



# LINKING DRIVING BEHAVIOR TO AUTOMOBILE ACCIDENTS AND INSURANCE RATES

AN ANALYSIS OF FIVE BILLION MILES DRIVEN



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# EXECUTIVE SUMMARY

“Snapshot®, and what is sure to follow in its evolution, is a meaningful start toward personalized insurance pricing based on real-time measurement of your driving behavior—the statistics of one.”

—Glenn Renwick, 2011 Letter to the Shareholders

## OVERVIEW AND FINDINGS

Historically, auto insurers have priced their products based on estimates derived from actuarial classes that include observable and verifiable characteristics like age, vehicle year/make/model, ZIP code, claims record, etc.

As good as the base science is, it lacks a direct relationship to individual driving behavior. Not surprisingly, people would prefer their rate to reflect their true behavior. They want to be treated as individuals—not as members of an actuarial class.

For 15 years, Progressive® has been collecting data on customer driving behavior, and analyzing how that data relates to the likelihood an individual will have a claim. The company has now collected 5 billion miles of driving data, giving it unprecedented insight into this relationship. Among the findings:

- **Driving behavior is the most predictive risk factor—more than twice as predictive of claims costs as any other factor.**
- **Drivers with the highest-risk driving behavior have loss costs that are approximately 2.5 times higher than drivers with the lowest-risk behavior.**
- **The majority of drivers with lower-risk driving behavior are subsidizing a smaller number of drivers with higher-risk behavior.**
- **7 out of 10 drivers who try Snapshot® receive a discount.**
- **The range of rates could be much wider and more personalized than they are today.**

## CONCLUSION

The data support the popular notion that there's a better way to calculate an individual's rate. The consumer was right all along—most drivers' rates are higher than the risk they present, and they're subsidizing higher risk behavior. What is surprising, perhaps, is the degree to which that notion is correct. Insurers like Progressive can now offer customers a far more personalized price—and lower-risk drivers will benefit the most.

## PROGRESSIVE'S MODEL—'SNAPSHOT®'

With Progressive's patented data collection program—called Snapshot—customers plug a small device into the on-board diagnostic (OBD) port in their car. The device collects and transmits data to Progressive on the time of day the car is driven, hard brakes and total mileage. Progressive then factors the data into the customer's rate calculation. After 30 days, the company can offer the customer a discount of up to 30 percent.

Snapshot is now available to policyholders in 42 states and the District of Columbia. And having seen the predictive power of this data, Progressive has launched a major expansion of Snapshot. Drivers now don't need to be a current Progressive customer to enroll in a 30-day free trial, during which they can learn whether their personal driving habits qualify them for additional savings of up to 30 percent off Progressive's auto insurance rates. They can then compare that price to the rate they currently pay with their existing insurer. Drivers who test drive Snapshot can track their potential savings on a daily basis during their trial.

## IMPLICATIONS FOR CONSUMERS

As driving data becomes more available, rates will become far more individualized—and fairer—than they are today.

# USAGE-BASED INSURANCE—OVERVIEW

## WHAT IS USAGE-BASED INSURANCE?

Historically, auto insurers set prices by grouping individuals into actuarial classes. These classes are based on observable and verifiable characteristics like age, vehicle year/make/model, ZIP code, claims record, etc. As good as the base science is, it lacks direct relationship to individual driving behavior.

It's only in recent years that the concept of pricing auto insurance based on actual driving behavior has become both technologically and economically feasible. Previously driving behavior was difficult or impossible to ascertain in a traditional insurance rating plan.

Usage-based insurance (UBI) considers multiple dimensions of driving behavior. This driving data can be integrated with traditional auto insurance rating factors to provide a comprehensive individual profile for predicting the risk of accidents.

