Pay-As-You-Drive Pricing and Insurance Regulatory Objectives

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Summary

This article evaluates Pay-As-You-Drive (PAYD) vehicle insurance pricing with regard to insurance regulatory objectives. PAYD pricing means that insurance premiums are based directly on the amount a vehicle is driven during the policy term. It changes the exposure unit from the vehicle-year to the vehicle-mile, vehicle-kilometer or vehicle-minute. It incorporates other rating factors so lower-risk motorists pay less and higher-risk motorists pay more per unit of travel. It gives motorists a new financial incentive to reduce their annual mileage, and therefore, decreases their chance of having crashes and insurance claims. PAYD pricing tends to support insurance regulatory objectives, including increased actuarial accuracy, increased insurance affordability, reduced uninsured driving, and reduced traffic accidents. It can also help achieve other social objectives, including reduced traffic congestion and pollution emissions. It is currently being tested by some insurance companies.

Introduction

Consumers are often able to choose among various price structures. For example, diners can often choose between all-you-can-eat and a la carte restaurant pricing. Similarly, telephone service purchasers can choose between flat rates that allow unlimited use, or rates based on the number of calls or minutes used. Consumers sometimes prefer a flat rate's predictability and low unit cost, and other times prefer the affordability that comes from paying according to how much they use.

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How goods are priced affects consumption patterns. A flat fee encourages people to maximize consumption in order to get their money's worth. Usage-based pricing encourages people to limit their consumption in order to save money. Usage-based pricing reflects the principle of economic efficiency, which requires that prices equal the marginal cost of providing a good. It also tends to be more equitable because individual consumers "get what they pay for and pay for what they get." (Litman, 2002)

Although flat rate pricing is more convenient to both producers and consumers, it is relatively uncommon due to the greater efficiency and consumption-based pricing. You may appreciate an occasional all-you-can-eat meal, but few people would want to live in a community where that is their only pricing option, since it would make a light meal unaffordable and encourages gluttonous eating habits.

Pay-As-You-Drive (PAYD) vehicle insurance is a usage-based pricing option in which premiums are based directly on the amount a vehicle is driven during the policy term. There is growing interest in PAYD among consumers, insurers, regulators and other stakeholders. Advocates promote it as a way to achieve a variety of objectives, including increased fairness, affordability, traffic safety and environmental objectives. Because of these social benefits, some jurisdictions have laws or programs to encourage PAYD vehicle insurance. Some insurance companies now offer PAYD pricing options, and many more are considering it.

This article describes PAYD and its impacts, and evaluates it with regard to insurance regulatory objectives. This analysis can help insurance regulators decide how best to respond to PAYD pricing issues.

The Concept

Pay-As-You-Drive (also called *Distance-Based*, *Mileage-Based*, *Per-Mile*, *Usage-Based*, and *Cent-Per-Mile*) pricing means that a vehicle's insurance premiums are based directly on how much it is driven during the policy term (Litman, 2001). This is done by changing the unit of exposure from the vehicle-year to the vehicle-mile, vehicle-kilometer, or vehicle-minute. Other rating factors are incorporated so lower-risk motorists pay less, and higher-risk motorists pay more per unit of travel. PAYD is usually proposed as a consumer option, so motorists could choose between current insurance pricing or PAYD.[1]

Basic PAYD premiums are calculated by dividing existing premiums by a vehicle's rate class average annual miles. For example, a $250 annual premium for a 10,000 annual mile vehicle class becomes 2.5¢ per mile, and a $1,800 annual premium for a 15,000 annual mile vehicle class becomes

1. This is different from Pay-At-The-Pump (PATP) insurance, which means that basic vehicle insurance coverage is funded through a surcharge on vehicle fuel sales. For detailed comparison between existing mileage rating, PATP and PAYD see Litman, 2001.

12¢ per mile. PAYD premiums would average about 6.5¢ per mile in the U.S.[2] There are several possible variations. Only a portion of premiums may be converted to PAYD, and rate could decline marginally with increased mileage. There can be limits on the minimum and maximum annual premium. With some programs, premiums incorporate factors such as when and where driving occurs.

