Auto Loss Cost Trends Report

January 2018

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Collision frequency in the United States is strongly and positively related to various measures of congestion.

In the latter half of 2013, personal auto insurance carriers began to notice an uptick in property damage liability and collision frequency. This marked the beginning of a new increasing frequency trend bucking over 25 years of falling crash rates. While the period of falling frequency preceding this increase was largely attributable to safety awareness, technology, and enforcement, explanations supporting increasing frequency were largely speculative.

In response, industry partners banded together to analyze these trends. Using publicly available data from the Federal Highway Administration, Bureau of Labor Statistics, the Census Bureau, and other sources, an analysis group is searching for explanatory variables. This paper represents some of their findings around collision frequency, but further analysis is being conducted on frequency trends for other coverages and for severity. The group's goal is to provide an analytical basis for discussing and understanding auto insurance loss cost drivers that ultimately affect premiums.

Analysis

National private passenger auto collision frequency rates from 4Q 2011 through 4Q 2015 are shown in Figure 1[1]. Massachusetts, Michigan, Maryland, and New York have the highest average collision frequency, while South Dakota, Idaho, Wyoming, and Montana have the lowest.

To analyze collision frequencies, states were divided into quintiles each year based on their average collision frequency. Quintile averages were then plotted against a set of automotive and financial variables. A description of all the variables in the analysis is available at the end of this report. Sample plots are shown in Figure 2.

Figure 1
Average Collision Frequency, 4Q 2011 – 4Q 2015

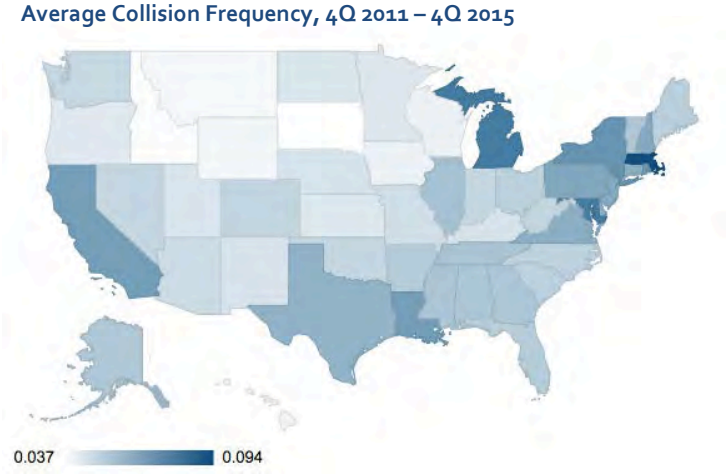
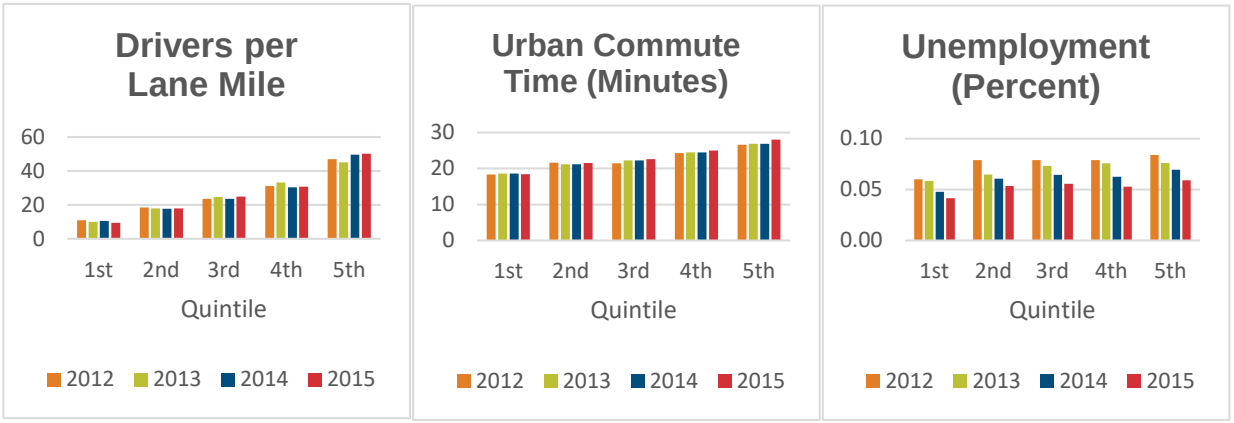
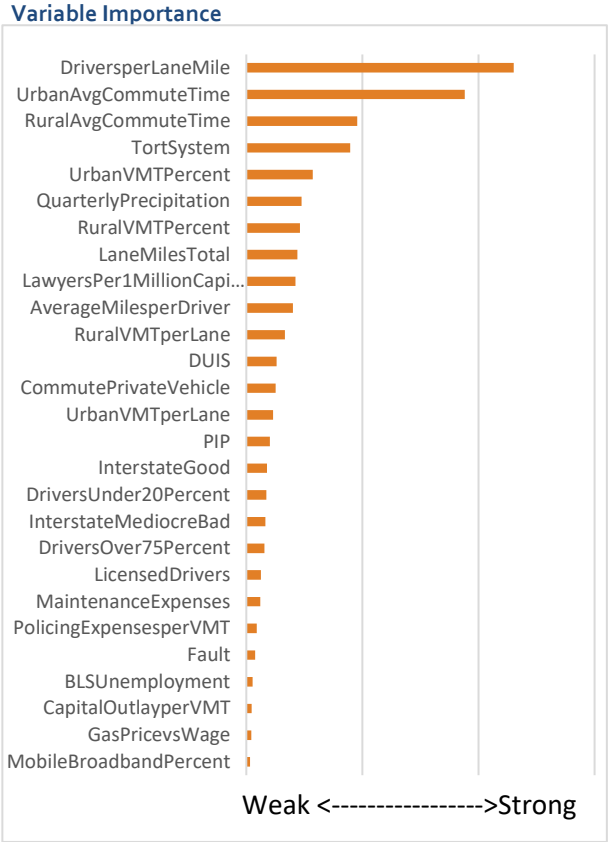


