



Harnessing predictive analytics to gain pricing insights in uncertain times

How auto insurers can model the impact of the economy on pure premiums



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Entering auto’s “new normal”

The COVID-19 pandemic has had a profound impact on almost all facets of civic and corporate life.

For both commercial and personal auto insurers, the lockdowns precipitated by the pandemic forced millions of cars off the road, leading to a sharp decrease in driving—up to 50 percent fewer miles driven in the span of a month, by some accounts.¹ This, in turn, prompted a number of insurers to return a portion of premium to their suddenly stationary customers. Insurers were likely guided in this decision by both state mandates (in some cases) and certain actuarial management and experience data—with fewer miles driven, experience suggested that risk levels (specifically accident frequency) were likely to drop, hence the ability to adjust premiums.

As the country adjusts to the “new normal,” auto insurers are no doubt exploring how risk levels will respond in a post-lockdown world.

In this case, predictive analytics can offer a useful complement to traditional experience data, allowing insurers to test a range of scenarios based on a variable set of assumptions about what the future may hold. Predictive analytics allows one to drill down to the roots of risk to better assess uncertainties and help drive profitability and growth in the long-term.

Deep uncertainties—from the course of the virus to the establishment of new habits and economic conditions—abound.



Putting predictive analytics to the test

Verisk subject matter experts recently analyzed the current auto insurance environment to explore the following questions:

**What are the potential impacts of the pandemic and economic recession on auto insurance pure premiums in the next year?
What can our predictive models tell us about this new normal?**

For this task we utilized ISO Risk Analyzer®, a suite of predictive models that helps classify, segment, and price insurance risks. The models predict expected losses at a highly refined level according to each risk's characteristics. The product covers four line of business: personal auto, commercial auto, businessowners, and homeowners.

Within ISO Risk Analyzer Personal Auto and Commercial Auto are the Environmental modules, which examine the interactive effects of hundreds of variables to provide more refined estimates of loss costs by geography. The model assesses features in various major categories (shown below with examples of characteristics considered):

- **Weather and terrain:** measures of temperature, wind speed, and topography
- **Traffic composition:** household size and home ownership
- **Traffic density and driving patterns:** commuting patterns and public transportation usage
- **Traffic generators:** transportation hubs, shopping centers, hospitals/medical centers, and entertainment districts
- **Experience and trend:** ISO advisory loss costs and state frequency and severity trends

By examining these attributes and accounting for the range of travel of vehicles, the models can provide insurers with a loss cost estimate that is more robust than relying on experience alone. The related rating plan is thus more specific than drawing traditional territory lines when confronted with low data volume.

Modeling traffic risk and economic decline

We can harness ISO Risk Analyzer and its predictive power to scenario test possible shifts in loss costs if we assume there will be changes to the underlying characteristics.

Our focus in this exercise lies in the Traffic Density and Traffic Generator components of the ISO Risk Analyzer model. Both components contribute to a traffic risk score that reflects auto risk in a given region.

What makes a model predictive?

Predictive models allow us to dig down to the roots of risk. We still use historical experience data to identify and measure predictive characteristics, but it's the characteristics that then drive the predictions.