There are several possible ways for insurers to collect PAYD premiums:

- Premiums can be paid as they are now, with discounts offered at the end of the policy term for mileage below a reference value, such as a 15,000 annual mileage.
- Motorists can be required to prepay for insured miles, either in a lump sum or in several payments. For example, some motorists might pay for 12,000 miles at the start of the term, while others might first purchase 5,000 miles and make additional payments as needed. The total premium is calculated at the end of the term based on recorded mileage. Vehicle owners are credited for unused miles or pay any outstanding balance.
- Insurers can bill motorists based on their monthly vehicle mileage, as with other utilities. This requires more frequent mileage data collection.

Pay-As-You-Drive pricing requires credible mileage data. The simplest method is for vehicle owners or brokers to report odometer readings, verified with occasional spot checks. Another approach is to certify third parties, such as service stations, to perform *odometer audits*, which involves checking odometer accuracy and reporting odometer readings to the insurance company. A more sophisticated but costly approach is to use electronic equipment installed in vehicles to automatically report mileage, or even to track when and where the vehicle is driven.

PAYD is a significant change from current practices. Many insurers use annual vehicle mileage or a surrogate such as commute distance as a rating factor, but most have a small number of categories and place relatively little weight on this factor (Schwartz, 2004). As a result, premium payers perceive little financial savings from marginal reductions in mileage. For example, most commuters would not save insurance costs by occasionally carpooling or using public transit. With PAYD, a typical commuter with a

2. According to *Average Expenditures For Auto Insurance* by the Insurance Information Institute (www.iii.org), in 2002 annual automobile insurance expenditures averaged $774. According to *National Transportation Statistics 2004*, by the Bureau of Transportation Statistics (www.bts.gov), in 2002 there were 221 million passenger cars and other 2-axle, 4-wheel vehicles driven 2,624 billion miles, an average of about 11,875 annual miles per vehicle.

20-mile round trip would save $1.30 per day, a 50% increase over current vehicle operating cost savings.

Based on standard vehicle travel price elasticity data, a 6.5¢ per mile average insurance fee is predicted to reduce vehicle travel by 10-12% among affected vehicles (USEPA, 1998; "Transportation Elasticities," VTPI, 2004; TRL, 2004). Higher-risk motorists would pay more per mile, and so would have a greater incentive to reduce mileage, which should provide extra safety benefits.

Mileage as a Risk Factor

Insurance actuaries have long recognized that mileage is a significant risk factor (CAS, 1996, p. 35, 242 and 250). Annual crash rates can be considered the product of two factors: per-mile crash risk times annual mileage. Changing either factor changes annual crash rates. A high-risk driver may crash every 50,000 miles, while a lower-risk driver may crash every 500,000 miles, but in either case reducing annual mileage reduces annual crash rates. Even drivers who never violate traffic rules face risks beyond their control – an animal running into the roadway, catastrophic mechanical failure, a sudden medical problem – and most drivers take minor risks that have small but real chances of contributing to a crash.

For example, if two motorists are otherwise equal in every measurable way, except that one drives 15,000 miles annually (perhaps due to a long automobile commute, and more dispersed family and friends), while the other only drives 7,500 annual miles (perhaps because she commutes by transit and has closer family and friends), it makes sense that the lower-mileage motorist has less crash risk due to reduced exposure. Similarly, if one year an individual motorist drives 15,000 miles, and the next only 7,500 miles, it makes sense to expect that the lower-mileage year would have less crash risk.