## THE UBI CONCEPT CONSIDERS THE FOLLOWING ELEMENTS OF DRIVING BEHAVIOR:



How much one drives: **Mileage.**



The quality of how one drives: **Fast acceleration, hard braking, turning, cornering.**



When one drives: **Time of day or night.**

The emergence since the early 1990's of computerized automotive systems, cellular technology/telematics, and the Internet means that insurers now have access to cost-effective technologies that can gather and transmit the data needed to measure individual driving behavior—and prove the actuarial and business model viability.

Progressive Insurance has emerged as the leader in UBI. Since the late 1990's, the company has introduced a series of UBI models—refining technologies and consumer approaches while collecting the critical mass of driving data needed.

## WHO BENEFITS?

Simply put, UBI is best for people who drive fewer miles, in safer ways and during safer times of day.

The approach is attractive to those who want more control over their insurance costs, those who want real-time feedback to teach other drivers (e.g., a parent of a teenage driver) and those who have traffic congestion or environmental concerns.

The potential social benefits have attracted the attention of academia. The economist Steven Levitt has written that UBI helps prevent accidents, road congestion and greenhouse gas (GHG) emissions.<sup>1</sup> This view is supported by a Brookings Institution report that estimates a multi-billion dollar savings to the economy if UBI models are adopted.<sup>2</sup> If drivers could be directly incentivized to adopt lower-risk

behaviors, the subsequent reductions in accidents, injuries and fatalities could also be substantial, and is a promising area for further inquiry.

For insurance companies, harnessing the power of UBI pricing models means collecting far more comprehensive sets of data on individual drivers. The potential means a much more powerful risk segmentation capability compared to companies that use only traditional pricing models.

Insurance companies that act first can enhance their consumer brand by offering a differentiated product and service(s). This is expected to lead to growth in interested consumer segments shopping for these products.

<sup>1</sup> Dubner, Stephen J., and Steven D. Levitt. "Not-So-Free Ride." *New York Times Magazine* 20 Apr. 2008: 40. Web. 5 July 2012.

<sup>2</sup> Bordoff, Jason E., and Pascal J. Noel. "Pay-As-You-Drive Auto Insurance: A Simple Way To Reduce Driving-Related Harms And Increase Equity." *Hamilton Project: Discussion Papers* 9 (2008): 1-54. Web. 5 July 2012.



# DATA METHODOLOGY

## BACKGROUND

Progressive's findings are based on analysis of UBI policies with approximately five billion miles of cumulative driving behavior along with those policies' associated parameters and loss costs.

Since the company's product introduction in 2004, almost a million customers have tried the company's UBI programs (*see Figure 1*).



One of the largest challenges insurers will face in 2012 and beyond is capturing and interpreting data from a growing number of structured and unstructured sources... Insurers that apply advanced analytical techniques to harness the power of big data will be better able to understand their customers, tailor products to meet their needs, and enhance the overall customer experience.<sup>3</sup>