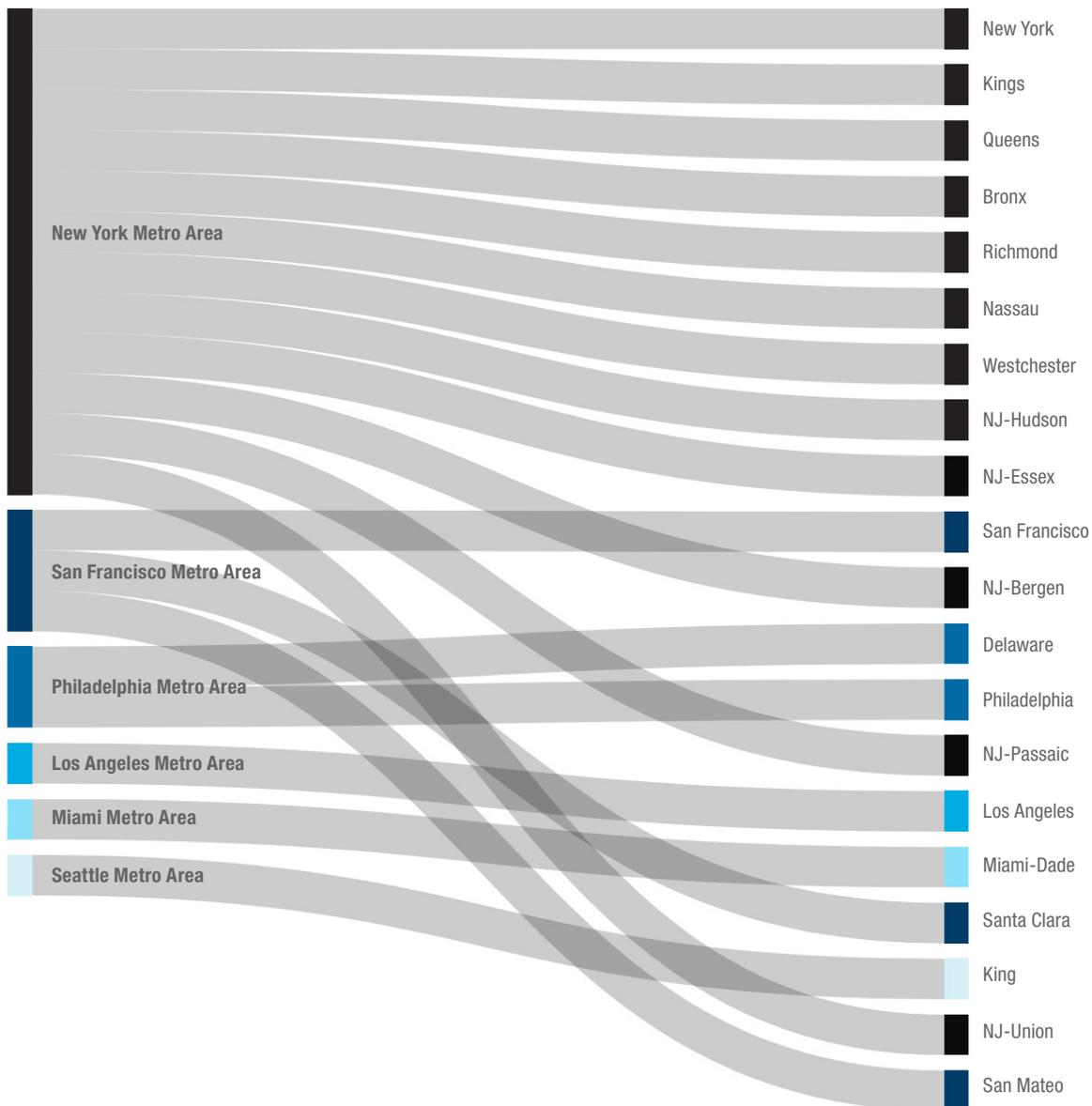
A critical component of any model, predictive or otherwise, is quality data inputs. The computer programming cliché, "garbage in, garbage out" definitely applies when it comes to model building.

How's traffic? Using advanced modeling to measure traffic risk

The traffic risk score has a lot in common with what we think about intuitively when we consider traffic. Dense metro areas will tend to score higher in the risk metric than other regions with lower population densities. A rigorous modeling process allows us to go beyond our general intuition and create a more finely-tuned metric that's useful for insurance predictions.

Counties with highest average traffic risk scores, by metro area

This chart depicts the ISO Risk Analyzer traffic risk score for Commercial Auto Trucks. The graphic shows the 20 counties with the highest average Traffic Risk Scores for property damage in descending order. The diagram also colors the counties by their greater metro area, to highlight the effects that some of country's population centers may have on traffic risk.



Without too much complication, we can use the big picture—the traffic risk score—in a **stress test**. The only other ingredient needed for this exercise is an economic indicator to seed the stress test:

What economic changes can we assume to measure downstream effects on mobility?

There are many possible choices for economic data inputs. ISO MarketStance produces a solution called Commercial Insight, which sizes out insurable markets within detailed cross-sections, including geography.

