Exploring the Resistance to Data Technology:
The Debate over Tracking in Usage-Based Insurance

Omri Ben-Shahar*
University of Chicago Law School

Abstract

Regulatory and psychological resistance to new market-driven technologies, and particularly to ones that rely on analysis of personal data, is prevalent even in cases where the technology creates large social value and saves lives. This article is a case study of such technology resistance—one installment in my broader exploration of the technology resistance phenomenon and its devastating social costs. The article focuses on a technological innovation introduced by auto insurers: real-time tracking devices in cars. When drivers agree to participate in the tracking programs, auto insurers collect data on how they drive and personalize the premiums to correspond to measures of risky driving. Sophisticated empirical work reveals that such "usage-based insurance" (UBI) generates robust gains in safety (roughly 30% reduction in fatal accidents) and a significant reduction in insurance premiums. The article examines the hostility to this tracking technology from regulators and consumer advocates. It reviews the substantial safety improvements that UBI makes available, and evaluates the equity, privacy, power, and transparency concerns raised by critics. It concludes that the social benefits dramatically outweigh the costs. The article also searches for the deeper underpinnings of the resistance to data technology, and the apathy this resistance displays towards the benefits of the technology.

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"Some of you may die, but it's a sacrifice I am willing to make"
— Lord Farquaad, Shrek (2001)

Introduction

This article is about the puzzling resistance to a life-saving technology.

Here is a novel tracking technology. It creates enormous social value to almost everyone involved. Yet it faces strong ongoing resistance, both regulatory and sociological, which slows down its proliferation. The article presents the technology and shows that without doubt the concrete benefits from it far outweigh even the most pessimistic assessment of its possible costs. The article explores why, in the face of such clear net social value—measured by thousands of lives saved and millions of injuries prevented—the resistance lingers. It identifies the justifications for the technology anxiety, grounded in various conceptions of dignified life, power imbalance, and distributive justice. It shows how the tension between the contesting values—between the concrete life-saving benefit and the potential threat to longstanding social and cultural practices—shapes the regulation of this technology, and of other pathbreaking innovations in a multitude of areas. This article is part of my broader exploration of that battleground.

The tracking technology at the heart of this article is embedded in devices that record how a car is driven and report the data to auto insurance companies. With the knowledge of how, when, and where people drive, the insurers can directly measure each driver's accident propensity, and charge insurance premiums commensurate with the individualized predictions.[1] To appreciate the value of this technology, let's take a step back and talk about auto safety.

Road accidents are a major cause of fatalities. Every year, roughly 40,000 people die and close to five million people are injured in the U.S. as result of motor vehicle crashes, with economic costs of half trillion dollars.[2] The great majority of accidents result from dangerous driving—inattention, speeding, and various forms of cognitive impairment.[3] Covid brought a temporary but significant reduction of travel, but also an unprecedented increase in death rate, due to more reckless driving.[4] Safety technologies, like airbags and seatbelts, have had success in lowering road deaths.[5] However, these measures have largely

[1] *Telematics/Usage-Based Insurance*, Center for Insurance Policy and Research (NAIC 2023), (hereinafter, "CIPR Study"), https://content.naic.org/cipr-topics/telematicsusage-based-insurance.
[2] *Motor Vehicle Introduction*, NATIONAL SAFETY COUNCIL INJURY FACTS, 2022, https://injuryfacts.nsc.org/motor-vehicle/overview/introduction/.
[3] *Road Traffic Injuries* (World Health Organization 2022), https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries.
[4] Supra note 2 ("Roads became less safe in 2020 for a variety of reasons, including an increase in non-restrained occupant deaths, speeding, and alcohol impaired fatal crashes").
[5] JAMES DAVID BEAN ET AL., NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, FATALITIES IN FRONTAL CRASHES DESPITE SEAT BELTS AND AIR BAGS 4 (2009) ("Seat belt use and air bags are each quite effective in reducing fatality risk in frontal impacts; the combination of seat belt use and air bags, even more.").

only reduced accident severity and have done little to address risky driving.[6] Regulatory innovations, like graduated driver's licenses, have also had some effect on crash risks of beginning drivers, but car accidents continue to be the leading cause of death for teens.[7] There are some who argue that the perceived safety gains of certain safety measures make drivers feel more secure and prompt them to drive more recklessly.[8]

Traffic enforcement tools can affect how people drive and the likelihood of accidents by penalizing risky behavior. Speed radars and cameras, for example, effectively deter speeding in the general population and reduce road crashes.[9] Unfortunately, their deterrent effect is local, occurring in the proximity of areas where driving speed is being monitored.[10] Moreover, since drivers are risking their own lives, it is hard to imagine that the incremental disutility of road fines would have a game-changing effect.

Against this grim background, a major new safety technology has been introduced, not by lawmakers, but rather by auto insurers, changing the way auto insurance is priced and improving the way policyholders drive. Generally referred to as usage-based insurance (UBI), integrated tracking devices record how a car is driven: how sharply it breaks, how often it engages in abrupt lane change maneuvers, when and how far it drives, and even the distractions of the driver (texting)—all are factors that don't only correlate with accidents but cause them.[11] And they are richly recorded and transmitted to the insurers. The abundance of such records, matched with background data on factors that cause accidents, gives insurers unprecedented tools to identify risk-increasing driving habits and rate each driver accordingly.[12] Premiums are no longer determined by indirect non-driving factors correlated with losses (like gender, marital status, or education). Instead, they can reflect the policyholder's idiosyncratic driving, and change continuously as these habits evolve.

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[6] Talib Rothengatter, *Drivers' Illusions—No More Risk*, 5 Traffic Psychology and Behavior 249, _ (2002). [check pincite.]

[7] NATIONAL HIGHWAY TRANSPORTATION SAFETY ADMINISTRATION, GRADUATED DRIVER LICENSING SYSTEM 2 (2008) ("Evaluations clearly show the benefits of adopting GDL laws and GDL components. Florida's GDL law resulted in a 9-percent reduction in crashes for drivers who were 16 and 17 years old."); *Unintentional injury deaths in children and youth, 2010–2019*, 78 J. Safety Res. 322 (2021) (traffic injuries the leading cause of unintentional death among teens).

[8] This is the widely known risk homeostasis theory, or the "Perlzman Effect." See Sam Pelzman, *The Effects of Automobile Safety Regulation*, Journal of Political Economy (1975); *see also* Gerald J.S. Wilde, *Beyond the Concept of Risk Homeostatis*, 18 Accident Analysis and Prevention 377, 379–80 (1986); Jeremy S. H. Jackson & Roger Blackman, *A Driving-Simulator Test of Wilde's Risk Homeostasis Theory*, 79 J. Applied Psychology 950, 955–57 (1994); Ben Lewis-Evans & Samuel G. Charlton, *Explicit and Implicit Processes in Behavioral Adaptation to Road Width*, 38 Accident Analysis and Prevention, 610, 615–616 (2006).

[9] See e.g., Charles Goldenbeld & Ingrid van Schagen, *The Effects of Speed Enforcement with Mobile Radar on Speed and Accidents*, 37 Accident Analysis and Prevention 1135, 1142–44; Kangwon Shin et al., *Evaluation of the Scottsdale Loop 101 Automated Speed Enforcement Demonstration Program*, 41 Accident Analysis and Prevention 393, 400 (2009).

[10] E. Hauer et al., *Speed Enforcement and Speed Choice*, 14 Accident Analysis and Prevention 267, 274 (1982) ("as the vehicle moves away from the site of enforcement their speed gradually returns to its desired speed of travel").

[11] See, e.g., Ignacio Elicegui et at., *Usage-Based Automotive Insurance*, in BIG DATA AND ARTIFICIAL INTELLIGENCE IN DIGITAL FINANCE 295, 297-98 (J. Soldatos and D, Kyriazis, Eds., 2022).

[12] Subramanian Arumugam & R. Bhargavi, A Survey on Driving Behavior Analysis in Usage Based Insurance Using Big Data, 6 J. Bg Data 1, 3 (2019).

While there is a lot to celebrate in usage-based insurance—not least its replacement of the traditional and somewhat problematic rating factors with an accurate new pricing model—by far the most important impact of the technology is the reduction in accidents and road fatalities. When people are tracked, they drive differently. Studies measuring this effect are new, and they are striking. According to recent estimates, the decline in fatal accidents that results from adoption of usage-based insurance and from the induced improvement in driving is in the range of 30 percent, and perhaps larger.[13] The combination of immediate premium incentives attached to improved driving, as well as the information effect of alerting drivers to features of their driving that are risky and could be improved, have an impact commensurate with, and possibly exceeding, some of the most historically important safety technologies.[14]

Insurance regulation has half-heartedly welcomed this innovation. It took time, but by now –almost two decades since the tracking technology was rolled out—usage-based insurance powered by tracking devices is available in principle in every state but California.[15] A strong current of resistance to this innovation accounted for slow rate of adoption, and continues to fuel an outright prohibition in California. California law explicitly prohibits the use of driving factors other than mileage, and as a result does not permit insurers to offer policyholders the option of installing recording devices.[16] Some other states, while permitting the use of the tracking technology, limit or burden the entry of carriers into this market, or their ability of insurers to price auto policies in a manner that reflects the risk information such tracking reveals.[17]

This article examines the regulatory debate. It examines the benefits of the technology—the phenomenal reduction in fatal accidents, as well as other incidental benefits like reduced driving and increased accuracy (and fairness) in pricing. It is against these upsides that the article evaluates the resistance, as reflected in the restrictive regulations and the advocacy supporting such restrictions. It identifies the specific reasons for the opposition, which include concerns over privacy, equity, and transparency, as well as more fundamental objections to institutions governed by bid data.

The goal of this article is to question the validity of these concerns. Not in the abstract, but against the social benefits that must be sacrificed to secure them. While the magnitude of

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[13] *Infra*, text accompanying notes __.

[14] Seat belts are widely regarded as one of the most impactful safety technologies. The Department of Transportation estimates a reduction in the risk of death of 45% and of serious injury by 50%. See *Traffic Safety Facts: Children. Washington* (NHTSA; 2010), http://www-nrd.nhtsa.dot.gov/Pubs/811387.pdfpdf icon. Other empirical studies offer a more modest estimate. See Alma Cohen and Liran Einav, *The Effects of Mandatory Seat Belt Laws on Driving Behavior and Traffic Fatalities*, 85 Rev. Econ. & Stat. 828 (2003) (raising the national usage level from 68% to 90% will reduce traffic fatalities by 4% to 8%). Airbags, another leading safety technology, are estimated to reduce fatality risk by 12%. See Charles J. Kahane, *Lives Saved by Vehicle Safety Technologies and Associated Federal Motor Vehicle Safety Standards, 1960 to 2021*, 128 (NHTSA,2015).

[15] [Rate of regulatory approval and the hold out states.]

[16] Haley Ross & Jason Woleben, *Tesla's Musk, Others Take Aim at California Law Restricting Telematics*, S&P Global Market Intelligence Jan. 27, 2022, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/tesla-s-musk-others-take-aim-at-calif-law-restricting-telematics-68615281 (California law prohibits carriers from employing granular usage-based data that they can obtain through telematics).

[17] See infra, at __.

the data that tracking devices transmit to insurers is massive and potentially sensitive, giving insurers much power and control, and while the personalized premiums these data fuel raise legitimate questions of distributive equity and transparency, the evaluation of such concerns must be done with the understanding of their true magnitude, in relation to the benefits of the technology. Slowing the implementation or shutting down the introduction of beneficial technology has a social cost. At what cost, the article asks, is it justified to protect the interests underlying the restrictive regulation?

Not to spoil the plot, the gist of what I report is a case of almost startling misalignment: the social value of the tracking technology far outweighs even its most pessimistic downsides. The interests that are thought to be endangered by the technology, which the restrictive regulation seeks to safeguard, are dwarfed by the benefits that the regulation inhibits. To put it bluntly, thousands of lives could be saved on the roads without a significant sacrifice of privacy and without any adverse impact on insurance equity. There is no surrender of control, no diminution of drivers' autonomy, and no loss of transparency. Shamefully, the so-called protective regulation hinders the dissemination of a major advancement in road safety.

This is a pilot study. My focus on usage-based-insurance and its regulatory torments is merely a prelude to a broader inquiry which, in ongoing work, I develop. The pattern I show is similar. A new technology or scientific advancement is introduced. It has a proven upside, but it could also change longstanding social and economic practices. In the past, these key inventions were mostly automation technologies that displaced humans. Nowadays, many of these are data-driven innovations, like databases containing electronic medical records that are able to refashion hospital routines and save numerous lives. These innovations are also manifested in other types of scientific progress, as for example in the development of GMO crops that replace conventional agricultural methods and deliver more food, healthier food, with less environmental harm. Increasingly, these technological breakthroughs utilize artificial intelligence and replace humans in a variety of activities. In these and other contexts, the technology delivers unparalleled benefits but with pivotal disruption to existing practices. It retires routines that rely on human expertise, situational knowledge, intuitions; it introduces synthetic elements not seen before; and it engenders new norms of surplus distribution. The fundamental question for society is how to welcome the innovations, and specifically how to prepare for their potential downsides. All too often, the social benefits of these "subversive" innovations are loudly met with an alarmist skepticism—a precautionary instinct—which regrettably dominates the ensuing regulatory approach. These skeptics say: something *could* go terribly wrong with this new method, and although the disaster has not yet happened nor is it likely to happen, we should put in place a political and bureaucratic order to prepare for it, and in the meantime slow down the introduction of the technology, no matter the forgone benefit, until we can make sure that it is fail-proof or harmless.

