

NAIC Telematics

Outline

I. Introduction

Historically, auto insurance premiums have been developed using several behavior-based demographic proxy factors. This paper explores telematics-supported usage-based insurance (UBI) which utilizes causal risk factors to assess risk and price auto insurance. There are many implications on insurers, consumers, and state regulators which will be discussed.

In 1929, Paul Dorweiler recognized the need for better variables to price auto insurance like driver habits, speed, weather conditions, and mileage. In more recent years, telematics has allowed insurers to start incorporating more sophisticated variables that seemed **simplistic for years but were never practical** because they could not be measured or their accuracy was questioned.

The following items accelerated the development and use of telematics:

- New digital technology in cars
- Increase of mobile telephones
- GPS
- Reduced cost of technology

Long-distance trucking was the first industry to track and coordinate vehicle movements.

Telematics is defined by SAS as “The use of wireless devices to transmit data in real time back to an organization. The data recorded in telematics devices can be used to develop more accurate pricing, improve the granularity of risk management techniques and reduce losses by enabling better claims assessments.”

Telematics may also offer significant discounts to consumers while providing the following **ancillary services** that increase consumer loyalty:

- Car diagnostics

- Roadside assistance
- Emergency response
- Stolen vehicle location

The most common rating variables from telematics include:

- Where the Vehicle is Driven (location)
- How Often (number of trips)
- How Far (mileage)
- How Well (driver behavior like braking, acceleration, and cornering)

While there are many benefits, **data privacy** proves to be a major barrier for public acceptance. Insurers must ensure that rates are not unfairly discriminatory while providing appropriate disclosure and transparency.

II. Telematics Technology in the Automobile Industry

Data has always been a huge asset to insurers. Telematics provides even more data, so it is imperative to collect and analyze the data to remain competitive and profitable. The cost of telematics hardware has decreased significantly which allows programs to scale more rapidly.

Telematics data and analytics present the following challenges and barriers of entry:

- Large data sets
- Lack of standardization
- Lack of public data
- Existing patents on UBI technology

There are four types of telematics solutions available in the market:

- 1) **Dongle:** Self-installed device provided by the insurer to be used for a specified time

Advantages

- Low cost
- High reliability of data for location and driving style
- Installed by the driver

- Can be bundled with add-on services

Disadvantages

- Can only be used in modern vehicles
- Vulnerable to fraud
- Technology will soon be obsolete

2) **Black box:** Professionally installed device

Advantages

- Most secure and reliable
- Provides most detailed data on driving behavior
- Ideally suited for first notice of loss with theft and accidents since the device is fixed in car chassis

Disadvantages

- Not portable
- Most expensive

3) **Embedded:** Devices embedded within car manufacturing like OnStar

Advantages

- Product differentiation
- Improved customer relationship
- Lower cost in the case of recalls

Disadvantages

- High cost on consumer since subscription based
- Lack of standardization
- Compatibility with insurance solutions
- Obsolescence

4) **Smart Phone:** Transmit a variety of information to and from the car since devices are already manufactured with a host of sensors like GPS and accelerometers

Advantages

- Large data storage capacity, especially if using the cloud
- Superior communication capabilities

- No costs for device, installation, or data connectivity

Disadvantages

- Low quality of data which has been a huge hindrance to market adoption

Sensors from telematics devices can capture the following elements:

- Date
- Time
- Location
- Distance Driven
- Speed
- Lane Changing
- Cornering
- Acceleration
- Deceleration

There are several telematics programs within the market:

Company	Device	Data Collected	Other Notes
Progressive	Dongle	Time, Mileage, Speed, Harsh Braking	598 patents related to telematics UBI
Allstate	Dongle	Time, Mileage, Speed, Harsh Braking, Number of Trips, Location	Drivers can monitor behavior on smartphone app
State Farm	Embedded	Time, Mileage, Acceleration, Hard Braking, Sharp Turning	Pay annual subscription fee after first year; Additional services like roadside

Nationwide and Hartford are mentioned providing a dongle telematics UBI program, and National General is mentioned having an embedded one. While we expect that programs do not need to be memorized, it is worth noting that programs vary significantly as insurers compete in the market with different rating variables and goals.