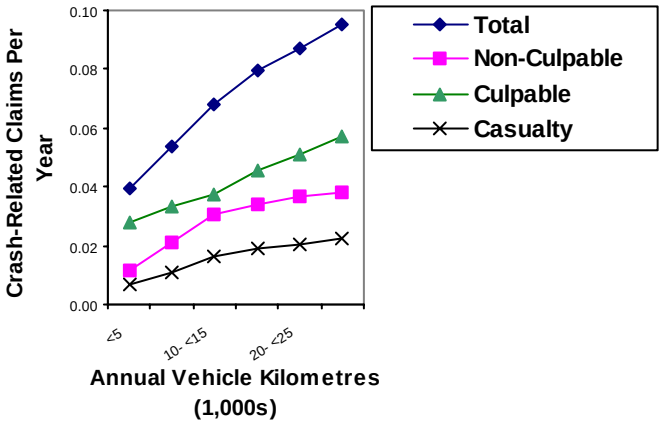
Various sources indicate that annual crash rates tend to increase with annual vehicle mileage (Litman, 2001). Balkin and Ord (2001) found a correlation between seasonal mileage and highway fatality cycles. A recession in 1981-82 caused a 10% vehicle travel reduction and a 12% reduction in insurance claims in British Columbia (ICBC Research Services, 1998). Female drivers' lower crash rates are approximately equal to their lower average mileage (Butler, 1996). A study of young drivers found that "the consistently significant factor influencing risk of motor vehicle crash involvement was *quantity* of kilometres driven" (Bath, 1993). Another study found traffic casualty rates tend to decline with unemployment, probably because it reduces vehicle travel (Mercer, 1987). Similarly, elderly drivers have higher crash rates per mile driven, but lower crash rates per vehicle-year due to their low annual mileage (Cooper, 1998).

These examples reflect aggregate data, that is, the relationship between mileage and claims for a group of vehicles. Until recently, data relating

annual mileage and crashes for individual vehicles was limited and unreliable because it was based on policy-holders' self-reported predictions of their expected mileage. Such estimates are inherently inaccurate because motorists cannot predict their future vehicle travel with certainty they have an incentive and opportunity to report a low value, since this reduces their premium, and insurers seldom challenge such predictions. Insurers find that most motorists claim to drive less than 7,500 miles per year, although vehicles actually average about 12,000 miles (Butler, Butler and Williams, 1998, p. 390).

In recent years, independent mileage data have become available from odometer readings collected during vehicle safety and emission inspections. These can be matched with crash and insurance claim records for individual vehicles (Litman, 2001). Figure 1 illustrates an example of this data for more than 700,000 vehicle-years. Crashes clearly increase with annual mileage.

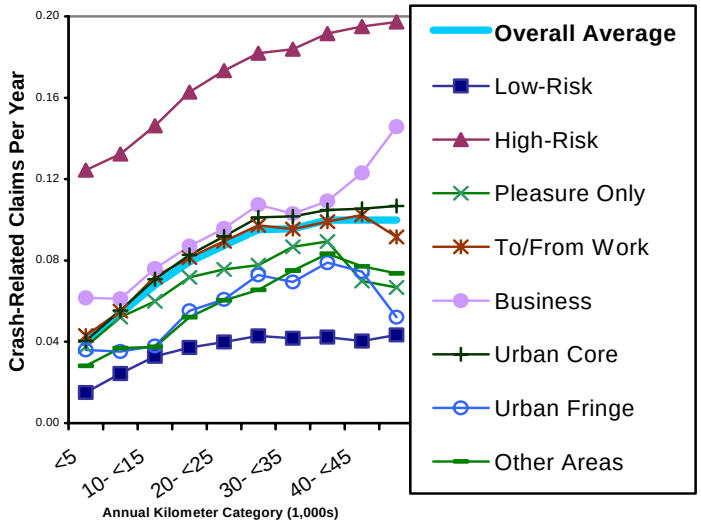
FIGURE 1
Annual Crash Rate by Vehicle Mileage (Litman, 2001)



Crashes per vehicle tend to increase with annual mileage.

Similar patterns are found when the data are disaggregated in various ways, as indicated in Figure 2. In virtually every rating category large enough to provide statistically credible data, crashes increased significantly with annual vehicle mileage. Even comprehensive coverage claim costs increase with annual mileage, apparently because exposure to risks, such as theft and vandalism, tend to increase with vehicle use, and because a significant portion of comprehensive claims are for glass and paint damage caused by gravel thrown by passing vehicles when a vehicle is driven.

FIGURE 2
Annual Crash Rate By Major Category and Vehicle Mileage



All major rate categories show a positive relationship between crashes and mileage.