So prominent and alluring is this precautionary instinct—so often does it seem to be a good approach to the uncertainty brought upon by a new technology—that many of its advocates do not pause to ask, "at what cost"? While some acknowledge, in passing, the social cost of slowing down the adoption of new technologies, they assume—often without analysis—that the sacrifice is worth making. I need a term for regulators and advocates who refuse to

consider the appropriate proportion and costs of the regulatory restraints. "Precautionites" seems to describe their moto. It expresses a regulatory position with varying justifications and motivations, for it is a generalization as, say, "conservative" or "progressive" are. But it is a useful abstraction because 'precaution'—a safeguard against a threat—is the dominant sentiment that the technological innovation evokes among the precautionites.[18]

I recognize that it is impossible to defeat the precautionite thesis because the ingredients that fuel it are not concrete. What exactly could go wrong, how likely it is, and what might be the consequential harms, are sufficiently nebulous at the infancy of the new technology that, yes, if the perfect storm hits the precautionite instinct would turn out to have been prophetic. My strategy, then, is to focus primarily on the benefits from technologies that precautionites want to subdue. The policy debates about novel technologies are too often dominated by the precautionite ethos and they therefore lack concrete discussions of the benefits—of the sacrifices that precautionites are asking society to make. I hope that by the end of this article readers will acquire a concrete grasp of these benefits in the specific case of auto tracking technology, and that their sympathy towards the sentiments driving the precautionite opposition will subside.

The article begins with a brief description of the UBI tracking technology (Part I) and the law governing it (Part II). Part II then examines with greater detail the benefits of the technology, highlighting its significant accident reduction effect and pointing to the desirable distributive impact it has in relation to other methods of risk classification. Finally, Part IV examines the grounds for the opposition, focusing first on the specific pinpointed reasons provided by stakeholders (privacy, equity, transparency), and then on the more fundamental, and somewhat abstract, precautionite instincts fueling them, surrounding power imbalance, vulnerability, and exploitation.

I. The Technology

Prior the introduction of usage-based insurance, auto insurers used demographic and past-experience metrics to predict policyholders' idiosyncratic risks and set the premiums.[19] Primarily, insurers had to settle for fragments of crude risk-correlates. They asked policyholders to declare their car usage habits and mileage, they looped in data about prior violations and accidents, and they learned to rely on socio-economic non-driving proxy factors that were shown, in their data models, to correlate with risk—like gender, age, marital status, school grades, or credit scores. These predictors, most of them devoid of true causal relation, exhibit sufficient correlation with accident risk to allow insurers to rationally

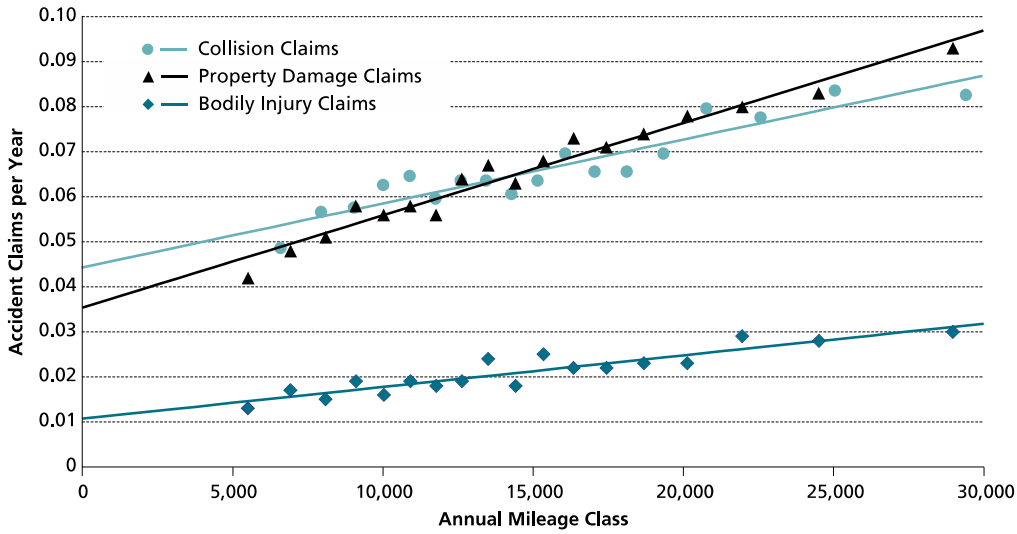
[18] Footnote on the "Precautionary Principle" and how the 'precontionite' concept is broader.

[19] *What Determines the Price of an Auto Insurance Policy?*, INSURANCE INFORMATION INSTITUTE, https://www.iii.org/article/what-determines-price-my-auto-insurance-policy; *Watch Where You're Going: What's Needed to Make Auto Insurance Telematics Work for Consumers,* Consumer Federation of America 4 (2021), https://consumerfed.org/wp-content/uploads/2021/05/Insurance-Auto-Telematics-White-Paper-5-26-21.pdf ("Auto insurers have, both before and after the advent of telematics, calculated premiums and costs based on a variety of variables such as driving safety records (accidents and tickets), mileage, vehicle type, credit scores, age, gender, marital status, zip codes, occupation, education level, and others.)

sort their policyholders into statistical risk groups and vary their premiums across groups.[20] Some of these demographic factors, however, like homeownership and credit score, have been particularly noisy and devoid of causal foundations, making them politically controversial and subjecting them to restrictive rules in several jurisdictions.[21]

Prior to usage-base insurance models, the most important driving factor used by insurers to rate policyholders was annual mileage. "Pay As You Drive" (PAYD) schemes rely on this central accident-predictive factor, for a good reason. As depicted in Figure 1, the more the policyholder drives the great the likelihood of property or bodily injury claim:[22]

FIGURE 1
Yearly Accident Claims by Annual Mileage



Source: Progressive 2005.

Moreover, driving creates insurance externalities. An additional driver increases accidents and insurance costs to other drivers, at a level estimated in the range of $1725 - $3239 (in the 1990's).[23] Thus, paying for insurance in proportion to miles driven makes not only the private insurance contract more efficient; it also has Pigouvian logic—reducing the negative externality.

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[20] Predicting Individuals' Car Accident Risk by Trajectory, Driving Events, and Geographical Context, 93 Computers, Environment and Urban Systems 1 (2022).

[21] See e.g., Katherine Chiglinsky, *Credit Scores for Car Insurance Become a Target for Regulators*, Bloomberg Businessweek (December 22, 2021) (noting states such as California, Texas, Colorado, and Washington have various limits on the use of credit score data in car insurance rates); Victoria Spears, *New Bill Aims to Ban Non-driving Factors from Insurance Rate Decisions*, ALM Property Casualty 360 (August 21, 2019) (discussing political efforts to limit the use of home ownership and other factors in insurance rate calculations). See, also, Ellen Garbarino, Robert Slonim and Justin Sydnor, *Digit ratios (2D:4D) as predictors of risky decision making for both sexes*, 42 J. Risk Uncertain 1 (2011) (finding that the ratio between the length of the second and fourth finger, which is linked prenatal exposure to testosterone, predicts financial risk taking behavior).

[22] See *Texas Mileage Study: Relationship Between Annual Mileage and Insurance Losses*, Progressive Insurance Company (2005). See also Jason E. Bordoff and Pascal J. Noel, *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity* 8, The Hamilton Project (2008).

[23] Aaron S. Edlin and Pinar Karaca-Mandic, *The Accident Externality from Driving*, 114 J. Pol. Econ. 931 (2006).

Information about miles driven is low tech—it does not require recording devices (although their presence makes the reports more accurate.) It could be assembled via odometer readings, and even before the dawn of the Big Data tracking era such information was publicly available in states that mandated periodic vehicle inspections, or privately assembled by platforms like Carfax that sell vehicle history reports to insurers and car buyers.[24] PAYD was a big step to liberate insurers from the irrationality, previously recognized by economists, whereby "the manner in which premiums are computed and paid fails miserably to bring home to the automobile user the costs he imposes in a manner that will appropriately influence his decisions."[25]

Predicting accident risk by miles driven makes insurance premiums more aligned with the expected loss, but its impact on driving is limited. It is an activity level metric, and while the scope of activity is of course important in creating risks, so much of the auto accident risk depends on the individual driving habits and precautions, which PAYD does not measure. Two individuals may drive the same number of miles but create dramatically different risks.[26] Moreover, upon further reflection, it is questionable how much impact PAYD pricing has even on activity levels. Ideally, policyholders subject to this scheme would recognize that insurance costs like gasoline—that each additional mile driven increases the charge—and would moderate their activity accordingly. But policyholders tend to think of insurance premiums as a fixed cost.[27] Auto insurance is priced annually and, unlike gasoline, paid in lump sums. As a result, the incremental mile-by-mile accumulation of the premium is less salient and has diminished presence in the calculus of marginal costs and benefits.[28] The decision whether to make an additional car trip is therefore less affected by PAYD.

Enter usage-based insurance. In 2008, Progressive Insurance Company introduced a revolutionary product in the auto insurance market: the "Snapshot" tracker Enter Snapshot. A novel technology developed (and, at the time, patented[29]) by Progressive, it offered policyholders the option to install a free device in their cars, which then tracks and records how the car is driven second-by-second, transmitting the information to the insurer. No longer having to rely on policyholders' non-verifiable reports regarding their driving habits,[30]

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[24] David Lazarus, *Your Car Dealer May be Quietly Selling Your Data to Your Insurer*, LOS ANGELES TIMES (January 31, 2020), www.latimes.com/business/story/2020-01-31/car-dealer-odometer-mileage-data-insurance.
[25] William Vickrey, *Automobile Accidents, Tort Law, Externalities, and Insurance: An Economist's Critique*, 33 Law and Contemporary Problems 464, 470 (1968)
[26] See e.g., Lidia P. Kostyniuk et al., *Are Women Taking More Risks While Driving*? (Federal Highway Administration, 2000), https://www.fhwa.dot.gov/ohim/womens/chap26.pdf ("However, the positive relationship between total mileage and accident risks is not necessarily always a monotonically increasing linear function. Higher mileage may also result in a lower per-mile crash rate because high-mileage drivers are also more skilled and long-distance driving happens more on highways than inside urban areas.").
[27] See CIPR Study, *supra* note 1, at _.
[28] Brice Nicols and Kara Kockelman, *Pay-As-You-Drive Insurance: Its Impacts on Household Driving and Welfare*, 2450 Transportation Reas. Rec. 76, 77 (2014) ("In general, insurance costs are often "hidden" to drivers, but generally comprise 10 to 15% of annual vehicle costs."
[29] Insurance Networking News. 2014. "Progressive UBI Patents Cancelled." Insurance Networking News Online.
[30] Jean Lemaire et al., *The Use of Annual Mileage as a Rating Variable*, 46 ASTIN Bulletin 39, 40 (2015) ("insurers have been reluctant to use annual mileage due to their inability to verify policyholders' statements and the relative easiness to tamper with odometers").

Snapshot measures the exact miles driven, and much more.[31] Based on granular data analyzing causes of past collisions, the new device was programed to measure factors that reflect these causes and increase the probability of road accidents. Such factor included hard cornering, rapid acceleration, sharp breaking, nighttime driving, and location in high-risk areas.

This big data technology offered meaningful improvement in predictive analytics relative to the prior classification methodology. Whereas the old predictors, like gender, accident history, or vehicle type, reflect group characteristics—namely, *average* risks within the pool of drivers with similar traits (like "all men" v. "all women," or "all youth drivers with GPA of B or above")—they do not predict the individual risk that any single driver poses for the insurer.[32] The tracking system, by contrast, allows for a more personalized classification of risk. Having rich information about each trip and linking it with accident loss data and other external inputs such as maps, road type, and weather, enables the prediction model to identify the vehicle operation factors that are not only correlated with losses, but are likely to be the causes.[33] For example, Progressive found that drivers who brake hard more than eight time in 500 miles—a feature that measures unsafe following and speeding[34]—are 73% more likely to be involved in an accident,[35] or that the safest drivers allow an average of 39% more time and 32% more distance to stop.[36] As a result of this predictive power, the insurer is able, in principle, to offer more personalized premiums.[37]

The Progressive Snapshot technology constituted a major advance relative to prior PAYD auto insurance schemes. Eventually, other insurers managed to overcome barriers to entry imposed by Progressive's bastion of patents and began to catch up, offering their own tracking technology and usage-based schemes in a variety of opt-in programs.[38] Some insurers offer tracking devices similar to Snapshot. Other rely on smartphone technology, since most smartphones are equipped with sensors (GPS, accelerometers, and gyroscopes) and can readily measure and transmit the vehicle's driving patterns and location as well as a

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[31] https://www.progressive.com/auto/discounts/snapshot/snapshot-faq/

[32] See *Usage-Based Automotive Insurance*, supra note 11, at 29711 ("This is the traditional way of pricing based on population-level statistics available to the insurance companies prior to the initial insurance policy. The contemporary approach in motor insurance is to consider the present patterns of driving behavior through usage-based insurance schemes.").

[33] See CIPR Study, *supra* note 1, at 17.

[34] See *Lead Food Report from Progressive Insurance Busts Industry Braking Standards* (2015), at https://progressive.mediaroom.com/2015-05-14-Lead-Foot-Report-from-Progressive-R-Insurance-Busts-Industry-Braking-Standards ("After analyzing Snapshot driving data, we've found hard braking to be one of the most highly predictive variables for predicting future crashes,")

[35] Imke Reimers & Benjamin Shiller, *The Impacts of Telematics on Competition and Consumer Behavior in Insurance*, 62 J. L. & Econ. 613 (2020).

[36] See *Lead Food Report from Progressive Insurance Busts Industry Braking Standards* (2015).

[37] In principle, premiums actually charged may reflect not only the personalized risk estimate but other factors, including those that are thought to affect each policyholder's willingness to pay and switching costs. To the extent that such third-degree price discrimination is practiced, it is not fueled by the UBI data, and is already occurring under traditional insurance pricing models. So while the premiums charged under UBI schemes may reflect loss predictions only in part, this part is subject to greater personalized accuracy.