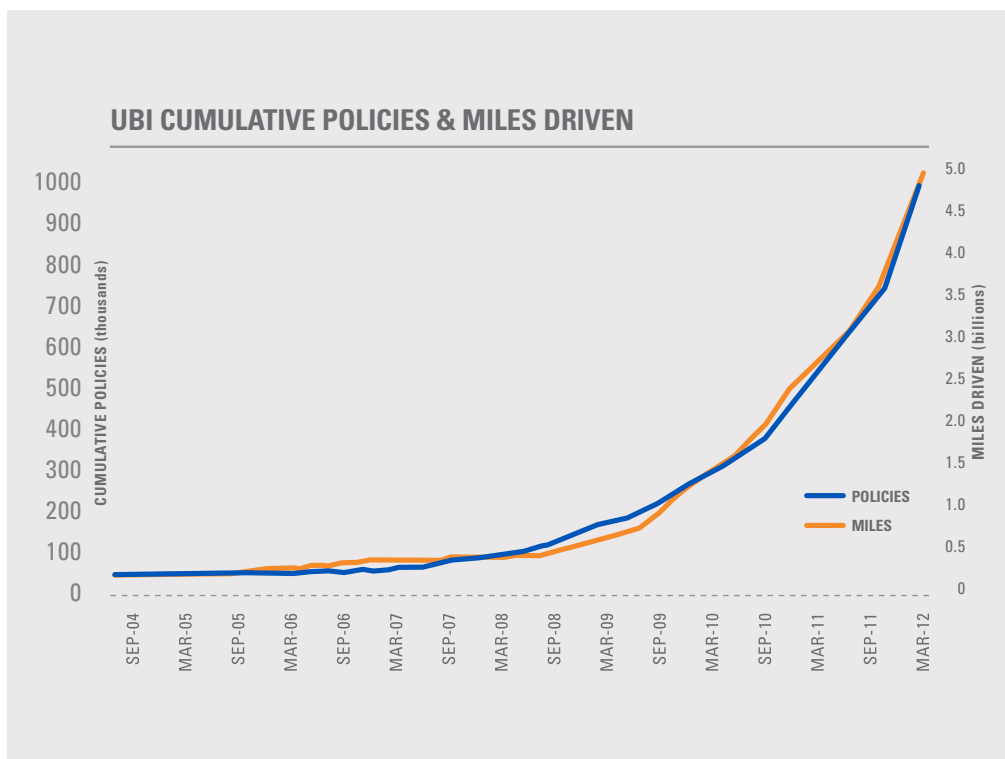


Figure 1 - Cumulative miles driven

## STUDY GROUP

The study group consists of almost a million Progressive customers who, by participating in the company's UBI programs, shared their driving data between 2004—2012. Through this period, Progressive made the offer to eligible drivers in states where the UBI program was available.

## STUDY FOCUS

The primary hypothesis is that driving behavior variables are more predictive of auto insurance accidents than historical rating variables. Proving or disproving this hypothesis requires a large set of driving data and accidents.

<sup>3</sup> "2012 Is the Year of the Customer, According to PwC Top Issues in Insurance Report." PwC. N.p., 27 Mar. 2012. Web. 06 July 2012. <http://www.pwc.com/us/en/press-releases/2012/2012-is-the-year-of-the-customer.jhtml>.

# KEY FINDINGS

## DRIVING BEHAVIOR AS A PREDICTOR OF AUTO INSURANCE ACCIDENTS

Individual driving behavior data introduces a new data universe to auto insurers with multiple variables that can add insight on risk segmentation and accident claims prediction.

### THE MAJOR FINDINGS FROM THE DRIVING BEHAVIOR DATA ARE:

1

An analysis of the reduction in average squared error—a method to measure statistical accuracy associated with driving behavior and other traditional rating variables—indicates that **driving behavior is the most predictive of expected claims costs**. The predictive power associated with driving behavior is more than twice as powerful as the second most powerful variable, which is driving record points (see Figure 2).