Figure 2
Histograms of Factors Grouped by Quintile



[1] Private Passenger Auto Paid Collision Claim Frequency, FAST TRACK PLUS™, 06 October 2017

Figure 3
Variable Importance



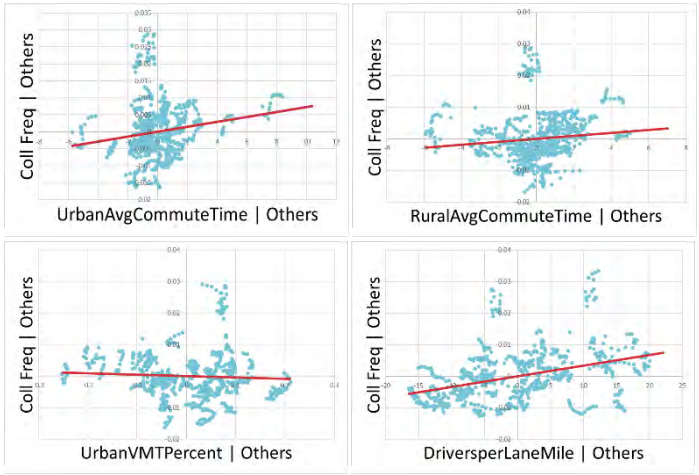
Another way to examine the impact of a single variable is an added variable plot. These plots show the relationship between collision frequency and the chosen variable after accounting for the impact of all the other variables in the model. When looking at the added variable plot we see that the pattern is consistent for both commute time variables and for drivers per lane mile. Urban VMT became slightly negatively related, though the relationship is not terribly strong.

Drivers per lane mile has a strong positive relationship with collision frequency, and the relationship is very consistent across years. The same is true about many of the other congestion variables (rural/urban vehicle miles traveled (VMT) per lane, rural/urban commute time, number of licensed drivers, etc.).

Other variables which are driven by national trends, like unemployment, don't show much of a pattern other than between the years within the quintiles.

Many of the variables which appear to be strongly correlated with collision frequency are related to congestion. To distinguish between the variables and find the ones which best predict collision frequency, a random forest was constructed to compare the importance of each variable to the model. Variables with more importance have the best predictive ability. As seen in Figure 3, five variables stand out: Drivers per Lane Mile, Urban Average Commute Time, Rural Average Commute Time, System, and Urban VMT.

Figure 4
Added Variable Plots



Similar to the relationships seen in Figure 4, the state-specific relationships with collision frequency are relatively strong for all the congestion variables, especially drivers per lane mile. One notable exception is Connecticut, shown in Figure 5. It seems to follow the pattern relatively well except for 4Q 2011. During that quarter, a major storm caused excessive snowfall throughout the state.

Figure 5
Connecticut collision and congestion

Other Interesting Relationships to be Further Explored

There are a few interesting relationships that we are still investigating. As we continue this analysis to more coverages and more years, we hope to gain a better understanding.

- DUIs appear to be negatively related to collision frequency, even after accounting for a few outlying states.
- Mobile broadband access (used as a proxy the likelihood that a driver may have a mobile device while driving) appears to have no impact on collision frequency. With all the current press around distracted driving, this was surprising (if it is a good proxy). Likely, we need to find a better proxy for distracted driving.
- The system (no-fault vs. tort) doesn't appear to impact the expected collision frequency, but has a big impact on the variance of the frequency.
- Both CA and WY increase in collision frequency, but decrease in drivers per lane mile each quarter.

Data Description

For this analysis, we focus on auto collision frequency and its drivers. We have quarterly frequency (claim count/exposures) data for each state (excluding DC and HI) from Q4 2011 through Q4 2015. Additionally, we have the following state-level explanatory variables.

- UrbanVMTPercent: Percent of the vehicle miles traveled (VMT) in an urban area.
- LawyersPer1MillionCapita: Number of lawyers in the state per 1 million people.
- UrbanAvgCommuteTime: Average commute time in minutes for people in urban areas.
- RuralAvgCommuteTime: Average commute time in minutes for people in rural areas.
- MobileBroadbandPercent: Percent of population with access to mobile broadband
- InterstateGood: Percent of interstate miles rated as good
- DriversUnder20Percent: Percent of drivers under age 20
- DriversOver75Percent: Percent of drivers over age 75
- CommutePrivateVehiclePercent: Percent of people who commute by private vehicle
- AverageQuarterlyPrecipitation: Average quarterly precipitation in inches.
- BLSUnemployment: Unemployment rate from Bureau of Labor Statistics (BLS)
- UrbanVMTperLane: Urban vehicle miles traveled per urban lane mile.
- RuralVMTperLane: Rural vehicle miles traveled per rural lane mile.
- CapitalOutlayperVMT: Total transportation dollars spent on capital projects, per vehicle miles travelled.
- MaintenanceExpensesperVMT: Total transportation dollars spent on maintenance expenses, per vehicle miles travelled.
- PolicingExpensesperVMT: Total transportation dollars spent on policing expenses, per vehicle miles travelled.
- DUIs: Total DUIs per driver
- GasPricevsWage: Average gas price in dollars divided by average hourly wage in dollars.
- TortSystem: No-fault, optional no-fault, tort
- LicensedDrivers: Number of licensed drivers in the state.
- LaneMilesTotal: Total number of lane miles in the state.
- DriversperLaneMile: LicensedDrivers/LaneMilesTotal