[38] See, e,g., www.geico.com/driveeasy/; www.statefarm.com/insurance/auto/discounts/drive-safe-save; www.nationwide.com/personal/insurance/auto/discounts/smartride/.

variety of risky distracting usages like texting, web surfing, or phone dialing.[39] In addition, UBI programs increasingly rely on built-in technology in connected cars.[40] Tesla, for example, which has access to elaborate usage-data as part of the vehicles' multitude of cameras and auto-pilot capability, now offers drivers in several states a Tesla Insurance plan that rates their driving via continuously evolving "Safety Score" and charges them monthly premiums reflecting that score.[41] With the entry of many competitors, UBI's market share in auto insurance has been growing rapidly, reaching a global size of $28 billion in 2020.[42]

Wireless devices that transmit data in real time back to a platform, which then analyzes the data and personalizes the treatment, are of course not unique to insurance. In other sectors, data are used to personalize various aspects of the users' experience and service. Netflix recommends shows, Google personalizes search results, and Amazon offers products, based on what people watch, browse, and buy. In insurance, the data recorded by the devices are used to improve risk predictions, develop more accurate pricing, and allow for more reliable claims assessment. But it is responsible for more than efficient management of the insurance business. Usage-based insurance fueled by driving data provides drivers with personalize feedback through risk scores, premium adjustments, and Manage How You Drive coaching programs (MHYD).[43] This interaction opens the door to more granular risk management techniques, changing how policyholders drive, and reducing auto accidents. Before reviewing the evidence on the magnitude of this effect, let's briefly review the regulatory landscape in which usage-based insurance operates.

II. The Law

Most states do not regulate usage-based auto insurance directly. Oops, 'not regulate' is a bit of an exaggeration. States regulate auto insurance rates quite heavily, typically requiring periodic preapproval of the rating plan.[44] The non-regulating states merely treat UBI models of pricing as a type of statistical data which they review when they approve any new rating plans. They do not treat data originating from car usage and collected by tracking devices differently than any other statistics used to support the proposed rating structure.[45] Some non-regulating states view usage-based insurance as potentially raising privacy concerns,

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[39] See *Usage-Based Automotive Insurance*, supra note 11, at 29811 ("Since 2012, smartphone auto insurance policies are another type of GPS-based systems utilizing smartphones as a GPS sensor. Although this system lacks in reliability, it is used due to its availability as it only requires a smartphone that most of the insureds use and no other special equipment.")

[40] https://grapeup.com/blog/connected-vehicles-impact-the-insurance-industry/#

[41] https://www.tesla.com/support/insurance/real-time-insurance ("Your premium can adjust monthly based on your Safety Score. The higher your score is, the lower your premium can be.").

[42] https://www.fortunebusinessinsights.com/automotive-usage-based-insurance-market-104103.

[43] https://blog.amodo.eu/en/insights/mhyd-and-tbyd-next-generation-of-ubi-product-models.

[44] See, e.g., David Eley, *Rate and Form Regulatin in the Twenty-First Century,* 18 J. Ins. Reg. 277 (2000); PROPERTY AND CASUALTY COMMERCIAL RATE AND POLICY FORM MODEL LAW (NAIC 2002), https://content.naic.org/sites/default/files/model-law-777.pdf.

[45] See, e.g., Douglas Heller and Michael DeLong, WATCH WHERE YOU'RE GOING: WHAT'S NEEDED TO MAKE AUTO INSURANCE TELEMATICS WORK FOR CONSUMERS (Consumer Federation of America, 2021) (hereinafter "CFA Report") ("Florida regulates UBI policies according to the same standards it uses for auto insurance regulation generally. The Office of Insurance Regulation (OIR) requires that auto insurers disclose the data collected and used in determining the rates. OIR then conducts an actuarial review of the data and examines the methodology.").

and as part of their privacy protection laws require disclosure to policyholders of how the data is used.[46]

Among the states that do regulate usage-based insurance sui generis, California stands out at the most restrictive, effectively prohibiting the tracking schemes. An outgrowth of Proposition 103—an auto insurance reform initiative that passed in 1988—California law sets strict guidelines and oversight on how auto policies may be priced. Premiums must reflect three "Mandatory Factors": a driver's safety record, the number of miles driven annually, and years of driving experience.[47] (The regulation also specifies fifteen "optional" factors insurers may consider in pricing, which include some of the familiar risk-correlated features like academic standing and marital status.[48]) Importantly, under the second mandatory factor, the regulation eventually permitted a "verified actual mileage" factor, whereby insurers may use "technological" devices to collect mileage data.[49] But in the same breath it proceeds to prohibit the collection of usage-based data beyond miles:

> "an insurer shall only use a technological device to collect information for determining actual miles driven under the Second Mandatory Factor . . . [and] shall not use a technological device to collect or store information about the location of the insured vehicle."[50]

At some point, as usage-based insurance has grown increasingly popular elsewhere in the country, California insurance regulators signaled their openness to reconsidering, in their words, the "antiquated" system of insurance rating and pricing under Prop. 103, "breathing new life" into it by allowing premiums to be based on how people drive, including reliance on vehicle tracking data.[51] But for reasons that I discuss later, these flickering second thoughts were rapidly extinguished. Indeed, in response to Elon Musk's demand that California change its insurance rules to allow Tesla Insurance to use the very same driving information the cars' operating software already obtains, the California Insurance Commissioner announced (twitted):

> "we won't bend on protecting consumer data, privacy, and fair rates. The Department of Insurance continues to uphold and implement the consumer protections set forth in voter-enacted Proposition 103 & since 2009 we have

[46] Cite

[47] California Insurance Code Section 1861.02 (a)(1)-(3).

[48] The fifteen optional factors are: (1) Type of vehicle; (2) Vehicle performance capabilities; (3) Type of use of vehicle; (4) Percentage use of the vehicle by the rated driver; (5) Multi-vehicle households; (6) Academic standing of the rated driver; (7) Completion of driver training or defensive driving courses by the rated driver; (8) Vehicle characteristics; (9) Marital status of the rated driver; (10) Persistency; (11) Non-smoker; (12) Secondary Driver Characteristics; (13) Multi-policies with the same, or an affiliated, company; (14) Relative claims frequency; (15) Relative claims severity. Cal. Code Regs. tit. 10, § 2632.4 (d).

[49] 10 Cal. Code of Regs., tit.10, §2632.5 (c)(2).

[50] State of California, Department of Insurance. Title 10, California Code of Regulations, Chapter 5, Subchapter 4.7, Section 2632.5. Pay-Drive (Usage Based Auto Insurance. See, specifically, 10 CCR § 2632.5 (2)(F)(i)(5)(a). This section specifies the use of a technological device is strictly limited for the purpose of collecting vehicle mileage information.

[51] *Lara tells insurers he's 'receptive' to their ideas, including vehicle data use*, Politico (July 29, 2019), at https://www.politico.com/states/california/story/2019/07/29/lara-tells-insurers-hes-receptive-to-their-ideas-including-vehicle-data-use-1121365.

allowed vehicle data only to determine actual miles driven, and only in a way that protects the driver's privacy."[52]

California stands alone in the U.S. in its outright rejection of usage-based insurance, but other states impose some moderate restrictions.[53] These include the standard non-intrusive consumer protection safeguards: any opt-in scheme requires policyholders' separate consent and it must include a right to dispute, regulatory review of the agreement and of the rating algorithm, and liability for data breach.[54] The data may not be used or sold for non-rating purposes, and whenever sold or transferred they must be deidentified.[55] Many states who do permit UBI programs nevertheless establish barriers for approval the could delay entry by competitors, sometime for years. For example, at the time of the ~~first~~ second draft of this paper, only ~~six~~ twelve states permitted Tesla Insurance.[56]

More intrusive, and harder to justify, is a class of restrictions that protects policyholders from rate increases. (How much this should be counted as "protection"—considering insurance cross subsidies—and who pays for such protections, will be discussed later.) A common restriction takes the form of a "discount only" rule: insurers are permitted to use the tracking data to reduce premiums, but not to increase them, not to "downtier" the policyholder, nor to deny renewal.[57] A similar restriction, applied specifically to smartphone app-based software that detects distracted driving, limits insurers' use of the distracted statistics in computing a driver's UBI risk score.[58] Another restriction requires the algorithm to have short memory: a "distracted driving" score has to be "refreshed at each policy renewal."[59]

Most states have a more permissive approach to usage-based insurance, some with no specific regulations governing it. For example, Ohio—a "file and use" state[60]—requires insurers to file their rating system but does not apply regulatory overview and does not condition the plan on its approval.[61] In Maryland, another state with no specific black-letter

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[52] California Insurance Commissioner Ricardo Lara, @ICRicardoLara, Twitter, Jan 27

[53] California law makes it particularly difficult to reform the law to permit UBI. Since the prohibition is a voter approved initiative, it grants the authority to set the rules solely to the Insurance Commissioner and prohibits the state legislature from altering or legislating around these restrictions. See CFA Report, *supra* note 45, at _.

[54] See, e.g, "Updated Guideline for New York UBI Programs (Plug-in Telematics Devices and Smartphone Apps)"; Washington RCW 48.18.600, 46.35.020, 46.35.030; Florida Rule: 69O-128.007

[55] See e.g., *Updated Guideline for New York UBI Programs* , *id*., Sec. 14.

[56] Matthew Edmonds, Tesla's Head of Insurance, stated: "The data is there, it's all there, cameras in and all around your car, all of the data points are there. It really comes down to case law, and how much of the data we can utilize. It would have to be a state-by-state proposition."https://www.reuters.com/article/us-tesla-markel-insurance/teslas-use-of-individual-driver-data-for-insurance-state-by-state-proposition-idUSKCN1VQ0FY.

[57] *Id.,* Sec. 10 ("The data collected for the UBI program will not be used to affect policyholders in a negative way (e.g., increasing premiums (including application of surcharges), non-renewing policies, preventing downtiering, etc.).").

[58] *Id.*, Additional Rules, Sec. 6a. ("A company may collect distracted driving statistics; however, such statistics may not be used in the algorithm to determine the final UBI score/factor").

[59] *Id.i,* at 6b.

[60] See *File and Use Rating Laws*, https://www.insuranceopedia.com/definition/74/file-and-use-rating-laws.

[61] See CFA Report, *supra* note 45, at _.

regulation of UBI, regulators informally apply specific considerations when reviewing a usage-based rating system.[62]

In sum, the regulatory landscape involves growing permissiveness towards usage-based insurance that deploys tracking technology, coupled with the standard watery protection for data privacy and security. But significant pockets of resistance remain. At the extreme, there is outright prohibition (only in California). Less extreme are the provisional prohibitions, whereby states slow down the approval of new usage-based insurance providers (as in the case of Tesla Insurance). Finally, there are significant substantive limits on how the data can be used for pricing, with the most significant limitation involving the "discount only" rule (New York and other states).

III. The Benefits

As the regulatory survey shows, usage-based auto insurance that relies on real time tracking is controversial. California prohibits it, other states limit it, and advocacy groups campaign for thinning it down. The reasons why it is resisted—privacy? Discrimination? Redistribution? Market power?—are explored in the next section. But before evaluating these reasons, it is critical to understand the benefits of this technology, because the appropriate limits to an activity cannot be sensibly discussed without an account of the loss of value such limits exert.

Usage-based insurance has generated substantial benefit to insurance companies that led the way in introducing it, but the focus in this section is on the other elements of societal benefits, not on the rents that accrued to insurers.[63] First, there are private benefits to policyholders enrolled in UBI and to other people affected by their driving. Here, far and away the most important component of the social value is the reduction in the incidence of car accidents, and, as result, of road fatalities. Second, there are social benefits that result from changed behavior by policyholders which go beyond reduced collisions, primarily fewer miles driven and the associated reduction in emissions. Surveying the reasons for the dramatic changes in driving habits helps uncover a third and perhaps surprising benefit associated with the increased actuarial precision of usage-based insurance—its potential to improve equity and redistribution in pricing and access to insurance.

1. Road Safety

It is not shocking that UBI causes policyholders to drive more safely and suffer fewer accidents. Multiple channels of causation are responsible for this effect. First, the mere knowledge of being tracked prompts drivers to be more aware of their conduct and thus more restrained. The mechanisms are both fear and reward. Fear—due to the sense that a Big Brother is watching, holding any mishandling of the car against the driver. And reward—

[62] See *Use-Based Automobile Insurance in Maryland* (MD. Ins. Admin. 2020 Annual Report).
[63] See Reimers & Shiller, *supra* note 35, at 622 (UBI increased profits to the first mover, but not to subsequent entrants); *Telematics: How Big Data Is Transforming the Auto Insurance Industry*, (SAS White Paper 2014), http://www.sas.com/enus/whitepapers/telematics − 106175.html (insurers will receive more than 25% of their premium revenue from telematics-based insurance programs).

when policyholders see their improved safety score and experience a sense of accomplishment, thereby driving in a manner that would secure this satisfaction.[64]

Second, when the tracking software provides specific feedback, by showing policyholders the attributes of their driving that downgrade or elevate their safety score, drivers can be coached to correct driving patterns that unbeknownst to them are regarded as dangerous. For example, if the tracking device is set to beep when the driver is making a hazardous maneuver, or provides and explanation when a change to the safety score is executed, the feedback is instructive.[65]

Third, and possibly most important, is the price effect. UBI is a scheme of penalties and rewards, reflected in the insurance premium. The financial consequences provide a concrete and ongoing incentive to improve one's driving. Unlike traffic fines, which are incurred only probabilistically, and unlike exposure to hazards which provides motivation only when salient, UBI ratings could change continuously, and these changes affect each periodic premium, as often as month-by-month.[66]

It is therefore not surprising that a fine-tuned scheme of monitoring precautions—a type of private regulation of care levels—increases overall safety.[67] What is perhaps more surprising, even astonishing, is the possible magnitude of improved safety. A recent study by Reimers and Shiller offered a striking quantitative estimate of the reduction in fatal accidents that results under usage-based insurance.[68] The study found that the introduction of a usage-based program led to early enrollment of 9% of the drivers and to a corresponding reduction of fatal accidents by 4.61%. Assuming these early enrollees are just as likely as others to be in a fatal accident, for 9% of drivers to explain 4.61% aggregate reduction in fatalities they must have experienced a 51% reduction in fatal accidents.[69] Of course, the assumption is false. Early enrollees are not necessarily representative. In fact, they are likely to be among the safest drivers, eager to join a program that rewards them for their caution by premium discounts.[70] If indeed the sample disproportionately includes safe drivers, the reduction of fatal accidents for society at large would be even greater.[71]

This rough extrapolation seems almost too good to be true. But other studies offer estimates that are not too far apart. Jin and Vasserman analyzed a dataset of one million

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[64] It has been suggested that the experience to usage-based insurance policyholders goes "from being one of paying a premium and getting nothing in return to one of competition, interaction and fun." See CIPR Study, *supra* note 1, at 24. This conjecture is bolstered by the fact that UBI data reduces insurance reliance on rating factors that are not intuitive to policyholders and disproportionately disadvantage some. *Id.*, at 25.