Commercial Insight provides estimates for various economic and exposure measures, including a firms' sales, payroll, and number of employees. The measure that stood out for this exercise was the number of operating locations a business has. If we consider the reasons autos are on the road, it's usually to commute to/from work, to carry out business and deliveries, or to visit someone else's business establishment. A reduction in the number of these locations would likely come along with an overall reduction in traffic density and traffic generation, so number of employees proved to be a reliable economic indicator.

ISO Risk Analyzer was then used to estimate how much the effects of reduced mobility diffuse as you relate it back to insurance risk. The effects of these business closures will be tempered once analyzed specifically for traffic risk in auto insurance. In turn, a reduction in traffic risk is only one piece of the puzzle in auto insurance.

Usefully, the number of operating locations has a **log-linear** relationship with the county average Traffic Density and Traffic Generator scores in ISO Risk Analyzer. This makes it quite easy to identify the general relationship between mobility (via our proxy variable of number of operating locations) and traffic risk. With the economic variable from ISO MarketStance in hand, we can flow some assumptions about plausible shifts in mobility to corresponding shifts in the traffic risk.

Within the ISO Risk Analyzer models, the loss costs then have a log-linear relationship with the traffic risk scores. This completes the puzzle—we can take the shifts in traffic risk to estimate the corresponding shifts in loss costs. The results for a given economic shift are roughly similar across personal and commercial auto overall, but there are some variations by line of business and type of coverage, such as **bodily injury, property damage, collision, and comprehensive**.

Key terms

Log-linear

Used when one variable experiences an exponentially increasing relationship to another

Scenario test

An exercise where you assume specific circumstances and evaluate the corresponding model output

Stress test

Performing a series of scenario tests to better understand the range of outcomes

Bodily injury

Liability coverage with respect to bodily harm and related expenses of others

Property damage

Liability coverage with respect to damage to property of others

Collision

Physical damage coverage for your vehicle in the event of an accident involving another vehicle or other objects

Comprehensive

Physical damage coverage for your vehicle in case of other losses, such as theft, fire, hail, or vandalism

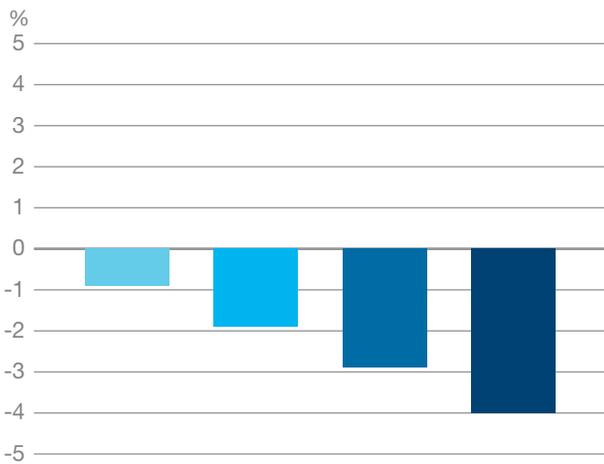
Measuring pure premium shifts in various economic scenarios

Comparisons are shown by line of business, coverage, and a given economic assumption, in this case a decrease in the number of commercial operating locations by 5, 10, 15, or 20 percent. A decrease in operating locations will naturally correspond to reduced traffic—with fewer open businesses, there will be a commensurate decline in traffic as delivery vehicles and passenger vehicles no longer frequent a closed location.

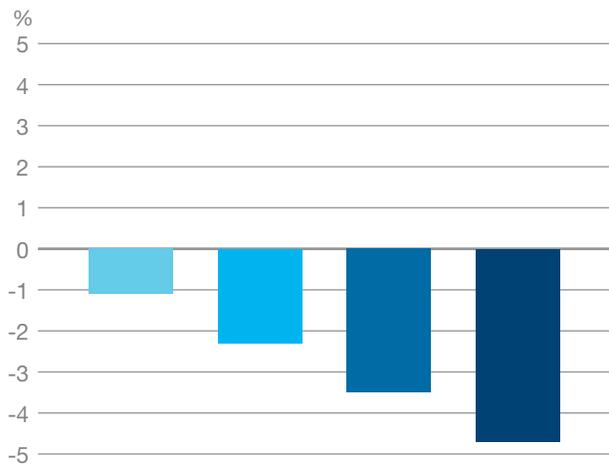
The output across the three lines of business (Commercial auto—trucks, tractors, and trailers, commercial auto—private passenger types, and personal auto) is outlined below:

Commercial Auto: Trucks, Tractors, and Trailers—Pure Premium Shift

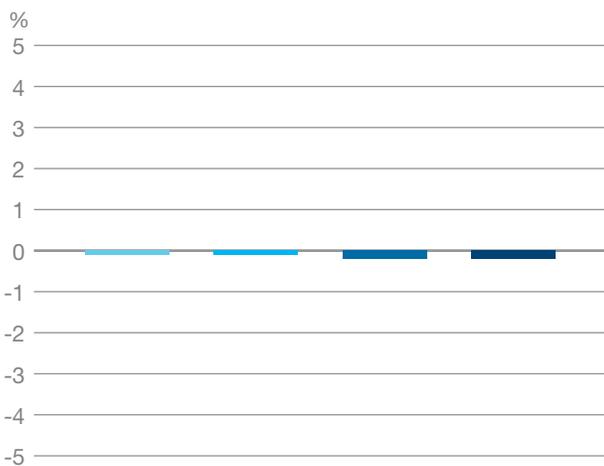
Bodily Injury



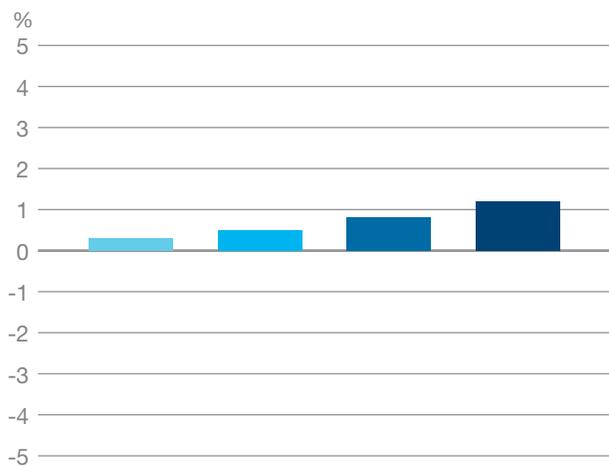
Property Damage



Collision



Comprehensive

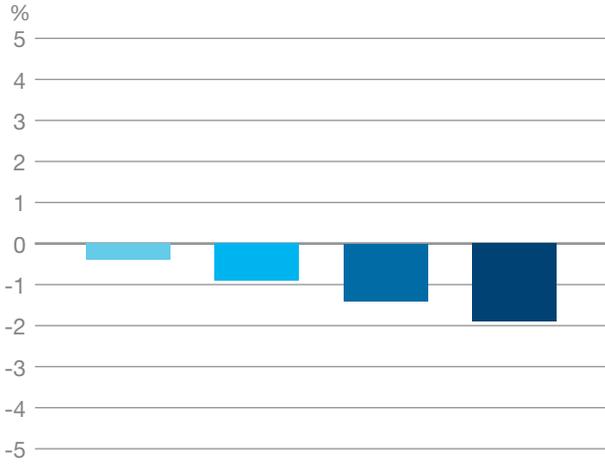


External Scenario

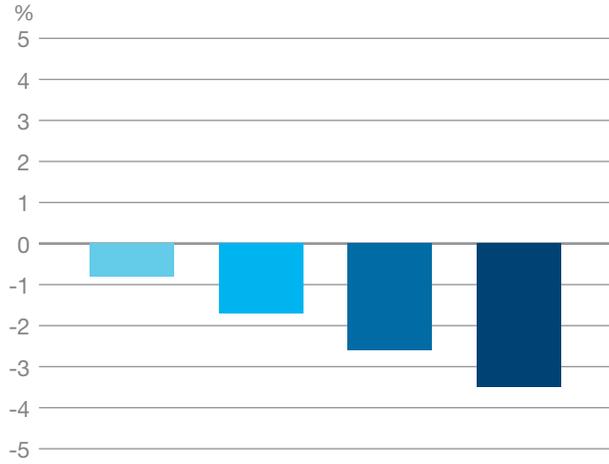


Commercial Auto: Private Passenger Types—Pure Premium Shift

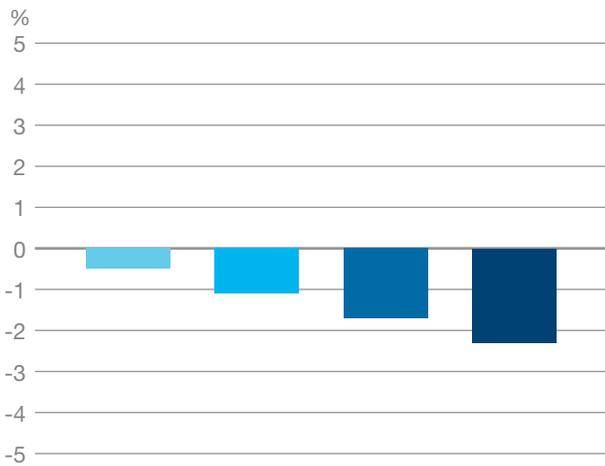
Bodily Injury



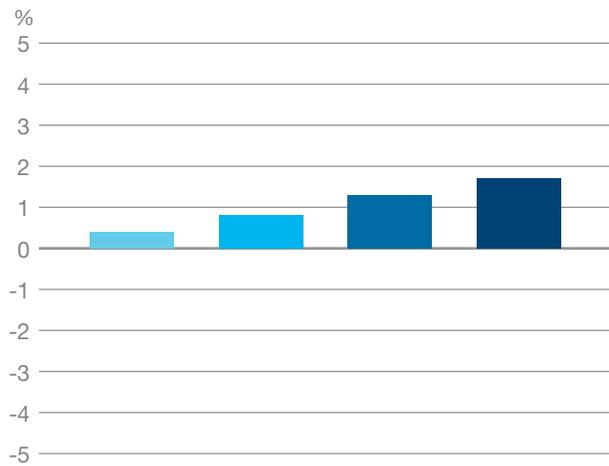
Property Damage



Collision



Comprehensive

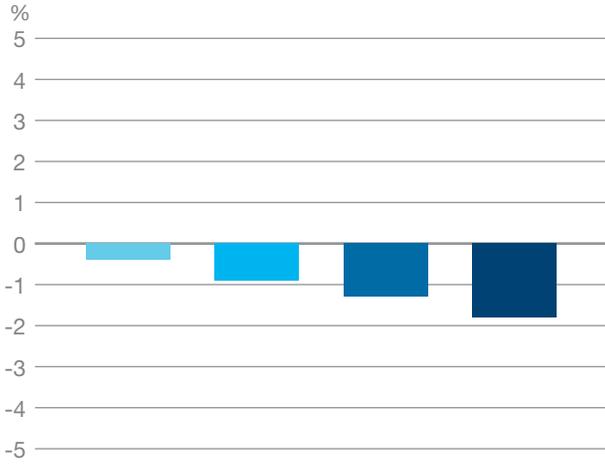


External Scenario

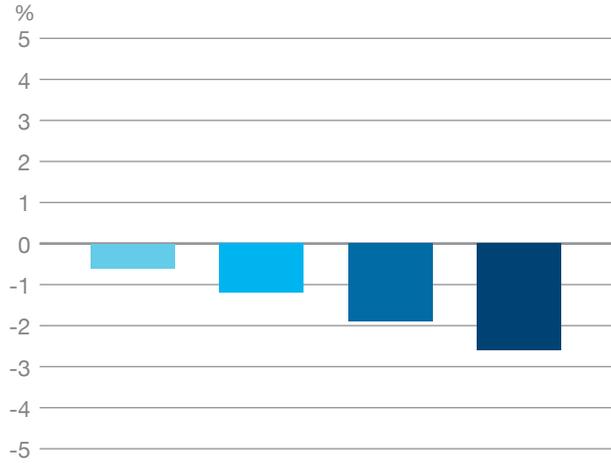


Personal Auto—Pure Premium Shift

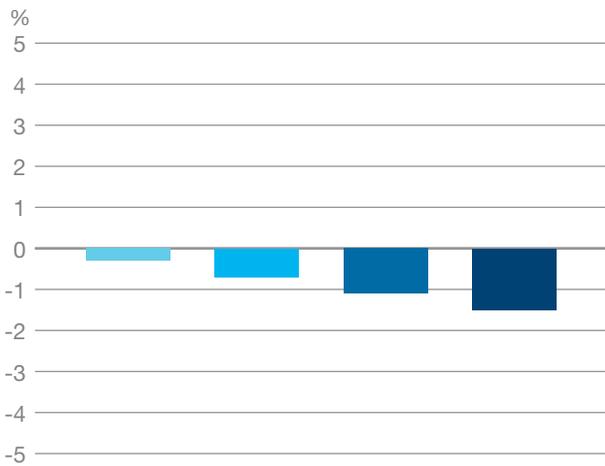
Bodily Injury



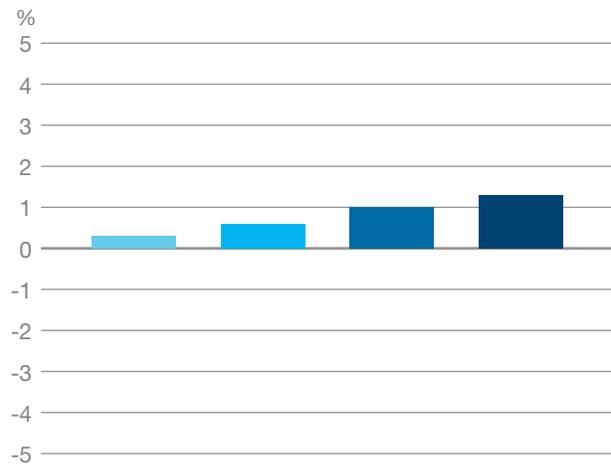
Property Damage



Collision



Comprehensive



External Scenario



Interpreting the results

For an individual insurance consumer, a premium adjustment of a few percentage points in a given direction may not typically amount to much. But from an insurer's perspective, multiplying that premium adjustment across an entire book of business can really add up.