The relationship between mileage and crashes is not linear. For example, motorists in the 25-30 thousand annual kilometer range drive 6 times as much as those in the <5 thousand kilometer range, but only have about 2.4 times as many crashes. There are various reasons for this (Janke, 1991):

- Motorists who are higher-risk due to age or disability tend to drive lower annual mileage, while high-mileage drivers are likely to be relatively capable drivers.
- Newer, mechanically safer vehicles tend to be driven more annual miles than older vehicles.
- Urban drivers tend to have higher crash rates and lower annual mileage.
- High mileage motorists do a greater share of driving on safer, grade-separated highways.
- There may be other types of offsetting behaviors, by which higher-mileage drivers take more precautions to limit their risk.

Many of these factors can be reflected in rating factors such as driver age or experience, type of vehicle use, and territory, allowing PAYD premiums to reflect different motorists' per-mile risk rates. For example, elderly urban residents are likely to have higher crash rates per vehicle-mile than middle-aged, suburban professionals, but these differences can be reflected in pre-mile premiums.

Since per-mile crash rates vary significantly between motorists it would not be actuarially accurate to use mileage *instead* of other rating factors by charging all motorists the same per-mile premium, but actuarial accuracy increases significantly with PAYD pricing that incorporates mileage *in addition* to other rating factors.

Reductions in total vehicle travel may provide proportionally larger reductions in *total* crash costs, since about 70% of crashes involve multiple vehicles, and the average crash results in about 1.5 claims (Vickrey, 1968; Litman, 2005). For example, if you (an individual motorist) reduce your chance of *causing* crashes by 10% (perhaps by driving more responsibly), your crash risk only declines about 5% since other drivers cause about half the crashes you are involved in. If your annual mileage declines by 10%, your total risk declines by 10%, and risk to other road users also declines since you are no longer a target when other drivers make errors. If your current mileage does not change but all other vehicles reduced their mileage by 10%, you could expect a 7% reduction in crash risk, since 70% of your crashes involve other vehicles. If you and all other vehicles reduce mileage by 10% you could expect a 17% reduction in total crashes, the sum of the 10% reduction from your reduced mileage plus the 7% reduction from their reduced mileage. Put differently, mileage reductions reduce traffic density (vehicles per lane-mile), which reduces crash rates.

Research by Edlin (1999) finds empirically that changes in total vehicle mileage do produce proportionately greater changes in total crash costs. He analyzed U.S. state-level mileage and insurance cost data, which indicates that the elasticity of insurance costs with respect to mileage is between 1.42 and 1.85, meaning that a 10% reduction in total vehicle mileage reduces total crash costs, insurance claims, and casualties by 14% to 18%. His reanalysis of a study by Lundy (1964) of the differences in accident rates between freeway segments with different traffic densities (vehicles per lane-mile) shows an elasticity of accidents with respect to vehicle-miles of 1.7. Per-mile crash rates and insurance claim costs increase with traffic density, an indication that the elasticity of crashes with respect to mileage is greater than 1.0 (Dougher and Hogarty, 1994)". Per-mile crash rates and insurance claim costs increase with traffic density (vehicles per lane-mile), an indication that the elasticity of crashes with respect to mileage is greater than 1.0 (Dougher and Hogarty, 1994).

Of course, per-mile crash rates are affected by various factors related to drivers, vehicles and road conditions, so the effects of mileage reductions on crash rates per vehicle-year depend on which types of miles are reduced. It is possible that a travel reduction strategy could produce relatively small

crash reductions if it reduced relatively low risk driving. For example, reductions in just freeway driving could cause relatively small crash reductions, since freeway miles have relatively low crash rates. Mileage reduction strategies that focus on higher-risk miles can provide relatively large crash reductions. PAYD should provide relatively large crash reductions since it give higher-risk drivers a greater financial incentive to reduce their mileage than lower-risk drivers, and some PAYD systems have rate structures that increase under higher risk conditions.

The empirical evidence described above indicates that broad reductions in driving do reduce overall crash rates, but only experience with a particular mileage-reduction strategy can provide the data needed to accurately determine PAYD traffic safety impacts, since there is no way to predict exactly how different types of motorists will respond to this incentive, and exactly what effect that will have on crash and claim rates. Insurers can respond to this uncertainty by implementing PAYD pilot projects. As they gain experience, actuaries will be able to better determine per-mile risks of different types of motorists and develop more accurate per-mile premiums.