Collecting the right data is necessary to understand and subsequently model the driving behavior. The **standardization** of telematics data is a necessary step for effective analytics and widespread

adoption. This allows analytic consistency and reduces the need to support multiple data interfaces. Even if the data is delivered, actuaries must also analyze and interpret it. No one event is the same since the real environment is complex. For example, a quick braking event is riskier than a slow braking event. Thus, counting events is not the most predictive measure.

III. Telematics UBI Modeling and Analytics

Insurers are usually not solely basing the entire premium on just driving behavior. Rather, insurers are building predictive loss models to incorporate into the rating algorithm.

The paper discusses two common modeling approaches.

- 1) Insurers utilize mileage, time, and a set of predetermined events. The event counter is limited because a few events do not constitute the entire universe of behavior
- 2) Insurers collect granular data on a second-by-second basis which is then used to research the predictive power of vehicle operation in a contextual basis. Researchers will identify predictive events over time which improves the model, but it comes at the cost of collecting and saving extremely granular data while also using location. Additional benefits include the ability to identify new predictive variables more quickly while also identifying risky behaviors that vehicle operators can reduce through coaching

Regulators have the challenge to balance privacy protection of consumers with the value of voluntarily allowing consumers to join programs. These programs provide data to improve models which leads to behavior changes resulting in lower costs, improved fuel consumption, and saved lives.

IV. Insurer Benefits of Telematics-Based UBI

Insurers benefit from more accurate risk assessment which leads to better pricing and underwriting. By using more granular predictors of risk, insurers can integrate telematics-based UBI into current rating structures but need to ensure they do not duplicate existing model predictions.

Insurers can better control risk exposure thus raising risk tolerances and reaching more consumers. Since there are strong incentives for consumers to improve driving behavior to lower premiums,

insurers should see lower loss costs associated with improved driving. People tend to modify their behavior when being watched, so there are also incentives for consumers to drive fewer miles.

Telematics-based UBI offers these competitive advantages:

- 1) Identifies and rewards lower risk drivers thus improving retention for preferred segments
- 2) Attracts new customers by offering all drivers to pay less for auto insurance
- 3) Influences young drivers who are riskier but can be coached to modify behavior
- 4) Provides new communication channels with consumers thus increasing interaction and building stronger relationships
- 5) Enhances claims management practices through efficient claims processing, more accurate damage estimation, fraud reduction, and stolen vehicle recovery

Early adopters will likely have a competitive advantage since they will have a head start on collecting data for analyses. Collected data is proprietary so competitors will not have historical data to price appropriately if they are late to adopt.

V. Consumer Benefits of Telematics-Based UBI

A **benefit** for consumers is the ability to reduce insurance premiums through participation discounts, improved driving performance, or reductions in mileage driven. Consumers also fundamentally understand the link between premium and driving behavior which increases transparency. Since insurers have improved risk classification systems, the subsidy between low and high risk drivers is reduced which benefits the majority of consumers. Even if high risk drivers do not benefit initially, they are able to control future premiums.

Consumers benefit from incentives to increase safety, especially young drivers. Young drivers can incorporate feedback, and parents remain informed of their young driver's performance.

Here are some ancillary benefits to the consumer:

- 1) More efficient claims settlement
- 2) Continuous communication between drivers and insurers which builds a personal connection

- 3) Insurers now able to provide benefit programs like faster emergency response, road-side assistance, stolen vehicle recovery, fuel efficiency reports, and vehicle maintenance reports

VI. Societal Benefits of Telematics-Based UBI

Consumer benefits also overlap societal benefits. Consumers are incentivized to reduce total driving mileage which leads to the following:

- Fewer cars on the road
- Less road congestion
- Lower infrastructure costs
- Lower overall fuel consumption and vehicle emissions

UBI programs will likely increase the number of insured drivers on the road by creating more affordable premiums. This is especially important for low-income earners. The previously mentioned reduction in subsidy between low and high risk drivers also benefits society because it is more equitable.