Consider that the commercial auto industry has exceeded \$45 billion in direct written premium, and the average top 25 insurer has a book of nearly \$1.2 billion.² As commercial auto insurers seek to improve the performance of their books, every premium dollar counts. In personal auto, the industry is even larger and has a high-profile with consumers, with direct written premiums over \$253 billion.³



Liability—Bodily Injury and Property Damage

The models show a clear-cut relationship for liability coverages: a reduction in our chosen economic indicator may come with a reduction in liability pure premiums.

The effect is a little stronger for trucks, tractors and trailers than they are for passenger vehicles like personal autos and commercial auto private passenger types; this could be due to a combination of trucks' ability to inflict greater damage with the time they spend in high-risk traffic geographies.

The reductions in bodily injury pure premium range from less than 1 percent (in a scenario where economic reductions are 5 percent) to around 4 percent for trucks in the scenario where mobility is reduced 20 percent.

For property damage, the effects are similar to bodily injury but even more heightened. This makes sense, as property damage coverage is typically influenced more by claim frequency (less by severity) than bodily injury. For instance, drivers seeing less traffic, may potentially drive at higher speeds; this scenario may offset some of the reduction in bodily injury, as the consequences could be severe if something goes wrong. Meanwhile, the bumper-to-bumper accidents that contribute to property damage claims are still generally mitigated as a result of reductions to traffic.⁴

The overall effect are modeled reductions to both bodily injury and property damage pure premiums, with the steeper impacts on the latter.

Our model projected a range from under a 1 percent reduction in pure premiums for passenger cars in a scenario of minor reductions to mobility, to a 5 percent reduction for trucks under the 20 percent operating location reduction.



Physical Damage—Collision and Comprehensive

For collision coverage, there is a slightly lesser effect on passenger cars, and nearly no effect on trucks, regardless of external scenario. A possible explanation again rests with the types of accidents that precipitate collision claims for trucks. They aren't your run of the mill fender benders, and whatever the reduction that might stem from reduced traffic may be almost entirely offset by increased severity of the collision. For personal vehicles there is, however, some sensitivity to the change in traffic.