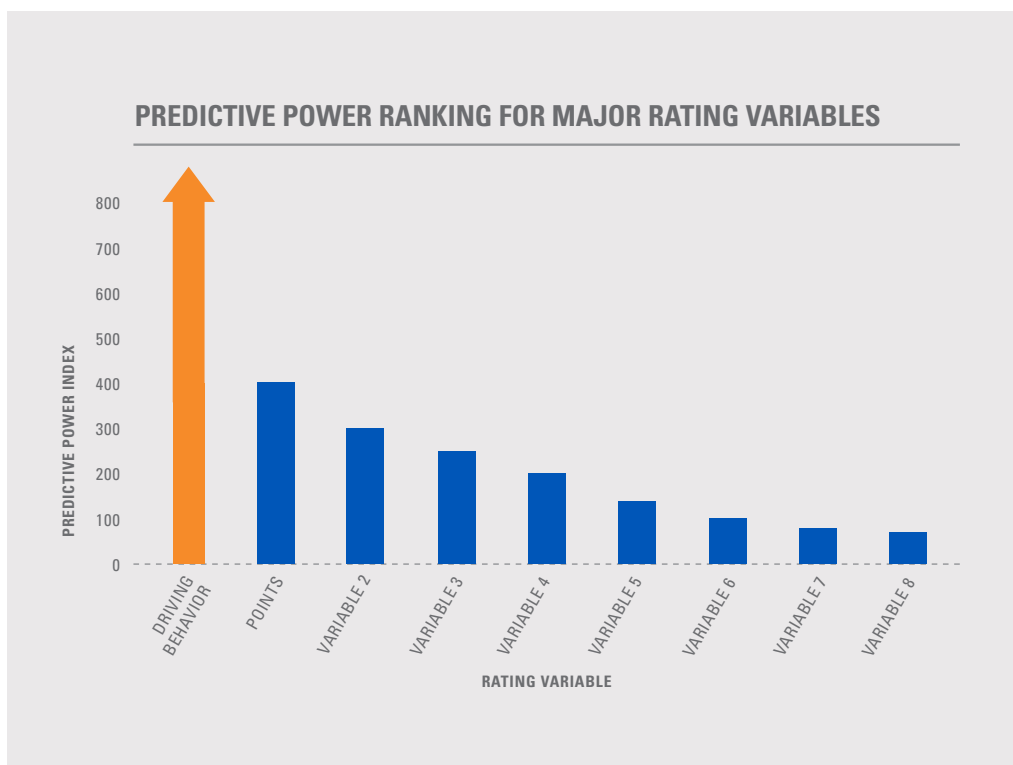


Figure 2 - ASE chart

# KEY FINDINGS

## 2

The predictive power of driving behavior is also demonstrated by the adjusted loss ratio relativity—a measure of the range of claims costs associated with driving behavior—associated with different UBI decile groups. For otherwise identical drivers, **it costs about two and a half times more to insure those with highest-risk driving behavior than those with lowest-risk behavior** (see Figure 3). This suggests that, as driving behavior is introduced to auto insurance rating, the range of rates in the market could be much greater than with traditional auto insurance rating.