In order for telematics programs to benefit society, consumer behavior must change, therefore it is important for consumers to understand telematics programs. However, insurers use complex rating algorithms. The proprietary nature of these models reduces understandability. Increased transparency would benefit consumers and society even more.

VII. Consumer Concerns and the Promise of UBI

There are two public policy goals to keep in mind:

- 1) Ensure consumers have access to essential insurance products
- 2) Insurance is a core institution for loss reduction and risk mitigation

Consumer advocates have long pushed for pay by the mile insurance as it is fairer. In addition to the already mentioned benefits, UBI could eliminate the use of many socio-economic variables like education, occupation, prior insurance, credit scoring, and other proxies for race and income. For all the benefits, there are many concerns outstanding, as the author of this section states that telematics has taken a wrong turn. Here are the concerns:

- 1) Insurers have a lack of transparency with their programs thus creating a black box effect which reduces loss mitigation
- 2) Privacy issues and distribution of data for purposes other than mitigation and pricing
- 3) Insurers use data for claims settlement when helpful to insurer but not consumer
- 4) Disproportionate impact of offer and sale in low-income and minority communities
- 5) Limited regulatory oversight to date

This section states that the interests of insurers do not always align with consumers. Industry representatives have requested regulators not impede progress of telematics through regulation. There are concerns that lack of regulation could lead to abuse as seen with credit scoring and price optimization.

This section specifies that telematics has been a market failure to consumers and public policy. There are several recommendations to improve telematics through the regulatory framework which would increase transparency, ensure fairness, and promote more confidence that consumer data would not be used against them:

- Establish data ownership and privacy standards
- Establish standards for permitted and prohibited uses of consumer data
- Establish standards for disclosure of telematics results and rating programs to ensure consumers receive feedback necessary to alter behavior

By implementing standards, the author expects consumer use and confidence in UBI would grow more quickly, thus resulting in increased loss reduction and fairness.

VIII. Regulatory Implications of Telematics UBI

Initially, telematics appeared straightforward as there was little concern about data accuracy, discount application, and understanding. However, there are varied methods now for collecting and reporting data.

Regulators are concerned with methods related to recording, transmitting, and reporting driving data especially if insurers have an agreement with third parties. Here are questions to consider:

- How does a vendor process raw data before forwarding to insurer?

- Does the vendor scrub the data for accuracy?
- How will it be formatted, stored, and protected from misuse?

Regulators are also concerned with the different types of telematics equipment. With a wide variety of methods available, regulators should confirm the same data is obtained for every program participant. Furthermore, all potential discounts should be made available to all participants.

Regulators should also consider the frequency and duration of data transmission as some carriers collect data continuously throughout the policy term while others only collect for a specified period.

Driving behavior is understandable as a predictor of risk, but this section continues to push for **transparency** so that consumers can use information to reduce premiums. Here are some suggestions to increase transparency:

- Disclose information to regulators in a filing
- Clearly identify each driving factor being measured to consumers
- Explain why a factor is being measured (ex. explain why driving at certain times of day presents a greater risk)
- Provide access to mobile applications or websites that track driving history and identify driving improvements

Regulators should request the following during filing review to protect data privacy:

- Data collection
- Data use
- Data storage
- Data protection

Market conduct exams and consumer complaint investigations will also allow regulators to ensure telematics UBI programs are used appropriately.

Regulators must ensure that rates developed through these programs are not excessive, inadequate, or unfairly discriminatory. There is potential for discrimination on certain classes of drivers if time of day is utilized since specific occupations work during the night.

Insurers may classify models as confidential information which can preclude proper review of the models. Regulators need to have appropriate access to review models and also be able to ask the correct questions.

The industry still believes that telematics-based UBI increases affordability. The segments that will **benefit the most** include consumers that pay higher than average premiums relative to income such as high-risk territories, inexperienced operators, and low-income individuals.

Here are a few outstanding concerns:

- 1) How do programs link driving behavior to the actual operator in every scenario?
- 2) Do programs discourage people from engaging in activities in specific zones if higher rates result?