[65] *Id.,* at 16.

[66] https://www.tesla.com/insurance (discussing its UBI insurance plan in which insureds pay a different premium each based on their driving and usage during the prior month).

[67] See, e.g., Omri Ben-Shahar and Kyle Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard* 111 Michigan Law Review 197, 236-37 (2012); Kenneth S. Abrahm and Daniel Schwacz, *The Limits of Regulation by Insurance*, 98 Indiana Law Journal (2023).

[68] Reimers & Shiller, JLE 2020

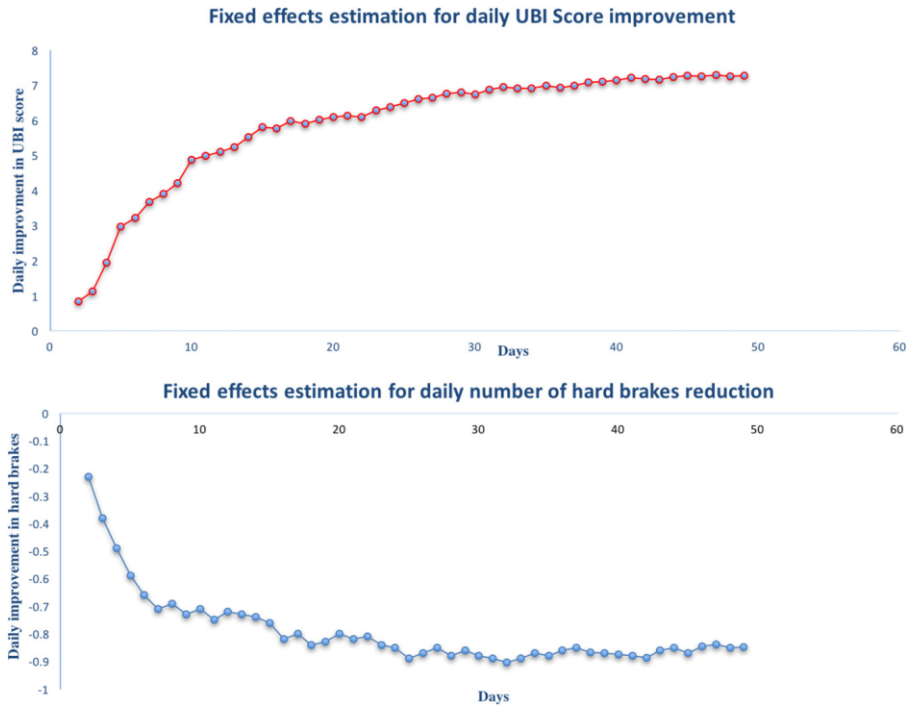
[69] *Id.*, at

[70] Chris Dijksterhuis et al., *In-car usage-based insurance feedback strategies. A comparative driving simulator study*, 59 Ergonomics, 1158, _ (2016).

[71] It is also possible that early enrollees are more safety-attuned and are therefore more responsive than the typical driver to the safety-inducing mechanisms of usage-based insurance.

drivers enrolled in UBI with a national auto insurer and reached comparable estimates of the safety benefit.[72] Observing the safety score for each monitored driver (as well as the corresponding premium adjustments reflecting their improved driving), the authors find that "consumers who opt in to monitoring become 30% safer, on average, while they are being monitored." The incentive effect, which causes these enrollees to drive safer, explains 64% of the risk differences between them and those who are not enrolled and are not unmonitored.[73] The story, then, is incentives, not sorting: the lower accident rate for enrolled policyholders is primarily due to improved driving, not to disproportionate adoption by safer drivers.

Another study of insurance data, by Soleymanian et al., compared participants in the program to non-participants.[74] It used individual-level day-to-day data from an auto insurer to examine how policyholders changed their driving over time. The study found that in the first couple of months, enrolled policyholders decreased their daily average hard-brake frequency by an average of 21% and improved their risk score (See figure below). It also found that these improvements had a lasting presence, and that they ultimately entitled participants for discounts of 12% on average. (We know from other studies that premium reductions reflect only part of the reduction in accident costs, since insurers—especially early adopters of the technology—scooped up a hefty chunk of the increased surplus.)[75]



[72] Yizhou Jin and Shoshana Vasserman, *Buying Data from Consumers: The Impact of Monitoring Programs in U.S. Auto Insurance*, Working Paper 29096, NBER (2021), available at http://www.nber.org/papers/w29096.
[73] *Id*., at 14.
[74] Miremad Soleymanian et al., *Sensor Data and Behavioral Tracking: Does Usage-Based Auto Insurance Benefit Drivers?*, 38(1) Marketing Science 21 (2019)
[75] See Jin and Vasserman, *supra* note 72, at 3; Reimers & Shiller [Cite].

There are other notable findings in the Soleymanian et al. study. The most pronounced safe driving effect was found for young urban drivers, but there were significant improvements also for experienced drivers.[76] Only a tiny fraction of the policyholders in the study—less than 1%--exhibited no improvement in driving and failed to qualify for a premium discount.[77] Here too, as in the Jin and Vasserman study, the measured effects among the monitored group of drivers were not an artifact of a selection bias, whereby more cautious drivers are disproportionately enrolling into monitored insurance. On the contrary: the policyholders who opted into the UBI program in this study were classified by the insurer, on average, as higher risk.[78] Importantly, this study confirmed two channels by which safe driving is induced. First, the financial reward: in "No Fault" states where auto insurance is more expensive, and where premium reductions are therefore potentially greater, the driving improvements observed were larger.[79] Second, information-on-the-go: receiving a safety alert at a given day was associated with greater reduction in the number of hard brakes in the following day.[80]

In addition to statistical measures of the impact of usage-based insurance on drivers, various experimental studies provide suggestive evidence of this effect and its magnitude. In one road study conducted in the Netherlands, drivers were rewarded for adapting their speeding behavior, up to 50 Euros per month. Speeding incidence was reduced as a result of this intervention, and the effect was particularly strong in high-speed roads.[81] The magnitude of the effect is impressive – a reduction of 14% of volitional speeding.[82] To get a sense of the safety impact of such speeding reduction, note that the European Transport Research Center estimates that a 5% reduction of speeding may lead to as much as 10% decrease in injury accidents and a 20% decrease in fatalities.[83] Thus, with a 14% reduction in speeding, the overall benefit in terms of reduced injuries is commensurate with the magnitude found in the above mentioned studies.

Similar effects on speeding and other driving factors were measured in several other studies.[84] One set of studies showed a drastic reduction in hard braking and acceleration

[76] *Id.*, at 35
[77] *Id.*, at 25.
[78] *Id.*, at 27.
[79] *Id.* at 38–39.
[80] *Id.*, at 37-39.
[81] J.W. Bolderdijk et al., *Effects of Pay-As-You-Drive vehicle insurance on young drivers' speed choice: Results of a Dutch field experiment*, 43 Accident Analysis and Prevention 1181, 1184 (2011).
[82] *Id.*, at 1186. See also Lars Hultkrantz and Gunnar Lindberg, *Pay-as-you-speed: An Economic Field Experiment*, 45 Journal of Transport Economics and Policy 415, 432 (2011).
[83] *Speed Management* 39 (OECD 2006).
[84] For instance, in field trials by Lahrmann et al. (2012) and Bolderdijk et al. (2011) drivers reduced speeding behavior substantially when being either penalized for speeding or rewarded for keeping within the speed limit. In a simulator study by Dijksterhuis et al. (2015), rewards and penalties, based on driver behavior, were combined and resulted in a reduction of the number of speeding events by over 90%. The same study also demonstrated the effectiveness of the implemented UBI system to encourage smooth driving, as time spent on harsh cornering, accelerating, braking, and speeding were all reduced by over 50%. This is relevant because, in general, smooth driving can be taken as an indication of a safe driving style (Dingus et al. 2006; Af Wåhlberg 2008; Barkenbus 2010; Young, Birrell, and stanton 2011; simons-Morton et al. 2013; Dorn 2014).

(93% and 69%, respectively).[85] Another speeding experiment conducted in Sweden tracked drivers' excess speeding over two months.[86] The participants were paid lump sum, but some of them were subject to a "penalty" treatment—their payoff was reduced every time they exceeded the speed limit. This structure was meant to simulate insurance premiums that reflect speeding risks. The results showed that all participants in the tracking scheme reduced speeding violations to some extent, but most pronounced was the effect on the penalized group, who displayed a larger and lasting impact: a reduction of 64% in violations (compared to 15% in the non-penalized group). This suggests that some monetary consequence is essential for having a lasting incentive effect.

Because usage-based insurance improves overall safety, it more often manifested in discounts, rather than penalties, to policyholders. People generally rate rewards as more acceptable tools for behavior change than penalties.[87] This might bolster the effect of UBI, and its potential to be viewed more acceptable than other penalty-based speed monitoring systems, which typically only involve penalties.[88]

2. Reduced Driving

Do people drive less under usage-based insurance? If verified mileage data is a factor in pricing the premium, the answer must be yes. Increasing the marginal cost of an extra mile would prompt people to drive less. The question is how much less.

Several early studies by economists, before tracking devices were offered as part of UBI, aimed to predict this activity level effect. Edlin used premium data to calculate average insurance cost of accidents per mile driven. He and estimated the equilibrium per-mile premium and driving reduction, showing approximately 10% decrease in miles driven, nationally.[89] Refining Edlin data, a follow-up study estimated a 9.1% reduction in driving.[90] Subsequently, a Brookings Institution study conducted when fuel prices were significantly higher, estimated a somewhat smaller nationwide reduction of 8%, with significant variation state-by-state. The highest reduction was predicted for states with more accidents and higher premiums (e.g, 13.5% reduction in New Jersey; only 5.7% reduction in Wisconsin).[91]

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[85] Chris Dijksterhuis et al., *In-car usage-based insurance feedback strategies. A comparative driving simulator study*, 59 Ergonomics 1158, 1167 (2016). See also Dijksterhuis et al., *The Impact of Immediate or Delayed Feedback on Driving Behaviour in a simulated Pay-as-You-Drive system*, 75 Accident Analysis & Prevention 93 (2015).

[86] Lars Hultkrantz and Gunnar Lindberg, *Pay-as-you-speed: An Economic Field Experiment*, 45 Journal of Transport Economics and Policy 415, 432 (2011).

[87] Arjaan Wit and Henk Wilke, *The presentation of rewards and punishments in a simulated social dilemma*, 5 Social Behaviour 231 (1990).

[88] *Speed Management* 146-47 (OECD 2006), at https://www.roadsafetyfacility.org/publications/speed-management-guide-oecd-2006.

[89] Aaron S. Edlin, *Per-Mile Premiums for Auto Insurance*, in ECONOMICS FOR AN IMPERFECT WORLD: ESSAYS IN HONOR OF JOSEPH STIGLITZ 53, 55 (2003) 4 ("We estimate that such a system would reduce driving nationally by 9.2 – 9.5%, and insured accident costs by $14 - 17 billion.").

[90] Ian W.H. Parry, *Is Pay-as-You-Drive Insurance a Better Way to Reduce Gasoline Than Gasoline Taxes?"* 95(2) AEA Papers and Proceedings 287 (2005).

[91] Bordoff and Noel, *supra* note 22, at 25-26.

These estimates need to be viewed with caution. A reduction in driving would, for one, reduce traffic and the likelihood of accident, reducing insurance cost, thus offsetting some of the driving reduction due to the per-mile charge. Also, usage-based insurance would make premiums more affordable for reasons other than miles-driven, which could reduce the per-mile insurance charge, and also increase car purchases.[92] Thus, the estimates of reduced driving that were made under the assumption that UBI relies solely on miles (namely, the older model of Pay-As-You-Drive) are not quite reliable in an era of more comprehensive UBI, which incorporates other factors of risky driving.

It worth pointing out, however, that any reduction in driving activity would have social benefits beyond the costs of accidents and insurance. Less driving means less emissions, congestion, and time spent on the roads.[93] For example, one estimate suggests that per-mile insurance pricing would reduce gasoline demand by 11.4 billion gallons (9.1 percent) and increase social welfare by $19.3 billion per year.[94]

3. Fair Premiums

Usage-based insurance changes the price people pay for insurance. By far, the biggest impact is due to safer driving and the resulting decline in accidents. If there is a smaller risk to insure, a lower price would be set to insure it. Second, the reduced reliance on non-driving group factors improves the personalized nature of risk prediction. UBI data allows insurers to charge each policyholder a more precise premium, reflecting the risk created by this driver rather than by the larger pool. Third, greater underwriting accuracy reduces the cross-subsidies among members of the insurance pool in a manner that favors lower-income drivers.[95] Let's briefly review these effects in turn.

(i) Lower Premiums

Monitored drivers change their driving and become less risky. This reduces the cost of insuring them, and some of the saving trickles down to the policyholders. Tesla's UBI insurance, for example, varies the premium month-by-month, based on the car's safety score in the previous month, calculated based on tracking data. Improving one's score translates into significant savings.[96]

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[92] *Id*., at 28.

[93] Sinisa Husnjak et al, *Telematics System in Usage Based Motor Insurance*, 100 Procedia Engineering 816, 820 (2015).

[94] See Parry, *supra* note 90, at 291-92.

[95] The progressive effect of driving-factor premiums was already noted for older Pay-As-You-Drive plans. See e.g., Todd A. Litman, *Pay-as-you-drive Pricing for Insurance Affordability* (2011) ("PAYD charges premiums by the vehicle-mile, so a lower-risk driver pays 2-4 cents per mile and a higher-risk driver pays 10-20 cents per mile. This […] tends to benefit lower-income motorists.").

[96] See *Insurance* (Tesla.com), https://www.tesla.com/insurance ("Your score at the end of the month determines your next month's premium."); *Tesla Insurance: A look at its cost and which states it's available in*, https://www.notateslaapp.com/tesla-reference/913/tesla-insurance-a-look-at-its-cost-and-which-states-it-s-available-in, ("Tesla Insurance users make monthly payments based on their driving behavior rather than factors typically used by other insurance providers.").

