most countries readily available and can produce custom analyses of correlation for many insurance markets globally upon request. As examples, tables for the U.S., Canada, Colombia, and China appear below.

U.S.

	Homeowners	Private Passenger Auto	Commercial Multi Peril	Commercial Auto	Workers Compensation	Other Liability - Occurrence	Medical PL - Claims Made	Other Liability - Claims-Made	Products Liability - Occurrence
Homeowners		1%	29%	5%	-5%	3%	6%	2%	15%
Private Passenger Auto	1%		9%	18%	40%	18%	23%	19%	15%
Commercial Multi Peril	29%	9%		47%	28%	49%	47%	43%	39%
Commercial Auto	5%	18%	47%		47%	58%	60%	40%	56%
Workers' Compensation	-5%	40%	28%	47%		48%	51%	51%	52%
Other Liability - Occurrence	3%	18%	49%	58%	48%		71%	54%	61%
Medical PL - Claims Made	6%	23%	47%	60%	51%	71%		67%	56%
Other Liability - Claims-Made	2%	19%	43%	40%	51%	54%	67%		29%
Products Liability - Occurrence	15%	15%	39%	56%	52%	61%	56%	29%	

Canada

	Accident & Health	Credit	Fidelity & Surety	General Liability	Marine, Aviation & Transit	Motor	Property	Special Liability
Accident & Health		71%	-14%	25%	-5%	-2%	26%	-18%
Credit	71%		-43%	33%	26%	-3%	29%	-27%
Fidelity & Surety	-14%	-43%		11%	36%	-4%	-1%	80%
General Liability	25%	33%	11%		-2%	12%	0%	19%
Marine, Aviation & Transit	-5%	26%	36%	-2%		4%	9%	21%
Motor	-2%	-3%	-4%	12%	4%		10%	6%
Property	26%	29%	-1%	0%	9%	10%		1%
Special Liability	-18%	-27%	80%	19%	21%	6%	1%	

Columbia

	Accident & Health	Crop & Animal	Fidelity & Surety	General Liability	Marine, Aviation & Transit	Motor	Property	Special Liability	Special Property
Accident & Health		22%	2%	22%	-3%	18%	16%	14%	21%
Crop & Animal	22%		3%	14%	2%	42%	12%	11%	1%
Fidelity & Surety	2%	3%		41%	-4%	27%	10%	23%	15%
General Liability	22%	14%	41%		-5%	28%	17%	19%	13%
Marine, Aviation & Transit	-3%	2%	-4%	-5%		7%	7%	13%	10%
Motor	18%	42%	27%	28%	7%		19%	33%	27%
Property	16%	12%	10%	17%	7%	19%		13%	32%
Special Liability	14%	11%	23%	19%	13%	33%	13%		11%
Special Property	21%	1%	15%	13%	10%	27%	32%	11%	

China

	Accident & Health	Agriculture	Credit	Engineering	Financial Guaranty	General Liability	Marine, Aviation & Transit	Motor	Other	Property	Special Risks
Accident & Health		28%	12%	13%	10%	8%	1%	13%	-7%	12%	-9%
Agriculture	28%		32%	17%	9%	29%	-8%	7%	-15%	26%	-28%
Credit	12%	32%		32%	-11%	5%	4%	18%	6%	11%	4%
Engineering	13%	17%	32%		-2%	17%	-1%	28%	11%	12%	8%
Financial Guaranty	10%	9%	-11%	-2%		-4%	-3%	5%	-17%	-5%	-18%
General Liability	8%	29%	5%	17%	-4%		13%	22%	13%	9%	-6%
Marine, Aviation & Transit	1%	-8%	4%	-1%	-3%	13%		6%	73%	1%	43%
Motor	13%	7%	18%	28%	5%	22%	6%		17%	9%	-8%
Other	-7%	-15%	6%	11%	-17%	13%	73%	17%		17%	66%
Property	12%	26%	11%	12%	-5%	9%	1%	9%	17%		20%
Special Risks	-9%	-28%	4%	8%	-18%	-6%	43%	-8%	66%	20%	

Correlation is a measure of association between two random quantities. It varies between -1 and +1, with +1 indicating a perfect increasing linear relationship and -1 a perfect decreasing relationship. The closer the coefficient is to either +1 or -1 the stronger the linear association between the two variables. A value of 0 indicates no linear relationship whatsoever.