Regulators ultimately need to determine whether insurer programs comply with rating laws and ask questions during filing review.

Original Essay Problems

EP #1

A personal auto rate filing includes revisions to its rating algorithm that incorporates telematics.

- a) Describe telematics.
- b) Justify telematics rating variables by addressing the shortcomings of demographic rating factors.
- c) Identify three potential rating variables from telematics.
- d) Identify three recent developments that aided the development and use of telematics in recent years.

EP #2

- a) Briefly describe four ancillary services provided through telematics.
- b) Describe the benefit to insurers from ancillary services.
- c) Describe the benefit to consumers from ancillary services.
- d) Briefly describe two concerns to consumers from ancillary services.

EP #3

- a) Briefly describe three issues with Telematics data for insurers.
- b) Identify four types of telematics programs available in the market.
- c) Describe four data elements that a telematics sensor can capture along with an expected relationship to loss.
- d) Fully describe the barriers to public acceptance for telematics.

EP #4

Four potential telematics solutions include these programs: dongle, black box, embedded, and smart phone.

- a) Briefly describe each program and identify two strengths.
- b) Identify one weakness for each program.

EP #5

- a) Briefly describe three challenges to modeling telematics data.
- b) Discuss two approaches to modeling telematics data.
- c) Briefly describe two benefits of the standardization of telematics data.

EP #6

- a) Fully describe the benefits of telematics based UBI to insurers.
- b) Identify three competitive advantages for an insurer that uses telematics-based UBI.
- c) Describe the competitive advantage of early adoption.
- d) Identify two concerns for insurers considering telematics-based UBI.

EP #7

- a) Fully describe the benefits of telematics based UBI to consumers.
- b) Identify three ways for an insured to reduce premiums in a telematics program.
- c) Describe a potential benefit of telematics on young drivers.

EP #8

- a) Fully describe the benefits of telematics based UBI to society.
- b) Describe how these benefits will increase affordability and availability of insurance.
- c) Describe how telematics achieves the public policy goal of insurance is a core aspect to loss reduction and risk mitigation.

EP #9

Consumers need to understand telematics programs so insurers, consumers, and society benefits.

- a) Identify two issues controlled by an insurer that reduces understandability.
- b) Propose a solution to these two issues.
- c) Describe two considerations from ASOP No. 41 Actuarial Communications when preparing a rate filing for telematics-based UBI.

EP #10

- a) Briefly describe affordability and availability of insurance.
- a) Identify four rating variables that could be eliminated through telematics-based UBI.
- b) Justify the benefit of eliminating these variables.
- c) Identify two concerns with telematics-based UBI programs and briefly propose a solution to address.

EP #11

- a) Identify three recommendations to improve telematics through the regulatory framework.
- b) Identify three benefits of improving telematics through the regulatory framework.
- c) Fully describe regulatory concerns with data processing and accuracy.
- d) Fully describe the concern with data privacy to a consumer.

EP #12

- a) Describe the benefit of increased transparency for telematics programs.
- b) Briefly propose four solutions to increase transparency in telematics programs.
- c) Fully describe market conduct exams and briefly justify a regulator relying on market conduct exams for telematics programs.

EP #13

- a) Describe the concern that confidential information precludes proper review of telematics-based UBI.
- b) Justify the benefit that telematics based-UBI rates increase affordability.

EP #14

Fully describe an example where an insured is unfairly discriminated against through a telematics program.

Original Essay Solutions

ES #1

- a) Telematics is the use of wireless devices to transmit data in real time back to an organization. The data recorded in telematics devices can be used to develop more accurate pricing, improve the granularity of risk management techniques and reduce losses by enabling better claims assessments.
- b) Demographic rating factors are proxies for behavior-based rating variables. These demographic rating factors are correlated with losses but not causal. Telematics rating variables are behavior-based variables which segments behaviors based on causal factors.
- c) Potential rating variables include the following:
- Where vehicle is driven
 - Number of trips per day
 - Mileage
 - Braking
 - Acceleration
 - Cornering
- d) Recent developments include the following:
- New digital technology in car
 - Increase of cellular phones
 - GPS
 - Reduced cost of technology

ES #2

- a) Ancillary services include the following:
- Car diagnostics
 - Roadside assistance
 - Emergency response
 - Stolen vehicle location

- Driver coaching
- b) Improved Retention from add-on services which establishes a relationship with the company.
 - c) The benefits include efficient claims settlement, improved safety for young drivers, and vehicle maintenance along with fuel efficiency reports.
 - d) Two concerns to consumers include insurers using data for claims settlement when helpful to insurer but not consumer and data privacy/selling driver data.