How much of the reduced accident costs is reflected in premium discounts depends, among other things, on competition among insurers. In the early days of usage-based-insurance, when only one or a few auto-insurers offered tracking options, profits of these insurers increased in large part due to market power.[97] Over time, the discounts became more significant. Indeed, a recent study found that:

> "consumers who enroll in the UBI program and allow the automobile insurance company to access their otherwise private driving behavior data become better drivers by the end of the monitoring period and receive discounts (on average of 12%) that apply to all future insurance premiums as long as they remain policy holders with this company."[98]

An earlier study that focused solely on mileage tracking predicted that 63.5 percent of households with insured vehicles would save an average of $496 a year (a 28 percent average reduction in premium) under a fully variable mileage-based insurance program.[99]

Another reason why UBI premiums would potentially be lower is the reduction in the cost of investigating and processing claims. Insurers can verify causes of accidents in a speedy and accurate manner (for example, by digital evidence of the driver's distraction), which reduces administrative costs and, more importantly, reduces exposure to fraud and uncovered claims. Velocity data prior to the collision can indicate which vehicle caused an injury and how sever the injury is, mitigating medical build-up and fraudulent claims.[100]

Finally, while I have not seen data supporting such conjecture, tracking devices are likely provide the additional benefit of locating and recovering stolen cars. This could reduce the cost of the theft coverage in auto policies, and—to the extent that thieves recognize connected cars or ones installed with tracking devices—deter theft in the first place. In fact, when thieves cannot differentiate tracked cars, once sufficient fraction of cars have a tracking device that permits its immediate recovery, a deterrent effect that benefits all policyholders (including those with non-tracked cars) would be achieved.[101]

(ii) Reduced Reliance on controversial rating factors.

Usage-based insurance is priced to reflect each policyholder's actual driving activity and the frequency of collision-prone driving maneuvers. It allows insurers to personalize the premiums and reduces the need to rely on other predictors, particularly on group classifications that, based on aggregate historical data, crudely correlate with accident risk. Depending on a state's specific regulations, non-driving rating factors—such as credit score, occupation, marital status, and education—would otherwise be used to price auto

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[97] See Reimers & Shiller, *supra* note 35, at _ (noting that early entrants into PHYD had "supernormal" profits that were eventually lowered due to competition).
[98] Soleymanian et al, *supra* note 74, at 22.
[99] Bordoff and Noel, *supra* note 22, at 45.
[100] Scott Palmer, *Telematics in auto claims is inevitable*, PropertyCasualty360.com (August 18, 2016).
[101] Ian Ayres & Steven D. Levitt, *Measuring Positive Externalities from Unobservable Victim Precaution: An Empirical Analysis of Lojack*, 113 Quar. J. Econ. 43 (1998); Omri Ben-Shahar and Alon Harel, *Blaming the Victims: Optimal Incentives for Private Precautions Against Crime,* 11 J. L., Econ. & Org. 434 (1995).

insurance policies. These standard classifications are widely regarded as problematic due to their imprecision, poor explainability, and discrimination.

First, the problem of imprecision. The classification factors are data-proven to be correlated with the risk and are therefore statistically valid predictors of accidents. However, they are good only *on average*, which means that they are potentially imprecise in any individual case. Men may cause more accidents per mile driven than women, but not all men. Good students may be less prone to reckless driving, but not all good students. Moreover, the classifications apply in an all-or-nothing fashion, not allowing for continuous and incremental measurement. For example, marital status is used by insurer as a risk predictor because married drivers get into fewer accidents—perhaps because they have more to lose (children, financial stability), or because they drive less.[102] But these factors that account for the relation between marital status and accident risk develop over time. A 28-year-old male does not become a better driver the morning after his wedding. The insurance discount, in contrast, applies immediately upon marriage and removed upon divorce.[103]

Second, the problem of explainability. Unlike a history of dangerous acceleration and sharp turn—which points to risk a policyholder could review, understand, and intuit—the traditional classification factors are not entirely transparent or sensible, thus making insurance pricing enigmatic and puzzling.[104] Credit score is perhaps the poster case for this enigma.[105] Low credit score is widely and intuitively understood as a reason for higher interest rates on loans, but why for higher accident probability?[106]

Third, some generalizations used by the standard classification methods could be viewed as discriminatory. The use of credit scores is particularly problematic, resulting in people with poor credit paying 122% more than people with best credit ($1566 extra per year, on average), which led several states (CA, HI, MA) to prohibit use of this factor presently.[107] The use of sex to price insurance is also controversial, and was prohibited in a different insurance market by the Supreme Court, even when the statistics underlying it where not contested.[108] In that Title VII case, an employer required women employees to make larger pension contributions because they were expected to live, on average, longer than men employees and needed to capitalize a larger pension fund. The Court held that there is no assurance that any individual female policyholder fits the generalization (that is, that she specifically will live longer and reach the age predicted by mortality tables) because not all females are the average female. This practice of putting all females in one bin, separate

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[102] *Car Insurance Married vs. Single: Everything You Need to Know,* Car and Driver, *https*://www.caranddriver.com/car-insurance/a35824548/car-insurance-married-vs-single/.

[103] See *The State of Auto Insurance* 16, The Zebra (2021) ("When single people get married, their car insurance rates drop about 6.5%, saving roughly $96/year.")

[104] Regina Austin, *The Insurance Classification Controversy,* 131 U. Pa. L. Rev. 517 (1986).

[105] *Dehoyos v. Alstate Corp.*, 345 F.3d 290 (5th Cir. 2003).

[106] A footnote explaining the intuition of using credit score, citing, among others, Ellen Garbarino, Robert Slonim and Justin Sydnor, *Digit ratios (2D:4D) as predictors of risky decision making for both sexes*, 42 J. Risk Uncertain 1 (2011) (finding that the ratio between the length of the second and fourth finger, which is linked prenatal exposure to testosterone, predicts financial risk taking behavior).

[107] See The State of Auto Insurance*, supra* note 103, at 14.

[108] *City of Los Angeles, Dept. of Water and Power v. Manhart*, 435 U.S. 702, 708-09 (1978).

from all males, was defined as discriminatory against any individual.[109] In fact, the European Court of Justice held that gender classifications in insurance is a human rights violation.[110] At the other end, many states reject this conception of equal treatment and, under state insurance law, hold that sex classification is just when based on actuarially sound risk tables.[111] This question continues to be one of the more controversial in insurance law.[112]

Consumer advocates have long been arguing that the use of some of these classification generalizations disproportionately harms certain disadvantaged classes.[113] They highlight their potential to penalize young drivers, the poor, senior citizens, urban residents and non-homeowners with higher rates.[114] This critique was illustrated in a recent Consumer Federation of America (CFA) report, which found that a Baltimore driver would pay 46% less in premium for minimum liability coverage if they were a married homeowner in a higher-income ZIP Code. The same report also noted that auto premiums were higher in urban areas, and they exceeded $500 annually in 24 out of 50 of the nation's largest cities. Because urban drivers usually drive fewer miles, they would likely pay less if insurance pricing were based on miles driven.[115]

(iii) Distributive Fairness

The discussion of traditional risk classification and the resulting divergence of premiums paid across demographic groups raises questions of insurance equity. Since usage-based insurance does not engage in such classification, it removes the cross-subsidies that the current system creates, including those that violate intuitions about distributive justice.[116] Cross-subsidies, it should be stressed, are an intended feature of insurance, and they could flow in desirable directions. For example, when healthier people cross subsidize sicker members within the health insurance pool they offset the impact of unequal health endowments. This rationale does not have much weight in auto insurance, where people are perceived to create the hazards, and therefore a widely accepted maxim in this sector is each policyholder should "carry their own weight."[117]

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[109] *Id*., at 708-09.

[110] *Test-Achats ASBL v Conseil des ministres*, Case C-236/09, European Court of Justice (invalidating a provision of Directive 2004/113/EC of the European Union that permitted sexual classification in insurance rating even when based on accurate actuarial data).

[111] See, e.g., *Telles v. Comm'r of Ins*., 574 N.E.2d 358, 361 (1991) (*quoting* Life Ins. Ass'n of Mass. v. Comm'n of Ins., 4530 N.E.2d 168, 171 (1988)); *Ins. Servs. Office v. Comm'r of Ins*., 381 So. 2d 515, 517 (La. Ct. App. 1979).

[112] See, e.g., *Hartford Acc. & Indem. Co. v. Ins. Comm'r of Penn.*, 482 A.2d542 (S. Ct. Pa. 1984) (sex-based rating are "unfairly discriminatory). The decision was overridden in the state legislature. 40 P.S. 1183(e) ("this section shall not be construed to prohibit rates for automobile insurance which are based in whole or in part, on factors, including, but not limited to sex …"). This law was struck down by Pennsylvania state courts as violation the Equal Rights Amendment to the state Constitution. See *Bartholomew ex rel. Bartholomew v. Foster*, 541 A.3d 393 (1988). See also Ronen Avraham, Kyle D. Logue, and Daniel Schwarcz, *Understanding Insurance Anti-Discrimination Laws*, 87 S. Cal. L. Rev. 195 (2014).

[113] See CIPR Study, *supra* note 1, at 25.

[114] Cite

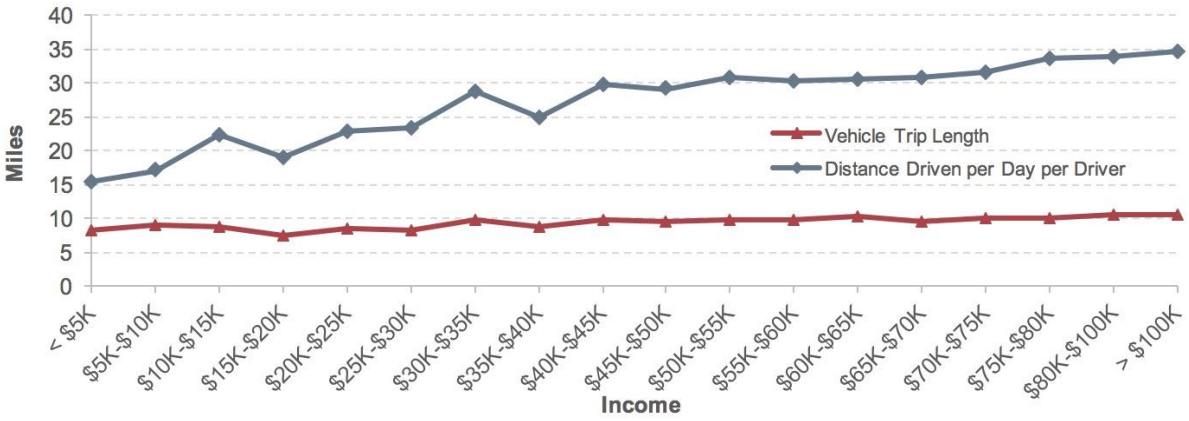
[115] See CIPR Study, *supra* note 1, at 48, 51.

[116] Soleymanian et al., *supra* note 74, at _.

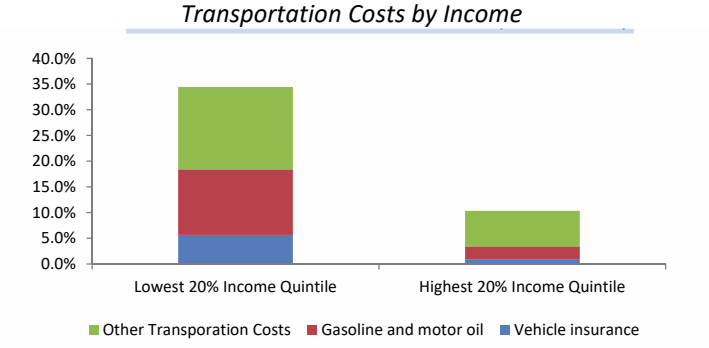
[117] See *Ins. Servs. Office v. Comm'r of Ins*., 381 So. 2d 515, 517 (La. Ct. App. 1979) (people of certain low-risk classes should be classified so that they "will not be subsidizing insureds who present a significantly greater hazard.")

Cross-subsidies in insurance could also be desirable as a form of progressive redistribution when they operate in favor of low-income policyholders, making insurance more affordable to them. But this rationale, too, flies in the face of classification-based auto insurance, where cross-subsidies are largely regressive, flowing *against* low-income policyholders. Consider, first, the failure of ordinary auto insurance to charge premiums that reflect exact number of miles driven. As a result, low-mileage drivers subsidize high-mileage drivers in each risk class. It is well documented that low-income people tend to drive less and use other forms of transportation.[118] A Department of Transportation study found that more affluent drivers drive more often and longer distances, with the highest earners driving approximately *twice* the distance compared to those at the low-income echelon.

Vehicle Travel Distances and Income, 2009[119]



Put differently, pricing insurance on usage and actual driving would help lower total transportation costs, which (in 2013) represented one third of income for the lowest income quintile, but only 10% income for the highest: [120]

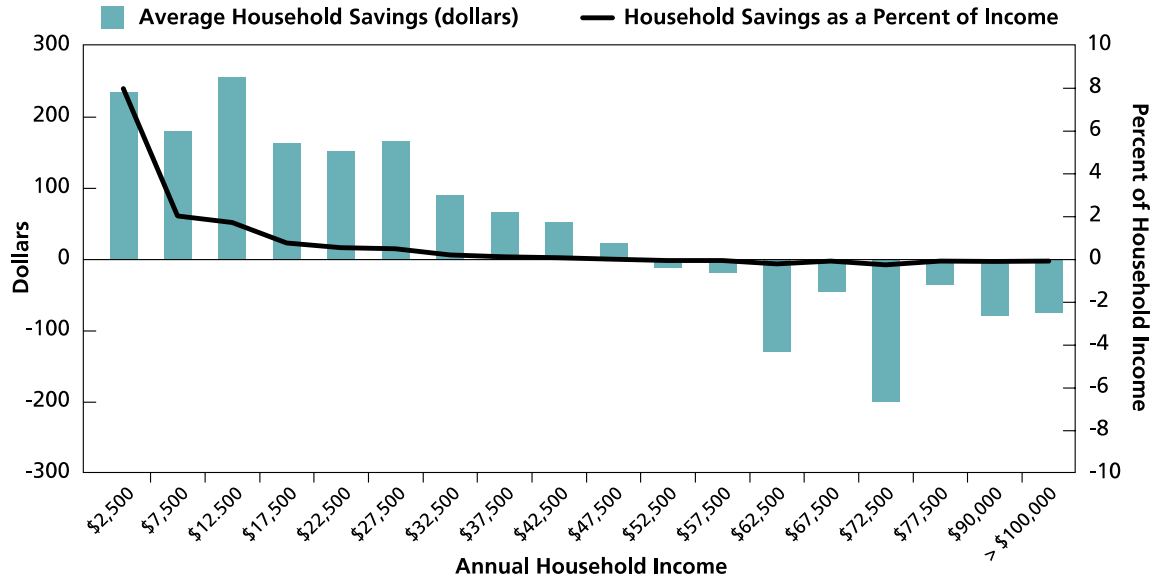


[118] Litman, *supra* note 95, at 4 ("Since lower-income motorists tend to drive less than average, current insurance pricing is regressive.").