All correlations in the Study are estimated using the Pearson sample correlation coefficient.

In each table the correlations shown in bold are statistically different from zero at the 95 percent confidence interval.

Sources and Notes

Global Premium, Capital, Profitability & Opportunity

Sources:

A.M. Best, Axco Insurance Information Services, IMF World Economic Outlook Database April 2019 Edition, SNL Financial, Standard & Poor's, World Bank

Notes:

Premium amounts stated in USD are converted to USD by Axco. Growth rates are calculated in original currency and exclude currency exchange fluctuation.

Country Opportunity Index Calculation: For each combined ratio, growth and political risk statistic, countries were ranked and segmented into quartiles. A score of 1 to 4 was assigned to each metric based on quartile. Opportunity Index Score = one-third multiplied by combined ratio score plus two-thirds multiplied by average of premium, GDP and population growth and political scores. Ties were broken by premium growth.

Growth Markets and Out/Underperformers—Premium and growth calculated using Axco data. Loss ratios for motor, property and liability lines also calculated using Axco. “All lines” loss, expense, and combined ratios are calculated using A.M. Best’s Statement File—Global and are based on the net results of the largest 25 writers for a given country (where available).

Global Risk Parameters and US Risk Parameters

Sources:

Superintendencia de Seguros de la Nación (Argentina), FMA (Austria), Superintendencia de Pensiones, Valores y Seguros (Bolivia), Superintendencia de Seguros Privados (Brazil), Financial Supervision Commission (Bulgaria), MSA Research Inc. (Canada), Superintendencia de Valores y Seguros de Chile, China Insurance Yearbooks, Superintendencia Financiera de Colombia, Czech National Bank, Danish FSA (Denmark), CADOAR (Dominican Republic), Superintendencia de Bancos y Seguros (Ecuador), Superintendencia de Pensiones de El Salvador, NACI Annual Statements (France), BaFin (Germany), Comisión Nacional de Bancos y Seguros de Honduras, Hong Kong Insurance Authority, Magyar Nemzeti Bank (Hungary), IDRA (India), bapepam.go.id (Indonesia), Ernst & Young Annual Statements (Israel), ANIA (Italy), The Statistics of Japanese Non-Life Insurance Business, ISM Insurance Services Malaysia Berhad, Comisión Nacional de Seguros y Fianzas (Mexico), DNB (Netherlands), Superintendencia de Bancos y Otras Instituciones Financieras de Nicaragua, The Insurance Association of Pakistan, Superintendencia de Seguros y Reaseguros de Panama, Superintendencia de Banca y Seguros (Peru), Insurance Commission (Philippines), Polish Financial Supervision Authority KNF, Autoritatea de Supraveghere Financiară (Romania), Central Bank of the Russian Federation, Monetary Authority of Singapore, Quest Market Profile/ FSB (South Africa), FSIS (South Korea), Finma (Switzerland), Taiwan Insurance Institution, Annual Reports (Thailand), Undersecretariat of Treasury (Turkey), National Financial Services Commission (Ukraine), SFCR (UK), SNL Financial (US), Banco Central del Uruguay, Cámara de Aseguradores de Venezuela, Association of Vietnam Insurers, and annual financial statements

Macroeconomic, Demographic, and Social Indicators

Sources:

Aon Political Risk Map 2019 Edition, Aon Terrorism & Political Violence Map 2019, Axco Insurance Information Services, Bloomberg, IMF World Economic Outlook Database April 2019 Edition, KPMG, Penn World Table Version 9.0, World Bank

Notes:

Table—GDP (PPP) is GDP in local currency adjusted using purchasing power parity (PPP) exchange rate into US dollars. The PPP exchange rate is the rate at which the currency of one country would need to be converted in order to purchase the same amount of goods and services in another country.

Global Correlation Between Lines

Sources:

MSA Research Inc. (Canada), SNL Financial (US), Superintendencia Financiera de Colombia, and China Insurance Yearbook

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