ES #3

- a) Three issues with Telematics data for insurers include large datasets, lack of standardization, and intellectual property and existing patents on UBI.
- b) Four types of telematics programs include dongle, black box, embedded, and smart phone.
- c) Here are four data elements with the associated loss propensity:
 - Time - Driving at night has a higher expected cost as people are tired, less visibility, and more drunk drivers
 - Location - Urban driving with congestion leads to more frequent accidents
 - Distance Driven - More driving leads to more potential for loss. Variable is now verifiable
 - Speed - Driving faster tends to lead to more severe accidents
- d) Privacy of data as there are elements of big brother knowing location as well as consumers questioning ability of an insurer to safeguard data given security breaches can occur.

ES #4

Dongle: self-installed device provided by the insurer to be used for a specified time

Advantages include Low cost, High reliability of data for location and driving style, Installed by the driver, and Can be bundled with add-on services

Disadvantages include Can only be used in modern vehicles, Vulnerable to fraud, and Technology will soon be obsolete

Black box: professionally installed device

Advantages include Security and reliability and Provides most detailed data on driving behavior

Disadvantages include Not portable and Most expensive

Embedded: Devices embedded within car manufacturing like OnStar

Advantages include Product differentiation, Improved customer relationship, and Lower cost in the case of recalls

Disadvantages include High cost on consumer since subscription based, Lack of standardization, Compatibility with insurance solutions, and Obsolescence

Smart Phone: Transmit a variety of information to and from the car since devices are already manufactured with host of sensors like GPS and accelerometers

Advantages include Large data storage capacity, Superior communication capabilities, and No costs for device, installation, or data connectivity

Disadvantage is Low quality of data which has been a huge hindrance to market adoption

ES #5

a) Three challenges include the following:

- Collecting the right data variables
- Analyzing and interpreting data in a real environment
- Cost of storing a large dataset

b) Insurers utilize mileage, time, and a set of predetermined events. The event counter is limited because a few events do not constitute the entire universe of behavior – And – Insurers collect granular data on a second-by-second basis which is then used to research the predictive power of vehicle operation in a contextual basis.

c) Standardization would aid widespread adoption and analytical consistency while reducing need to support multiple interfaces

ES #6

a) Telematics benefits insurers by reducing claim costs since incentives are provided to modify risk behavior through lower premiums. Risky behavior is further modified through coaching and feedback reports. Better risk pricing, underwriting, and segmentation will lead to better market penetration while reducing adverse selection. Customer retention/loyalty is improved by creating relationship through ancillary services. Finally, claims management practices are

enhanced through efficient claims processing, more accurate damage estimation, fraud reduction, and stolen vehicle recovery.

- b) Three competitive advantage include the following:
- Grows new customers by offering all drivers to pay less for auto insurance
 - Influences young drivers who are riskier but can be coached to modify behavior
 - Provides new communication channels with consumers thus increasing interaction with them which allows stronger relationships
- c) Early adopters will likely have a competitive advantage since they will have a head start on collecting data for analyses. Collected data is proprietary so competitors will not have historical data to price appropriately.
- d) Data storage and intellectual property/patents

ES #7

- a) Consumers benefit though reduced insurance premiums, enhanced safety, improved claims experience. Further, consumers also fundamentally understand the link between premium and driving behavior which increases transparency. Since insurers have improved risk classification systems, the subsidy between low and high risk drivers is reduced which benefits the majority of consumers.
- b) Premiums are reduced through the following:
- Participation discounts
 - Improved driving performance
 - Reductions in miles driven
- c) Young drivers can incorporate feedback from monitored driving while parents remain informed of their young driver's performance.