[119] National Household Travel Trends, Ch. 3, exhibit 3-26 (U.S. Dept. of Transportation 2019), https://www.fhwa.dot.gov/policy/23cpr/index.cfm (("Average high-income drivers (household annual income above $70,000) drove more than 30 miles per day, approximately twice the distance driven by drivers from households with income below $10,000.").

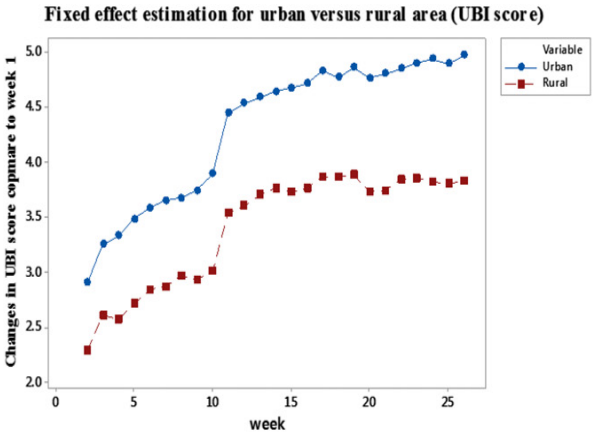
[120] U.S. Bureau of Labor Statistics, Consumer Expenditure Survey, at __; See also CIPR Study, *supra* note 1, at _.

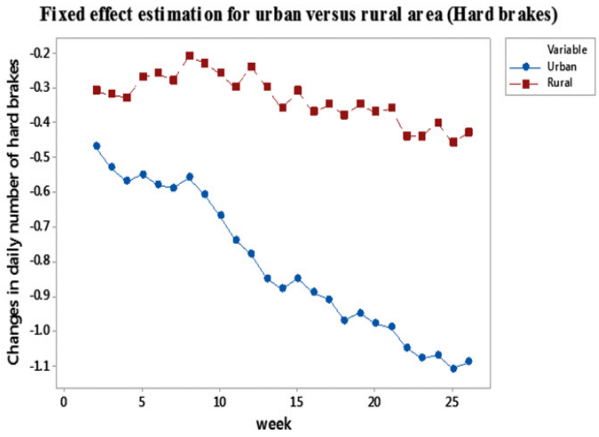
Because low-income families make up a disproportionately large fraction of the low-mileage drivers, they would benefit from usage-based insurance. Simulating this saving, a Brookings study calculated that under pay-for-miles insurance, households in the low-income half would have a reduction in insurance cost, with the savings for the lowest bracket reaching over 6% of household income. Households in the upper distribution of income would pay more, but the burden as a fraction of their income would be relatively insignificant.[121] Indeed, two thirds of households with insured vehicles would save money if switched to per-mile insurance, a reduction largely due to safer driving and to the eliminated cross-subsidy for high-mileage drivers.[122]



In addition, usage-based insurance would eliminate the cross-subsidies that result from non-driving rating factors, which end up penalizing urban residents, non-homeowners, and senior citizens, even though these groups driver fewer miles.[123] Urban drivers, who are more likely to be low income and members of racial minorities, drive significantly less.[124] Urban drivers have also been shown to respond more sharply to UBI. The rise in their safety scores in the first months of enrollment is larger than for those living in rural areas (see figure below).[125]

[121] Bordoff and Noel, *supra* note 22, at 39.
[122] *Id.*
[123] See CIPR Study, *supra* note 1, at 48.
[124] John Pucher and John L. Renne, *Urban-Rural Differences in Mobility and Mode Choice: Evidence from the 2001 NHTS*, 32 Transportation 165 (2005) (On average, rural households cover 38% more mileage per person per day than urban households").
[125] Soleymanian et al, *supra* note 74, at 36.





Finally, UBI could favor customers who might otherwise be deemed too risky to insure. The ability to tie premiums to driver behavior allows insurers to price their risk exposure more accurately, which in turn allows them to raise their risk tolerance and reach new customers. So while some high-risk policyholders would have to pay high premiums, those among them who are currently excluded from the insured activity may be able to purchase insurance.[126]

IV. The Resistance

We have a puzzling phenomenon: an innovation that is documented to provide such marvelous benefits to the people who deploy it, from protecting their lives to saving them money, and yet the regulators in charge of protecting people's lives and money are suspicious towards it. How can such suspicion, and the resulting restrictions it imposes, survive? If the technology is so good, why do lawmakers impose limit it? Why, perish the thought, don't they mandate it?

In this Section, I explore this tension in two parts. Part IV.A discusses several grounds precautionites invoke to limit the unchecked spread of usage-based insurance: privacy, transparency, ownership of data, and equity. It also begins to evaluate these grounds, by challenging the premises underlying each of the objections and the conclusions they draw. Part IV.B then attempts to distill from the various opposing accounts the more fundamental worries—how such technology disrupts existing social order, how it shifts the power dynamics, and how it creates templates of social domination that cripple weaker sectors. While I share and admire the instincts that elevates such concerns to the fore, I end the article with the conviction that the evidence in this case, about the effects of usage-based insurance, does not support the resistance.

A. The Objections

Precautionites raise four specific arguments in objection to usage-based insurance, each focusing on an interest of policyholders or of society that would be overlooked or insufficiently protected by the insurance companies that develop and market the plans. These interests are privacy, ownership of data, distributive fairness, and transparency.

[126] See CIPR Study, *supra* note 1, at 43.

1. Privacy

Any new digital technology that collects personal data raises privacy concerns, and still more when people's movements are tracked. A prolific literature in law reviews describes, and often bemoans, how "surveillance" spies that infiltrate and have a permanent foothold in people's personal space—home, car, connected devices—allows companies to learn, influence, and control people's lives.[127] With UBI's tracking technology insurers know where people drive and at what time, and this information could be private and sensitive. Precautionites warn: you are taking "the spy along for the ride" and it will be "the witness against you."[128] They have a powerful advocate in the form of the California Insurance Commissioner: "you shouldn't have to have the insurance companies in the car with you looking over your shoulders every time you brake, every time you steer. That's big brother. That's wrong!"[129]

The concerns with the collection and use of personal data are thought to have heightened severity in the context of driving. There are some of the standard privacy alarms. Perhaps insurers would share insights from the data with third parties who want to know where people are. For example, insurers might sell information to geographically-specific advertisers ("get 10¢ off every gallon in the nearby Shell station").[130] Another concern, very much at the core of data privacy law, is the "smoking gun"—the transfer of data to police or for use in legal proceedings, criminal and civil alike. "Your car can make a very convincing case against you" and "NSA can track people with the Progressive Snapshot."[131] I'm not sure how seriously to take these objections. Tracking data could at times be subpoenaed in legal proceedings and occasionally used against the driver. Is it "a good reason for concern," as precautionites argue, that "in some instances, telematics has convicted murderers, hit-and-run drivers and thieves of their crimes"?[132]

There are also concerns how the presence of the surveillance technology insides the car makes people day-day practices visible and measurable. This process of taking tasks of

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[127] This literature is too vast to cite, but here are some fragments: Eric Hornbeck, *"We Know Not Where We Go": Protecting Digital Privacy in New York City's Municipal Wi-Fi Network*, 45 Fordham Urb. L.J. 699 (2018); Andrew Guthrie Ferguson, *Structural Sensor Surveillance*, 106 Iowa L. Rev. 47 (2020); Katherine E. Tapp, *Smart Devices Won't Be "Smart" Until Society Demands an Expectation of Privacy*, 56 U. Louisville L. Rev. 83, 83 (2017); Marissa Merrill, *An Uneasy Love Triangle Between Alexa, Your Personal Life, and Data Security: Exploring Privacy in the Digital New Age*, 71 Mercer L. Rev. 637 (2020); Alexandra Rengel, *Privacy-Invading Technologies and Recommendations for Designing A Better Future for Privacy Rights*, 8 Intercultural Hum. Rts. L. Rev. 177, 178 (2013);

[128] Ed Leefeldt and Amy Danise, *The Witness Against You: Your Car*, (Forbes, March 26, 2021) (Police and other agencies can retrieve this data with a court order, and it can be subpoenaed in divorce proceedings).

[129] See consumerwatchdog.org/insurance/ricardo-lara-wants-give-insurance-companies-your-driving-data.

[130] See, e.g., Marisa Tashman, Who's Driving You? Driver Data Remains Unprotected Under Coppa and Shine the Light, 50 Loy. L.A. L. Rev. 423, 437 (2017) (opportunities for "abuse" by using the data to "personalize services based on individual user profile[s] and categorize customers for target marketing purposes.").

[131] *Witness Against You*, supra note 128; Becky Yerak, *Motorists tap the brakes on installing data devices for insurance companies*, Chicago Tribune (Sept 15, 2013) (("I'm waiting for someone to leak documents showing the NSA can track people with the Progressive snapshot thing.").

[132] *Witness Against You*, supra note 128.

personal practice which are traditionally immune from oversight and converting them into objective and morally neutral standardized records is "potentially detrimental" to individuals.[133] Fleet drivers, for example, resist such monitoring schemes as invasive and violating of their privacy. A driver is quoted to say: "a computer does not know when we are tired, fatigued, or anything else. . . . I am a grown man and have been on my own for many many years making responsible decisions."[134] Fleet drivers complain how their 'scorecards' are made publicly visible, to create social pressures on underperforming drivers by being shamed or embarrassed in front of co-workers.[135]

Unlike fleet drivers, participation of households in UBI plans is of course optional. But privacy advocates worry how much choice people genuinely have. As in other big data contexts that offer consumers some quid pro quo for allowing their personal data to be collected, UBI offers people incentives to participate and give up personal information. Which means that those who do not participate are "penalized" by forfeiting the premium discounts associated with safety ratings they would otherwise receive, as well as any upfront bonus for joining.[136] Consumers, it is argued, should not have to choose between their privacy and their ability to obtain affordable auto insurance.[137]

There is a tendency among privacy advocates to claim that the relatively slow adoption of UBI is due to people's privacy concerns. Indeed, adoption has been gradual—only 22% of the policyholders have such plan (in 2022), and many who could benefit from it outright, by receiving premium discounts, have not joined.[138] Privacy concerns must be the reason, concluded the Consumer Federation of America. In a 2021 report, the federation explains that "the public reaction has been lukewarm, likely due to privacy concerns and worries about corporate misuse of the collected data."[139]

Drivers' privacy is prominently cited by regulators as their motivation for the restrictions, but how significant is it in fact to policyholders? The slow level of adoption may be due to other reasons beyond privacy. Is it status quo bias? Uncertainty how it will affect the premium? Technological anxiety? When the Consumer Federation declared that privacy is the reason people are not joining, the substantiation it offers is rather thin: a 2016 online "news" piece titled *More Americans reject telematics over privacy concerns*, which in turn quotes a single individual driver in San Diego who proclaimed "I know some people say,

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[133] Karen E.C. Levy, *The Contexts of Control: Information, Power, and Truck-Driving Work*, 31 The Information Society 160, 161 (2015).
[134] *Id*., at 166.
[135] *Id.,* at 170.
[136] *A new kind of auto insurance technology can lead to lower premiums, but it tracks your every move*, CNBC (October 6, 2018) ("customers outside of the pool of users could face increasingly high premiums for not giving up their privacy.").
[137] Karl Bode, *Consumer Groups slam Comcast's Plan to charge Users for* Privacy, DSL Reports (Aug 05 2016), http://www.dslreports.com/shownews/Consumer-Groups-Slam-Comcasts-Plan-to-Charge-Users-for-Privacy-137588 (consumers are "put in the position to make Sophie's Choice—to give up the right to privacy in exchange for a right to essential broadband services" and that firms "manipulate and coerce consumers into giving up their privacy.")
[138] See https://www.gminsights.com/pressrelease/usage-based-insurance-ubi-market; .
[139] See CFA Report, *supra* note 45, at 8.

'What do you have to hide,' but I don't want big business or Big Brother involved in my personal life. It just creeps me out."[140]

One would think that in the specific context of UBI privacy concerns ought to be relaxed, due to the optional status of the program. In many other areas of the data economy people must opt out of the tracking default. They may switch off the data settings on Google or the location setting other apps. But opting out is a complex and deliberate action, both in terms of the information required and the affirmative acts needed, and thus its absence does not signify meaningful consent.[141] In the insurance case, by contrast, people *opt in*. No tracking, unless a policyholder makes the choice to switch from their current program, install the technology, and enroll in a different fee structure. Accordingly, if an act of consent could ever signify subjective intent, this seems to be a case in point. Oddly, precautionites are not convinced. They insist that unlike turning off cellphone surveillance, drivers' option to avoid tracking of their cars is impractical. Why impractical? Because "data such as vehicle location has saved many lives during accidents and injuries."[142]

2. Data ownership and control

Another category of interests that UBI is said to imperil, also owing to the data collection enterprise, is the control of information, the appropriation of its value, and the power imbalance it entrenches.[143] Driving data are aggregated into databases that are property of the insurers and used by them in a one-sided manner.[144] While privacy concerns address how the uses of personal data may harm the private spheres of its subjects, data ownership and control concerns focus more on collective derogations of consumer value and how the benefits from the databases are appropriated.