Justifications for PAYD

Pay-As-You-Drive pricing has been justified on a number of grounds (Vickrey, 1968; Wenzel, 1995; Litman, 2001; Litman, 2004; "Cents Per Mile For Car Insurance Website"). Some of these justifications are investigated below.

Actuarial Accuracy

As described earlier in this paper, there is strong evidence that current vehicle insurance rate structures fail to adequately account for mileage as a risk factor. PAYD pricing can therefore increase actuarial accuracy, that is, it can make the premiums charged for a particular motorist more accurately reflect the claim costs imposed by that motorist. Increased actuarial accuracy provides several benefits: it increases fairness (horizontal equity) by reducing the cross-subsidies from one group to another (Litman, 2002), and it also increases economic efficiency, which provides benefits throughout society.[3]

Consumer Cost Savings

Since PAYD insurance is a consumer option, motorists will only choose it if they expect to be better off overall, and they will only reduce

3. *Economic efficiency* is a fundamental economic principle which means that prices (what consumers pay for a good) reflect the marginal costs imposed by consuming that good.

miles they consider the mileage foregone to have less marginal value than their incremental savings, that is, if it increases their consumer surplus. For example, for an average motorist who shifts from fixed premiums to 6.5¢-per-mile PAYD premiums, and in response reduces their annual mileage from 12,500 to 11,000 annual miles, economic theory indicates they gain about $50 in consumer surplus, that is, the financial savings minus vehicle travel benefits foregone.[4]

Affordability

PAYD pricing offers a new option that should be particularly important to low income households. Lower-income, higher-risk drivers currently have three options: purchase unlimited-mileage insurance despite the large financial burden it imposes on their household budget, drive uninsured, or forego vehicle ownership. PAYD provides a fourth option: purchase insurance and minimize mileage to minimize costs. This should particularly benefit lower-income, higher-risk drivers, and other motorists who for any reason want to insure a low annual miles vehicle, either because they drive less than average, or because it is a supplementary vehicle.

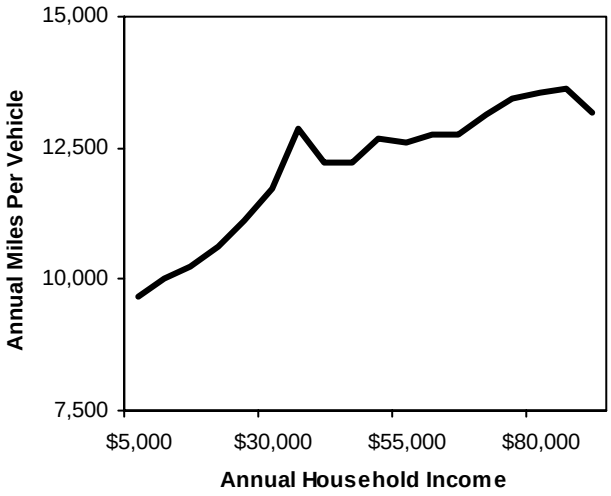
With current pricing, *insurance affordability* means that even high-risk, lower-income motorists can afford unlimited-mileage coverage. To achieve this, insurers tend to overcharge lower-risk motorists with regard to their claim costs (Butler, 1993; McDonald, 2000). This is unfair to the lower-risk motorists who overpay, and encourages high-risk driving, since a high-risk driver who pays relatively high premiums for unlimited-mileage coverage perceives a strong incentive to drive as much as possible to get a fair return on that investment. Other insurance affordability strategies tend to introduce other types of inequities. For example, no-fault coverage and liability caps reduce the amount of compensation injured parties may receive.

PAYD redefines *insurance affordability* to mean that motorists must limit their crash exposure to what they can afford. This is how affordability is defined for most consumer goods. For example, households limit their electrical use, long-distance telephone calls and clothing purchases to what their budget allows. PAYD achieves affordability by reducing accidents and total crash costs, rather than simply shifting costs. It results in true resource cost savings, not economic transfers. This is inherently better for society.