ES #8

- a) Consumers are incentivized to reduce total driving mileage which leads to fewer cars on the road, less congestion, lower infrastructure costs, lower overall fuel consumption and vehicle emissions.

- b) UBI programs will likely increase the number of insured drivers on the road by creating more affordable premiums which is especially important for low-income earners. Availability should increase as insurers improve risk segmentation which will improve pricing and underwriting.
- c) Telematics can promote the reduction of loss of life and property by giving feedback to consumers through driving reports. Further, it provides incentives for less risky behavior through premium reductions.

ES #9

- a) Insurers use complex rating algorithms and want to maintain confidentiality of proprietary programs.
- b) Increase transparency.
- c) Clarity should be sufficient such that another actuary qualified in the same practice area could assess the reasonableness of the work. The actuary should take reasonable steps to ensure that the actuarial document is clear and fair.

ES #10

- a) Affordability refers to whether a consumer is able to afford the insurance.
Availability refers to whether the insured is able to find insurance coverage available
- b) Rating variables that could be eliminated through telematics-based UBI include education, occupation, credit scoring, territory, and prior insurance.
- c) These variables are usually socio-economic variables which can be proxies for race or income.
- d) Insurers have a lack of transparency with their programs thus creating a black box effect which reduces loss mitigation. The solution would be to clearly identify each driving factor being measured to consumers.

Privacy issues and distribution of data for purposes other than mitigation and pricing. The solution would be that regulators should confirm data sharing practices and ensure consistency for each insured and across insurers.

ES #11

- a) Recommendations to improve telematics through regulatory framework include the following:
 - Establish data ownership and privacy standards

- Establish standards for permitted and prohibited uses of consumer data
 - Collect and analyze granular data on offers and sales of UBI based related to prohibited risk classification factors
 - Establish standards for disclosure of telematics results and rating programs to ensure consumers receive feedback necessary to alter behavior
- b) Three benefits include the following:
- Increasing transparency
 - Ensuring fairness
 - Promoting confidence that consumer data would not be held against consumers
- c) There are several methods for reporting and collecting data. Regulators are concerned with methods related to recording, transmitting, and reporting driving data especially if they have an agreement with third parties. If a vendor is processing data, then data scrubbing and accuracy should be considered.
- d) Consumers are concerned about data being used against them from a location monitoring perspective as well as charged higher premiums. Consumers also want the data to be protected so it is not subject to security breaches.

ES #12

- a) Transparency allows consumers to understand and use information to reduce premiums since driving behavior is an understandable predictor.
- b) Solutions to increase transparency include the following:
- Disclose information to regulators in a filing
 - Clearly identify each driving factor being measured to consumers
 - Explain why a factor is being measured such as why driving at certain times of day presents a greater risk
 - Provide access to mobile applications or websites that track driving history and identify driving improvements
- c) Market conduct exams reveal how insurers are operating, including marketing, advertising, soliciting, policy issuing, and claim handling. NAIC's Market Conduct Examiners Handbook is used by all states to some extent and allows examiners to review four key areas: sales and

advertising, underwriting, pricing, and claims. Since telematics programs are complex, the regulator should use a market conduct exam to ensure the insurer is operating the program as presented and intended. Thus, this would protect consumers.

ES #13

- a) Insurers may classify models as confidential information to protect their competitive advantage which can preclude proper review of the models. Regulators need to have appropriate access to review models and also be able to ask the correct questions.
- b) Participation discounts and ability to control premiums through driving behavior should reduce premium. Subsidy between low and high risk drivers is reduced which increases equitable nature of rates. High-Risk can control premiums in long run.

ES #14

Employees that work evening shifts at offices or hospitals located in urban areas would likely pay highest price for insurance under telematics program since time of driving at night is captured. Furthermore, frequent driving in urban areas will also be captured by GPS. These drivers could be unfairly discriminated against as a result of their occupation.