Policyholders are the ones providing the granular information—it is their behavior that is being measured—and therefore according to the "property" or the "labor" models of personal data they should also reap the benefits.[145] One of the primary implications of the present ownership model, whereby the insurers who collect and build the databases own it, is the inability of policyholders to transfer their personal information profiles to a new insurer to help price a new policy. This cripples people ability to shop around and switch carriers, making them hostages to the data-driven pricing advantage of their present insurer.[146] If they switch, they must "start over" and build a new record of safe driving to eventually qualify for discounts.

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[140] *More Americans reject telematics over privacy concerns*, at https://www.insurancebusinessmag.com/us/news/breaking-news/more-americans-reject-telematics-over-privacy-concerns-27554.aspx (1/12/ 2016).
[141] See, generally, Omri Ben-Shahar and Lior J. Strahilevitz, *Contracting Over Privacy: Introduction*, 43 J. Legal. Stud. (2016).
[142] See *The Witness Against You,* supra note 128.
[143] Freya Van Den Boom, *Putting Users Back in Control of Car Data to Fuel Innovations*, Bot Populi (November 8, 2021), https://botpopuli.net/putting-users-back-in-control-of-car-data-to-fuel-innovations/ ("The increased awareness about the value of car data has also led to debates about its ownership, control, and use.").
[144] Tzameret H Rubin et al., *Big data and data ownership rights: The case of car insurance*, Journal of Information Technology Teaching Cases 2 (2022).
[145] See, generally, Posner & Weyl, Radical Markets [Cite].
[146] See CIPR Study, *supra* note 1, at 27.

There are, to be sure, general solutions in the data economy to this mobility concern, foremost the portability of personal data.[147] For example, portability could be advanced by a 'data travels with you' regulation, allowing people to bring their data along when they switch carriers (similar to cellphone regulation[148]). Or, more comprehensively, portability could be achieved by the creation of a statistical intermediary for insurance, similar to credit bureaus that aggregate personal financial data and make them available to any financial institution. A centralized data agent would allow any auto insurer authorized by a consumer to receive their history of driving behavior, at the level of granularity held by the current insurer.[149] But 'data travels with you' or intermediation bureaus do not currently exist and would require regulatory mandates. So long as major insurers adhere to their strict data-property practices, UBI puts policyholders at a bargaining disadvantage.

Another implication of the present ownership model is the potential for selective and asymmetric use of data by insurers. For example, if there is a dispute between the insurer and the policyholder during claim settlement, the insurer could use information about how the car was driven prior to the accident to demonstrate the driver's fault and reduce their coverage. But not vice versa: when the data goes the other way—when it vindicates the position of the policyholder—insurers might be less likely to make it available. Thus, rather than increasing the precision of ex-post claim administration, UBI could bias it.[150]

Undoubtedly, the auto insurance contract is also a rent seeking contest with a lot at stake: who gets to scoop the surplus from the risk reduction. We know that insurers who were early adopters of tracking technology fared enviously well in this rent contest, pocketing much of the risk reduction benefit created by the scheme.[151] But auto insurance is a highly competitive sector, where the cost of insuring a car has barely kept up with the increase in miles driven, and where insurers profits have not increase in the past decades.[152] Any excess rents captured by early adopters of UBI technology dissipated once their IP-protect market power declined.[153] If usage-based insurance reduces accidents by anything resembling the magnitudes documented in Part II above, it is hard to imagine that policyholders are denied a good chunk of this benefit. At the end of the day, if less people crash and die, it is drivers and their passengers who benefit. And more still when they enjoy a reduction in premiums.

Like in any business to consumer relationship, there are one-sided aspects in the insurance contract and in how the data models are designed. Insurers own the information the

[147] See, generally, *Data Portability, Interoperability and Digital Platform Competition*, OECD Competition Committee Discussion Paper (2021).
[148] See, e.g., *Local Number Portability*, https://en.wikipedia.org/wiki/Local_number_portability.
[149] See CIPR Study, *supra* note 1, at 27.
[150] See CIPR Study, *supra* note 1, at 52.
[151] See Reimers & Shiller, *supra* note 35, at 625 (UBI increased profits to the first mover, but not to subsequent entrants).
[152] Martin Grace et al., *Cost Trends and Affordability of Automobile Insurance in the U.S.*, 38 J. Ins. Reg. 1, 3-6 (2019) ("Auto insurance markets are highly competitive, and insurer profits have not risen with the cost of automobile insurance").
[153] See, e.g., Yuanjing Yao, *Evolution of Insurance: A Telematics-Based Personal Auto Insurance Study* 7-9, Honors Scholar Theses, Univ. of Connecticut (2018), https://opencommons.uconn.edu/srhonors_theses/590.

tracking devices transmit, they train the algorithms, and they set up complex take-it-or-leave-it premium formulae. But does this control of the technology spell "entrenchment of power" and diminution of people's opportunity to "assert their identity"? This is *insurance*, a sector where firms are in the business of knowing people's ills and mishaps, where risk, loss, and misfortune are the "product." Now, with UBI, some of the mystery is removed, and policyholder can understand their risk ratings and scores, review the factors that explain why their premiums, learn rather quickly what they can do to affect improve their ratings, qualify for lower charges, and drive better. All the evidence shows that people are actually using and benefitting from these tools, experiencing a meaningful reduction in one of the biggest fatality risks they and their loved ones face—auto accidents.[154] Is there a serious assertion-of-identity or liberation-from-control reason to deny folks who want to opt in and take advantage of those benefits such opportunity?

3. Disfavoring low-income drivers

Insurance is the business of personalized risk classification, and to the extent permitted by law it charges different premiums to different people, depending on their expected risk. That's why life insurance requires health screening to determine individual mortality risk, why home insurance depends on fire and theft mitigation measures installed in each home, and why auto insurers adjust the premiums to each driver's risk signals. But in thus classifying people, insurers are also edging on the border of discrimination, particularly when the factors they use for differentiation are ones on which disadvantaged members of society—low-income people and racial minorities—score less favorably.[155] There is significant empirical grounding to this general concern with respect to traditional auto insurance risk classification, which relies on non-driving factors like credit history, homeownership, and education. Auto insurance becomes more expansive for protected groups, who, unfortunately, are also those who need it most and can afford it least.[156]

The same concern—that risk classification disparately affects weaker groups—is also raised by precautionites against usage-based insurance, based on speculative but not unrealistic assumptions.[157] While the traditional non-driving factors are replaced by actual driving metrics, the scores that drivers receive may still disfavor some groups relative to others. Indeed, this is a common concern with many machine learning algorithms, which use big data to discover by brute statistical power the factors that are corelated with some predicted outcome (here, accidents).[158] This is why the Federal Insurance Office at the

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[154] *Early Estimates of Motor Vehicle Traffic Fatalities And Fatality Rate by Sub-Categories in 2021* (NHTSA, 2022), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813298 (42,915 traffic fatalities in 2021).
[155] See CIPR Study, *supra* note 1, at 52.
[156] Julia Angwin et al., *Minority Neighborhoods Pay Higher Car Insurance Premiums Than White Areas With the Same Risk*, ProPublica (April 5, 2017), https://www.propublica.org/article/minority-neighborhoods-higher-car-insurance-premiums-white-areas-same-risk.
[157] Martim Brandão, Discrimination issues in usage-based insurance for traditional and autonomous vehicles, in Culturally Sustainable Social Robotics—Proceedings of Robophilosophy CULTURALLY SUSTAINABLE SOCIAL ROBOTICS—PROCEEDINGS OF ROBOPHILOSOPHY (M. Nørskov and J. Seibt, eds., 2020).
[158] See, e.g., VIRGINIA EUBANKS, AUTOMATING INEQUALITY: HOW HIGH-TECH TOOLS PROFILE, POLICE, AND PUNISH THE POOR (2018); SAFIYA UMOJA, ALGORITHMS OF OPPRESSION (2018). See also OMRI BEN-SHAHAR AND ARIEL PORAT, PERSONALIZED LAW: DIFFERENT RULES FOR DIFFERENT PEOPLE, 132-142 (2021) (exploring ways to reduce unintended distributive impact on weaker sectors).

Department of Treasury warns that "certain big data methodologies may hide intentional or unintentional discrimination against protected classes" and why it mentions usage-based insurance as one area where such concern arises (although without any concrete empirical support for this specific inclusion).[159] UBI, in short, is discriminatory.

But wait, UBI is *not* based on group factors and does not count social-demographic factors that might proxy protected-group membership, instead classifying *individual* driving behavior. How, then, could unintended discrimination result? Why would low-income drivers score less favorably when their driving is tracked minute-by-minute? I was able to identify two reasons that are given in support of the biased-classification conjecture: night-time driving and location tracking. It appears that some UBI algorithms rely on the time of the day in which driving occurs,[160] based on statistics showing that night-driving is more hazardous (limited visibility, glare, fatigue, intoxicated drivers).[161] All else equal, the formula charges night drivers higher premiums. Because low-income workers disproportionately work night shifts and must commute at hours that are rated as more dangerous,[162] and because UBI knows the time of each trip, premiums would rise and disfavor this group.[163]

The second reason for the alleged disproportionate effect on weaker populations is territorial rating. The home location of a car and of the trips it takes may be correlated with risks of theft, vandalism, and accidents. Because location is also correlated with characteristics such as race and socio-economic background, precautionites say that the use of location tracking "has a potential for indirect discrimination on such protected characteristics," that using location data for insurance purposes is "similar to redlining practices" and that it "refines this kind of [redlining] by using knowledge of, not only the area of residence, but also where a vehicle travels to and travels through in each trip or on average."[164] Thus, in recording the timing and location of car trips, usage-based insurance is seen "as merely another data mining exercise following on insurer use of credit information—including penalizing consumers not because of driving behavior but because of where and when they drive as a function of work and housing segregation."[165]

There is an additional, more speculative, disparate impact concern directed against UBI. If predictors of accident risk are related to *road quality*, and if urban road quality is worse in poor neighborhoods, there will be an incentive for drivers not to travel in these areas. This will contribute "to exclusion and the reinforcement of prejudices related to these areas . . . having a deteriorating effect in the local economy and isolating the area in terms of transportation" which, "in turn, could lower investment in infrastructure, lower housing

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[159] See CFA Report, *supra* note 45, at 9.
[160] See, e.g., *The Zebra*, *supra* note 103 (listing UBI insurer consider nighttime driving); *The Most Dangerous Time to Drive*,
[161] *The Most Dangerous Time to Drive*, National Safety Council, www.nsc.org/road/safety-topics/driving-at-night ("While we do only one quarter of our driving at night, 50% of traffic deaths happen at night.")
[162] *A Demographic Profile of U.S. Workers Around the Clock*, Population Reference Bureau, https://www.prb.org/resources/a-demographic-profile-of-u-s-workers-around-the-clock/ (low income people are more likely "to enter work at nonstandard times—between 10 a.m. and 2 a.m" and "at least twice as likely to report to work during the 3 p.m. to 7 p.m.")..
[163] See CFA Report, *supra* note 45, at 9.
[164] Brandão, *supra* note 157.
[165] See CIPR Study, *supra* note 1, at 52.

prices, and attract low-income residents thereby creating a spiral of risk and socio-economic reconfigurations."[166]

I admit that I am befuddled by these claims. In an era of insurance risk classification greatly and bluntly disfavoring low-income drivers, where discounts are dispensed to people with wealth, big homes, and more schooling, here comes a technology that helps eliminate these regressive practices and instead measures directly how risky are the car trips each person makes. Being poor is no longer a proxy for risk, no longer a reason to charge higher premiums. Yes, poor people might systematically score lower on one or two of the many usage inputs, but they would surely score well on other, more weighty ones (e.g., miles driven). And with the effect of UBI in reducing accidents, they will be involved in fewer accidents. Let's remind ourselves that advocates for minority neighborhoods are among those who vocally "pushed for pay-by-the-mile auto insurance, as a fairer way of pricing insurance."[167] If UBI bolsters the Pay-As-You-Drive model with additional non-demographic factors, further diminishing the weight of the unfair classification factors, why does it meet the wrath of these avocates? How could a system that is undeniably less discriminatory than any other auto insurance pricing model be condemned?

In reality, models used by insurers to estimate drivers' safety scores are designed with special attention to eliminate factors that drivers cannot control, which are more likely to also the ones thought to disfavor lower income people. Insurers distinguish between controllable and noncontrollable variables and adjust the loss functions their algorithms calculate so as to reduce the weight of the latter.[168] These noncontrollable variables are subject to "shrinkage" in their weight, and they include the type of road driven, time of day, traffic density, and location (e.g., urban versus rural).[169]

Perhaps I should read between the lines of precautionites' distributive complaints—not an all-out rejection of UBI, but rather a political strategy to further diminish the incremental (and already shrunk) weight of the specific inputs that are seen as disfavoring low-income drivers. Start from the concern that is prima facie most sensible – the impact of nighttime driving—which some insurers incorporate into their usage-based formulae. Does night-driving surcharge truly disfavor low-income policyholders? Peak time for car crashes on weekdays is evening travel, not night (4-8pm).[170] Crashes do peak at late night, but only on weekends and for teens, and these are not exactly working-class low-income drivers returning from night shifts.[171]

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[166] Brandão, at __.

[167] See CIPR Study, *supra* note 1, at 51. Cite also Angwin et al., *supra* note 156.

[168] Specifically, insurers use LASSO regression models which downweigh certain sets of variable – specifically, the noncontrolables. In essence, the regression model is adjusted to minimize no the squared error but rather a loss function that shrinks the variance in the noncontrollable variables. See __

[169] Cite [Interview].

[170] See *Crashes by Time of Day and Day of Week*, National Safety Council Injury Facts, https://injuryfacts.nsc.org/motor-vehicle/overview/crashes-by-time-of-day-and-day-of-week/.

[171] Id.*;* R.A. Shults and A.F. Williams, *Graduated Driver Licensing Night Driving Restrictions and Drivers Aged 16 or 17 Years Involved in Fatal Night Crashes — United States, 2009–2014*. MMWR Morb Mortal Wkly Rep 2016;65: 725–730.