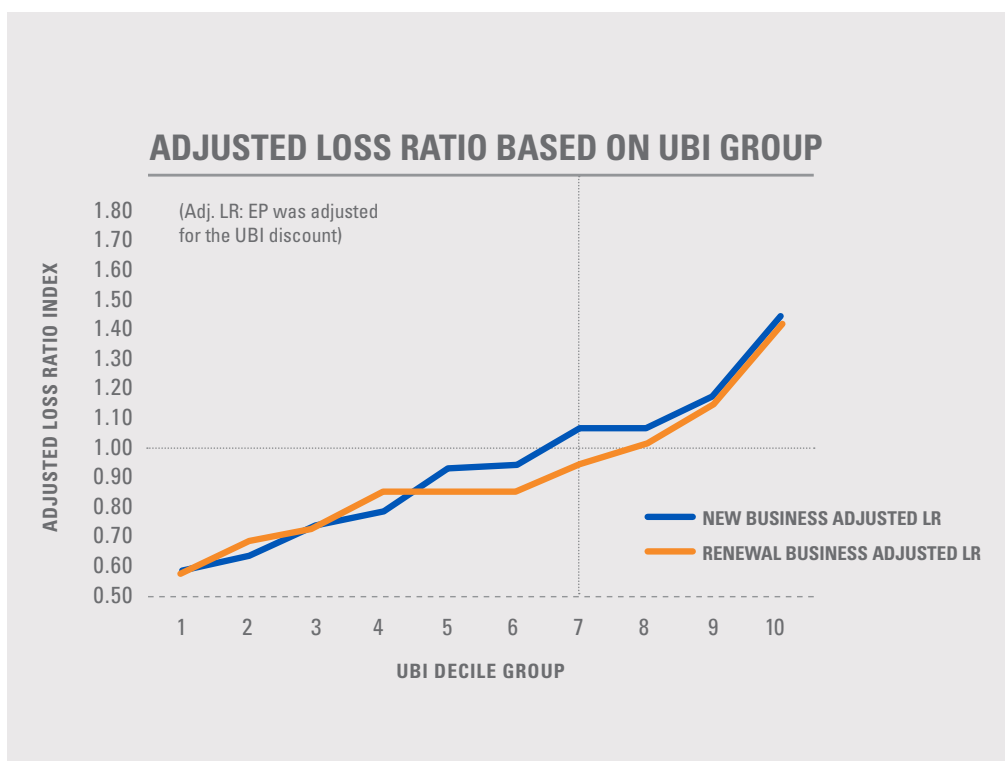


Figure 3 - Adjusted LR by decile group

# KEY FINDINGS

## 3

Driving behavior results from the study group show that the **majority of drivers, 70 percent, who try Progressive's UBI product, Snapshot, receive a discount** (see Figure 4). Further, the range of results on indicated discount or surcharge shows that the group of low-risk drivers who earn discounts subsidize the group of high-risk drivers. Note that Progressive's Snapshot model caps the discount at 30 percent and has no surcharge.

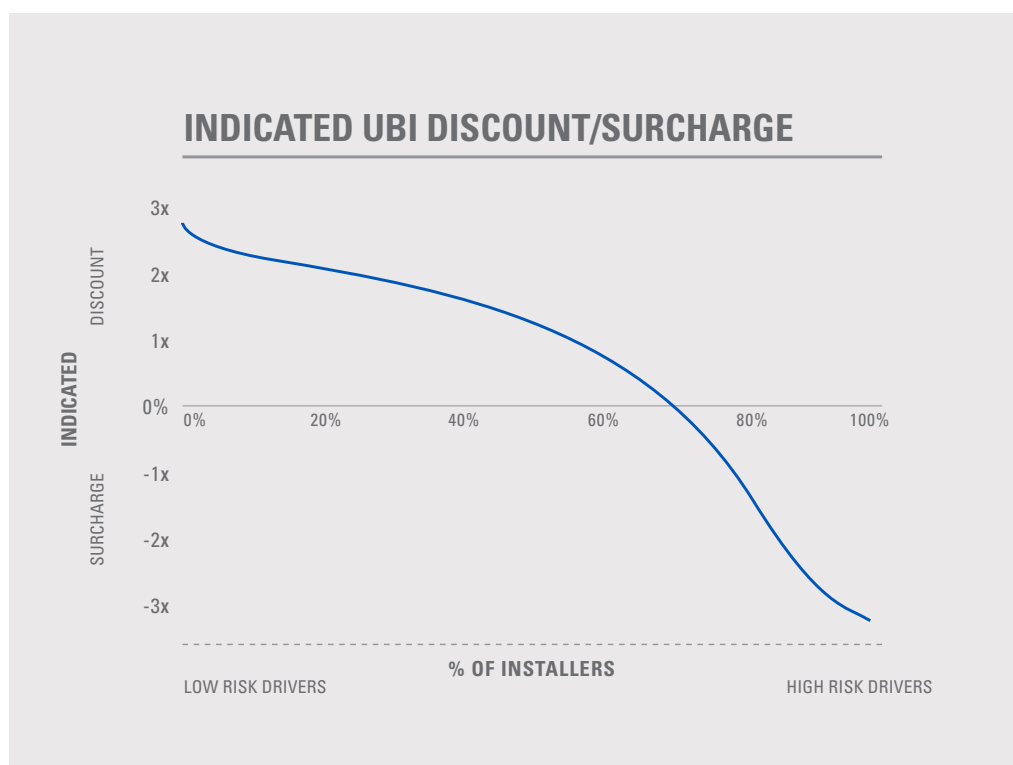


Figure 4 - Driving behavior indicated UBI discount/surcharge



# PROGRESSIVE'S MODEL—'SNAPSHOT®'

## UBI EVOLUTION AT PROGRESSIVE

Starting in 1998, Progressive introduced a series of UBI programs. Each successive program featured improved technology and user-friendliness, while the company kept refining its business model and pricing approach. Over the years, the company has attained five U.S. patents on its methods and systems for implementing UBI.