PAYD pricing tends to be progressive with respect to income. It benefits lower-income motorists directly as a group, since they tend to drive their vehicles less than average as illustrated in Figure 3. In addition, lower-income motorists tend to place a high value on opportunities to save money, so would probably reduce their per-vehicle mileage significantly if offered PAYD pricing.

4. This is calculated by multiplying the price times the reduced mileage time 1/2 (6.5¢ x 1,500 x 0.5), based on the "rule-of-half", as discussed in "TDM Evaluation," VTPI, 2004.

FIGURE 3
Average Annual Vehicle Mileage By Income (NPTS, 1998)



Per-vehicle annual mileage increases with income.

Uninsured Driving

One result of vehicle insurance unaffordability is a high rate of uninsured driving. Various studies indicate that 10-35% of vehicles are uninsured, and even more in some lower-income communities (Hunstad, 1999). This results in various economic and legal problems, both for the motorists who drive uninsured and to other road users who bear the costs of uninsured accidents. In lower-income communities this creates a spiral of rising premium rates, declining insurance affordability, increased uninsured driving, and increased claims per insured vehicle (Butler, 2000). Many uninsured drivers would purchase insurance if it were more affordable. A survey of uninsured drivers found that, "A majority of those currently uninsured and those currently purchasing a minimum limits policy had a high level of interest in a lower cost alternate to the current minimum limits policy and stated that they would probably purchase such a policy even if it was offered at only a 10% reduction from the current minimum level." (Hunstad, 1999).

Traffic Safety

By giving motorists a new incentive to reduce their annual mileage, PAYD pricing should reduce annual crash risk, both to vehicles with such

policies, and to other road users. Because higher-risk motorists pay the most per vehicle-mile, they have the greatest incentive to reduce mileage, and since most traffic crashes involve multiple vehicles, a reduction in vehicle mileage can provide a proportionally larger reduction in total crash costs. As a result, if fully applied in a jurisdiction (all policies were to shift to this price structure), PAYD should reduce total private vehicle travel by 10% or more, providing a 10-16% reduction in total crash costs (Edlin, 1999; Litman, 2001). There is some uncertainty as to these predictions. Actual crash reductions may be larger or smaller, although they will almost certainly not be zero or negative. Only with experience will it be possible to determine exactly how much crashes decline. Even if actual crash reductions are only half as large as these projections suggest (6-8%), safety benefits are large, comparable to other leading traffic safety strategies such as airbags and speed control.

Vehicle Mileage Reductions

By giving motorists a new incentive to reduce their mileage, PAYD can provide a variety of additional benefits to society, including reduced traffic congestion, road and parking facility cost savings, energy conservation, pollution emission reductions, and reduced urban sprawl. Put differently, unlimited mileage insurance pricing is a transportation market distortion that results in economically excessive automobile travel ("Market Principles," VTPI, 2004). This exacerbates traffic problems and increases transportation costs. By correcting this distortion, PAYD pricing increases transportation system efficiency, providing multiple benefits.

Cost Shifts

Pay-As-You-Drive reduces premium revenue from lower-mileage policies. These savings have two origins: a portion result from the reduced claim costs caused by reduced annual vehicle mileage, and other savings result from reductions in the overpayment by lower-mileage motorists currently pay relative to their claim costs, and other savings resulting from reductions in the overpayment lower-mileage motorists currently pay relative to their claim costs. These savings will need to be offset by increased premium rates on unlimited-mileage policies, so that higher-mileage motorists pay a greater portion of the claim costs they impose. As a result, once introduced into a market, PAYD is likely to become increasingly common as the price of unlimited-mileage policies increase, so the annual mileage point at which motorists consider PAYD to be cost effective will increase over time. However, this shift should be gradual and predictable, taking many years to occur. It will result in a more economically efficient insurance market, in which consumers have more diverse insurance pricing options to choose from, and premiums more accurately reflect the claim costs of an individual motorist.

Experience With PAYD

Several pilot projects have tested, or are currently testing PAYD insurance pricing. The Progressive Insurance Company offered *Autograph* Pay-As-You-Drive vehicle insurance pricing during a pilot project in the Houston, Texas area from 1999-2000 (Progressive, 1999). It used Geographic Positioning System (GPS) transponders in each participating vehicle to track location and use, with prices based on when and where a vehicle is driven. In 2004, Progressive introduced a new PAYD pricing program in selected states.