Even more questionable are the territorial rating conjectures—that owning a car or driving it in high property-crime or poor infrastructure locations raises UBI rates because cars are more likely to be stolen or vandalized, and this implicit surcharge is akin to "redlining." It should be noted, first, that the only coverage that is mandated by auto-insurance regulation is the liability coverage ("third party"), which protects victims of accidents, not the policyholder's car. Thus, the likelihood of theft or vandalism affects only the "first party" property coverage, which is optional. Moreover, the premise that first-party coverage would be more expensive is itself questionable, and I have not come across any precautionite claim in this spirit that cites statistical support.

Finally, there is the mysterious speculation that usage-based insurance will have the effect of drivers not entering poor neighborhoods (as if they currently do), all because insurers will charge higher rates to folks who drive in poorly maintained streets, thus worsening the inner city's isolation and dilapidation. How many implicit and dubious assumptions does this thesis pack! Let's count: that the asphalt in low-income neighborhoods is in disrepair; that because of it more driving accidents are prone to occur; that insurers have data to quantify this effect and charge more per-mile in these routes (they currently don't); that this incremental charge will be recognized by drivers and cause those who otherwise drive through the neighborhoods to more often avoid them; that the reduced traffic would further depress the neighborhoods' livelihood and economy; and that this economic slowdown will lead to reduction in local private investments. I am painfully reminded of a professor who could chart a unique curve with only one point—all that was necessary was to state the assumptions . . .

4. Transparency

Who does not believe that transparency is vital, that it is crucial to successful market transactions, that it promotes fairness and accountability? A lot of hopes are hung on transparency as a central tool in American law, making it an unfalsifiable virtue, which for decades has become the most widely adopted and politically resilient regulatory intervention.[172] In every area of the law, and most of all in areas that address imbalance in power, the playing field is sought to be leveled via mandated transparency.

In auto insurance markets, the traditional non-driving rating factors that insurers use are largely transparent. They may sometimes be bad or unfair; they may disparately affect low-income drivers; they may elevate the salience of characteristics that society no longer wants to regard as relevant; and may even reinforce stereotypes in potentially ruinous ways. But at least they are disclosed and known. For whatever it's worth, insurers must reveal their classification factors when filing the rating plans, and advocacy groups can watch over them.

Usage-based insurance, by contrast, relies on proprietary and often confidential algorithms that could be coded and manipulated by insurers with less oversight. "We shouldn't have to

[172] OMRI BEN-SHAHAR AND CARL E. SCHNEIDER, MORE THAN YOU WANTED TO KNOW: THE FAILURE OF MANDATED DISCLOSURE, Ch. 9(2014).

give away our secrets", insurers insist.[173] It is said that "insurance companies and their vendors have generally withheld the full scope of their programs, especially concerning the algorithms that make use of the gathered data and the role of artificial intelligence."[174] Thus, not only are consumer in the dark on what explains the premiums they are charged, or what data is collected by tracking, the method makes it more difficult for watchdogs to figure out the general patterns of classification. As a result, "certain big data methodologies may hide intentional or unintentional discrimination against protected classes."[175]

Indeed, prominent observers of the insurance community lament that UBI "has taken a wrong turn. Instead of using telematics to create transparency in auto insurance pricing and create new opportunities for loss mitigation, insurers have turned telematics into just another black box rating factor, like credit scoring but without even the limited protections afforded consumers for insurers' use of consumer credit information."[176] They are worried that the complexity of the algorithms—while decipherable to the insurers—fail to give policyholder guidance.[177]

Transparency is closely tied to another worthy ambition in the era of artificial intelligence: *explainability*. The decisions or predictions of the system must make sense to lay persons, so that they can anticipate how their conduct will be evaluated and ultimately trust it. If UBI reduces the reliance on older non-driving surrogates for risk, people need to be told what it is that's being measured, rather than receive blind assurances that the algorithm has figured it out. British regulators, for example, emphasize that "insurers should not be allowed to defer to AI as the justification for the selection of data to include and should be required to explain both mathematically and substantively why a relationship to risk exists with each data set included in a telematics program."[178]

Of course, precautionites want insurance regulators to do more than just require transparency in insurance. They would like to see the enactment of mandatory limits on the underwriting process and on tracking practices, to emphatically ensure that insurance affects redistribution in a desired manner and does not infiltrate personal domains. Well, good luck with that. Recognizing that "many state insurance regulators have only limited authority over the ways that insurers use big data", the lack of transparency becomes a pragmatic area for advocacy, perhaps in the hope that informed consumers will reject UBI. At the bare minimum, since the commanding force of mandatory restrictions is politically unattainable, transparency is the battle hymn. UBI is said to flunk the transparency bar.

But does it? Every policyholder enrolled in an insurance tracking program has easy access to an information device that no other auto insurance methodology offers, and that few if any

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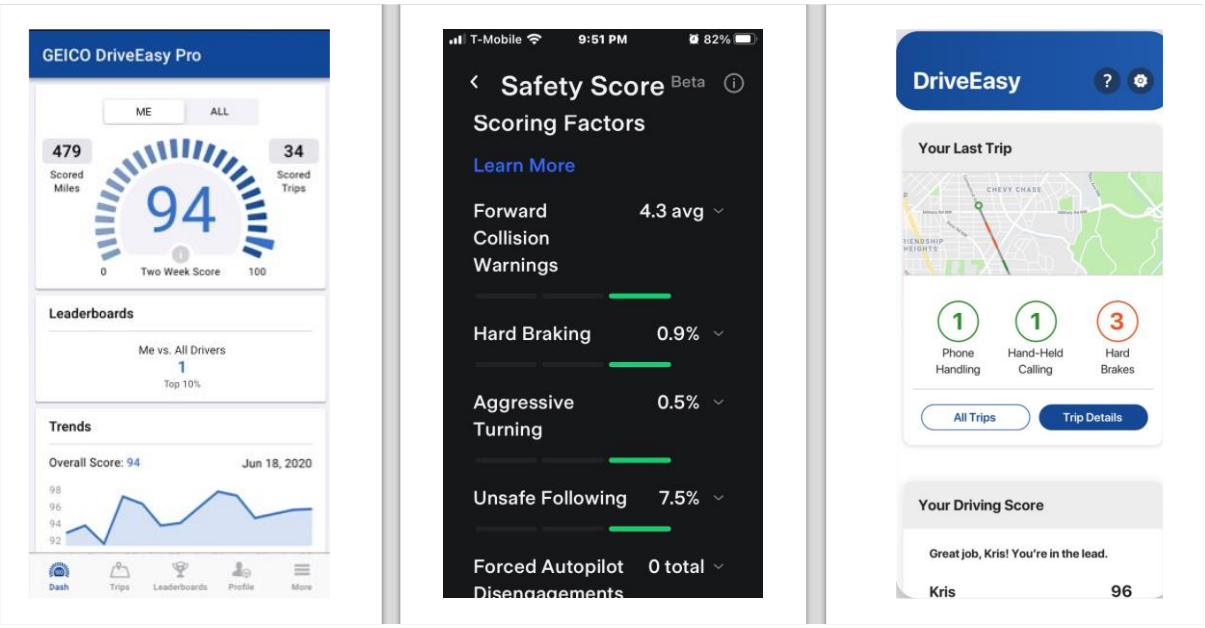
[173] *The Witness Against You: Your Car*, Ed Leefeldt, Amy Danise (Forbes, March 26, 2021) (citing the Insurance Information Institute) (https://www.forbes.com/advisor/car-insurance/telematics-data-privacy/?_sp=0a7b7784-1d4b-4e1a-860e-e727dc69b8bd).
[174] See CFA Report, *supra* note 45, at 8.
[175] *Report on Protection of Insurance Consumers and Access to Insurance* 6 (Federal Insurance Office, 2016).
[176] See CIPR Study, *supra* note 1, at 51.
[177] See, e.g., *Telematics and Personal Data Collection by Auto Insurers*, https://www.adlergiersch.com/provider-blog/telematics-and-personal-data-collection-by-auto-insurers/ ("Consumers have little power how data is collected or used by data brokers and vendors.").
[178] See CFA Report, *supra* note 45, at 11.

legally-mandated right-to-know templates can boast—a "dashboard" that displays the driver's safety score, broken down to the primary factors that are being measured, and the specific events during each trip and day that affected the score. Here are some illustrations:



Even if policyholders try to avoid this information, it would be hard not to know what is being tracked and measured. Furthermore, some UBI devices transmit real time alerts when dangerous maneuvers are recorded (e.g., getting too close to another car). Drivers are reminded periodically of premium changes resulting from adjusted safety scores, with explanations what feature account for the change.

Finally, if transparency were indeed the problem, the right regulatory response would not be to slow down the adoption of UBI, but to mandate additional information tools in it. Such tools are richly available. For example, when a tracking technology is adopted by fleets, truck drivers receive continuous feedback by the programs, they are allowed to communicate with it if behavior that was counted as risky was unavoidable, and much more.[179] Insurance regulation responding to transparency concerns could implement practices that some of the most advanced connected fleets have voluntarily adopted.

B. Why Object?

Part IV.A reviewed the concrete concerns raised by lawmakers, scholars, and advocates, touching specifically on privacy, transparency, and insurance fairness. Probing these objections beyond their surface leaves me bewildered. Of all the market sectors and activities in which big data is collected from people via tracking technologies in order to personalize the treatment, UBI is a practice where the trio privacy-transparency-fairness is really not up to much. Compared to the undeniably large social benefits this technology is delivering, there must be something else driving the precautionite dissent. What is it?
[THE REMAINDER OF THIS SECTION IS IN PROGRESS]

[179] Cite examples from telematics sold to truck fleets on these feedback features.

With a sense of trepidation—am I going to miss something big?—let me try to distill what is *really* driving the anxiety over UBI. Several more fundamental sentiments underlie the resistance to this technology:

First, power structures. Information does not exist in a social vacuum. Sociologically-alert precautionites examine how the accumulation personal information in the hands of already strong entities—employers, platforms, and, yes, insurers—redefines the market interactions, affects social order, and bends the ensuing power structures.[180] Karen Levy has brilliantly documented this sense of diminution among truck drivers, once their industry mandated the installation in every truck of the same tracking devices as in UBI.[181] The hovering cloud of surveillance created by the tracking technology overrides the truckers sense of 'captainship' of their vehicles. Their driving, previously "self-contained and immune from immediate oversight" in a manner that retained "a degree of autonomy unmatched in other blue-collar jobs" is now, in the era of "organizational surveillance," visible, measurable, quantifiable, and ultimately subordinated. Electronic monitoring creates new pathways of control over daily practices, and bolsters "the entrenchment of power in modern organizations."[182]

This ties to a second underlying value being threatened: individual autonomy. Say what you may about traditional insurance classifications, they are not personal. What insurers "think" about me is not who I am. When they use stereotypes, this is not me. But when firms have a foothold in people's private intimate spaces—homes, computers, cars—a sense of "creep" infiltrates and diminishes our right to be let alone.[183]

Third, personalization algorithms don't truly capture a profile of individuals, but rather a distorted, and sometimes distortive, snapshot. In many contexts, data offer "broad but indirect knowledge" about a person, serving as poorer approximation of what it is the data purport to measure, and ultimately drawing inaccurate inferences.[184] For example, algorithms that track choices people make, especially thoughtless actions online or in driving, may undermeasure embodied knowledge and aspirations and overmeasure snap reactions that do not reflect these individuals' more deliberate, thoughtful, preferences.[185] As a result, personalized treatments tailored by these algorithms would be biased. Such errors could have profound negative effects, for example by aggravating biases, polarization, and weakening self control.[186]

These
There is of course another way to tell the usage-based insurance story, as one of empowerment of drivers rather than their subjugation. Imagine, hypothetically, that

[180] Check and cite Kallinikos 2007; cf. Esposito 2004 (cited by Karen Levy reference above).
[181] KAREN LEVY, DATA DRIVEN (2022).
[182] *Id*., at 171.
[183] Cite privacy literature.
[184] Levy, at 67.
[185] See Amanda Agan et al, *Automating Automaticity: How the Context of Human Choice Affects the Extent of Algorithmic Bias* (Working Paper No. 2023-19, Becker-Friedman Institute, 2023).
[186] Jon Kleinberg et al., *The challenge of understanding what users want: Inconsistent preferences and engagement optimization* arXiv preprint arXiv:2202.11776 (2022).

Consumer Reports or The New York Times' Wirecutter service were to supply drivers with a free tracking app that coaches them to improve their driving and reduce their accident risks. Like all "free" apps, though, these services would retain ownership of the data drivers share with them.[187] would the data ownership and control alarm bells chime? Who would object to these services? Our digital world is loaded with sites that, in exchange for personal data, help people improve far less fateful dimensions of their activity (think: GPS and maps). It is hard to see why the bargain with insurers stands out as an "intimate invasion."

I described the objections to usage-based insurance and did little to hide what I think about their weight. I was left me mystified: with so much to gain and so little to lose, why are precautionites continuing to resist? Why, in other words, do precautionists think that the *hypothetical* problems of data privacy and data control, as well as some speculative concerns about distribution and transparency, justify the sacrifice of usage-based insurance's improvement in road safety?

Imagine the worst: Terrible things can happen. Not very likely but justify every kind of precaution

Raise the stakes: Fundamental moral values are at stake

Connect this to first order types of injustice in our society

impact personal freedoms,
domination
reinforce existing socio-economic prejudices.
Through such insurance policies, car users will keep being reminded of the socio-economic background of their family and relatives, about aspects of their social circle, about the riskiness of their place of residence, work, leisure, etc. This may also have an important impact in the spread and reinforcement of social prejudice and structural discrimination. Note that a violation of deliberative freedom is separate from, and may happen in addition to, the unfairness of pricing differences related to personal characteristics—and the associated negative freedom violation.

In our context, car users may come under the domination of insurance company algorithms, whether because they are not sure about the consequences of their travel behavior for future premiums, or they cannot control them. In the paradigm of usage-based policies, any small event (e.g. friend visit, mood change in the case of driving assist, weather change) comes with a possibility of a change of premium.[188]

[187] Cite NYT data privacy terms of service . . .
[188] Brandao, Discrimination Issues in Usage Based Insurance