### 1998

*Progressive tested the UBI concept in Houston with a program called Autograph. It was a research pilot that measured the technical capability to install telematics. The UBI device was the size of a car stereo, and had to be professionally installed.*

### 2004

*Progressive introduced the second-generation TripSense® program in three states (Minn., Mich., Ore.), leading to the first actuarially-justified UBI pricing model. TripSense® also featured the first device customers could simply plug into the vehicle's OBD port (usually under the dashboard). The device had to be unplugged at regular intervals so the customer could upload their driving information over the Internet.*

### 2008

*Progressive introduced the third generation program named MyRate® in 18 states. Like TripSense®, it used a self-installed OBD device. MyRate®, however, automatically uploaded the driving data over the cellular network. It also provided consumer access to UBI rates and reports through their online policy account. Depending on the model, the customer could either save money for safe driving, or be charged for high-risk driving behaviors.*

# Snapshot®

## TODAY

Progressive's current UBI model, launched in 2010, is called Snapshot. As of July 2012, the program is available in 42 states and the District of Columbia. The Snapshot program builds on Progressive's 15 years of innovative leadership in UBI.

Drivers who opt into Snapshot install a device in the OBD port (standard in all vehicles built after 1996) which interacts with the vehicle's onboard computer (see Figure 5).

While the vehicle is driven, the device records time of day and speed every second. The device also confirms vehicle identification number (VIN), odometer mileage and detects connects and disconnects to the OBD port. From the time and speed data, Progressive calculates a variety of other driving data—including the number of miles driven, and how often and how hard the driver brakes.



*Figure 5 – Progressive OBD device and installation process*

The device transmits the driving data to Progressive. The driving data is used to calculate an auto insurance rate plus it is shared with drivers via their online policy servicing accounts (see Figure 6).

With Snapshot there is no surcharge, and discounts can extend up to 30 percent.

# PROGRESSIVE'S MODEL—'SNAPSHOT®'



Figure 6 – Progressive telematics solution to capturing and applying driving data

## THE DRIVING DATA DISCOUNT IS CALCULATED IN TWO TIME PERIODS:

1. The first is 30 days after the device is plugged into the OBD port. Any discount, if earned, is applied for the remainder of the policy period; and
2. The second, and ongoing, discount calculation is at the policy renewal based on the six month policy period driving data. This discount is carried forward for the future policy periods until policy expiration, or until Progressive elects to re-monitor the vehicle or revise its UBI discount factors.

Unlike earlier Progressive UBI models, with Snapshot, the customer generally only has to have a device plugged in for one six-month policy period. The company reserves the right to ask the customer to plug in a device after this period, however, if it wants to collect additional data to re-evaluate how the vehicle is being driven and, if necessary, re-calculate the Snapshot Discount®.

In the 12 months preceding July 2012, Progressive has sold more than \$1 billion in written premiums with Snapshot.

## FREE TRIAL NOW AVAILABLE

Snapshot is also the first UBI product available to non-policyholders. As of July 2012, drivers in 36 eligible states can now try Snapshot and find out what kind of rate they'd pay with Progressive based on their driving behavior. Savings are applied to the Progressive rate at point of sale. The benefit is that consumers can see if they can save money before they buy a policy.

## PRIVACY PROTECTION

Progressive addressed consumer privacy concerns in its approach to UBI. The company has made its offering a voluntary program that can be exited without penalty at any time. Further, Progressive did not include a GPS module in the device to explicitly avoid locational privacy concerns, which was recognized as the most controversial element of UBI relative to consumer acceptance. Also, the company limited third party sharing of the personally identifiable data to court-ordered requests.

## FUTURE RESEARCH

As Progressive continues to gather and analyze data on driving behavior, it will periodically publish reports on its findings, and how those findings may contribute to the ongoing refinement of the UBI model.