For comprehensive claims, the effect is actually reversed! A reduction in our economic indicator comes with an increase in comprehensive pure premiums. This seems to align with some issues that have emerged during the height of COVID-19 "lockdowns." Vehicle thefts have skyrocketed in major cities at a time of depressed mobility, in some cities even above 60 percent.⁵ With stay-at-home orders in place, drivers may not be checking in on their cars as regularly.⁶ And this applies to commercial vehicles as well. This relationship may not be as extreme in a world that more closely resembles business as usual, but the extreme nature of the pandemic can shed light on some of the underlying risk factors.



Flexibility of scenario testing

Scenario testing is an effective method, because it allows us to understand the relative differences between possible outcomes given different coverages, lines of businesses, and economic states of the world.

Take our choice of number of operating locations. It's possible that while some operating locations will resist closure amid the pandemic, they may operate in new ways in deference to evolving social-distancing norms. The new mode of operations could precipitate less mobility than the prior mode. If a restaurant shifts more of its orders to delivery, it might mean more auto use for their particular autos, but still less traffic risk overall.

Knowing this, it's possible to predict a 5 percent reduction in the number of operating locations, and still expect pure premiums to drop between the levels indicated by the 5 and 10 percent mobility reductions.

Ceteris paribus

A key assumption of most models remains true here: we must view these effects as *ceteris paribus* or “all other things equal.” The indications of this exercise are only one component of the inputs acting upon the risk process. There are many others that can influence the trend in the opposite direction.

The modeled effect we demonstrated here is predominantly loss frequency—the reduction in mobility is likely to reduce risk through lower accident frequency. There would likely also be a tempering effect caused by severity, wherein drivers, seeing fewer cars on the road, may be more tempted to drive recklessly and get into more serious accidents.⁷ Importantly, ISO Risk Analyzer considers frequency and severity, thus these effects are still accounted for within this exercise.

Nonetheless, there remain other effects to monitor, such as rising repair and replacement costs driven by the use of advanced driver assistance systems in more vehicles.⁸

It's also possible that effects may vary quite substantially in major cities like New York and San Francisco than they do in rural areas. For this, the full ISO MarketStance dataset from Commercial Insight provides forecasts by county, within cross-sections of industry and firm size. These can be used to test the potential effects in different geographic areas and identify the leverage that these pressures can have on heterogeneous books of business.

Harnessing predictive power to better navigate the “new normal”

Anticipate events with market insights for smart growth

With the right inputs, predictive modeling can be a powerful tool for projecting loss costs. At a moment of intense uncertainty, these models can allow us to explore a range of scenarios and arrive at more refined loss costs than might otherwise be available using historical loss costs alone.

Traditional approaches to rating require your plan to draw larger territories and broader class groups in order to build up enough volume for a useful prediction. Comparatively, ISO Risk Analyzer employs volumes of underlying characteristics that tell us much more than experience by itself. This allows us to make reliable predictions that are much more tailored to each individual risk’s situation. The ISO Risk Analyzer model combined with economic insights by ISO MarketStance can work to minimize some of the looming uncertainty that hangs over our new normal.

While this exercise is novel given the unique situation presented by the pandemic, the underlying motivations are the same. We want our data and decisions to be responsive and accurate and predictive analytics can help.

Invest in quality data and models to better assess business impact

It can become difficult to manage and maintain advanced models, and it may be impossible to build them without a large repository of data. However, ISO Risk Analyzer’s modules are built to provide an easy implementation of predictive analytics into decision-making.

The predictive suite of analytic tools harnesses the power of granular data that can become even more critical when economic and social changes abound.

Potential strategies for success

1. Identify the goals of your model and how they nest with the greater goals of your analyses.
2. Understand the assumptions of your model and ask how different circumstances challenge those assumptions.
3. Remember that models are not replacing your intuition, rather they are finding ways to deploy your intuition at greater scale and in much more refined details.
4. Quality inputs matter. A model is only as good as its underlying data inputs. In this case, using high-quality econometric from ISO MarketStance gave us the confidence we needed to seed our model.

Author

Ralph Dweck

Senior Actuarial Consultant, ISO

For more information

 ISORiskAnalyzer@iso.com

 MS@marketstance.com

 verisk.com/isoriskanalizer

 verisk.com/marketstance

 1-800-888-4476

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