In 2003, Norwich-Union, the largest insurance group in the UK, began a two-year pilot project of Pay-As-You-Drive insurance pricing involving about 5,000 vehicles. Each participating vehicle is fitted with a small data recorder, which measures vehicle usage and sends data directly to Norwich Union using mobile telephone technology. This allows monthly payments to be calculated based on how often, when and where a vehicle is used. The company received more than the required number of volunteers, indicating that many motorists would like PAYD pricing. In a survey commissioned by Norwich Union, nine out of ten people say they would prefer their motor insurance to reflect the usage of their car and the type of journeys they make, with the majority favoring "pay as you go" systems similar to those offered by gas and electricity suppliers.

Beginning in 2004, General Motors Acceptance Corporation (GMAC) Insurance began offering mileage-based discounts to OnStar subscribers located in certain states (GMAC, 2004). The On-Star system automatically reports vehicle odometer reading at the beginning and end of the policy term to verify vehicle mileage. Under the program, motorist who drive less than specified annual mileage will receive the following insurance premium discounts:

1-2,500 miles	40% discount
2,501-5,000 miles	33% discount
5,001- 7,500	28% discount
7,501-10,000	20% discount
10,001-12,500	11% discount
12,501-15,000	5% discount
15,001-99,999	0% discount

Nedbank (2004), a major South African insurer, now offers *Pay Per K* vehicle insurance, which bases premiums on monthly mileage. *Pay per K* monitors the distance a vehicle is driven each month by means of a NedFleet card that is linked to the vehicle's comprehensive motor insurance. Premiums are based on the distance traveled in the proceeding month, and are debited in arrears.

In November, 2004, Polis Direct (2004), a major Dutch insurance company, began offering their "Kilometre Policy." Per-kilometer premiums are calculated by dividing current premiums by the current policy's maximum annual kilometers, which is typically 20,000, so a motorist who currently pays €500 for up to 20,000 kilometers would pay €0.025. Participants pay an "advance premium," which is 90% of their current premiums, so those who currently pay €500s under this system pay an advance premium of €450. At the end of the policy term the motorist receives a rebate of up to 50% of their premium for lower mileage (in this case, a rebate up to €250 if they drive less than 10,000 kms), or their premiums can increase up to 50% if they drive more than the current maximum (in this case, they could pay up to €750 if they drive 30,000 kilometers during the policy year). If this motorist drives 20,000 kilometers they pay an extra €50 at the end of the term, so their total premium is the same as with a standard policy. In the following years the advance premium is calculated based on the number of kilometers actually driven the previous year. Mileage is calculated using odometer readings collected during annual vehicle inspections, called the "national car card," and recorded in the national vehicle registration database. Participating motorists must be at least 24 years of age, have a car that sold new for less than €42,000 (Euro), and drive less than 40,000 kilometers annually.

Insurance Regulation Impacts on PAYD Implementation

Insurance regulation can affect PAYD implementation feasibility and costs. Below are potential regulatory treatments ranging from least to most supportive.

1. Maintain regulations and practices which assume that insurance is priced by the vehicle-year, creating uncertainty for other pricing units.
2. Change rules and practices which discourage pricing innovations or increase the cost of implementing small pilot projects.
3. Specifically allow PAYD with legislation that defines PAYD for insurance regulatory purposes. This is the case in Oregon (HB 2043, 2003) and Texas (HB 45, 2001),
4. Encourage PAYD pricing. This is the case in Oregon, which offers a tax rebate to insurers that offer PAYD policies.
5. Require that mileage be given significant weight as a rating factor. This is the case in California, although its application has been limited (Schwartz, 2004).
6. Support PAYD pricing by educating the insurance industry and sponsoring pilot projects.

7. Require optional PAYD, so all motorists can choose between vehicle-year and vehicle-mile pricing. Several organizations advocate this approach (see "Cents Per Mile For Car Insurance" and "Pay As You Drive Website"), but it has not been implemented.
8. Require mandatory PAYD pricing, so all insurance is priced by the vehicle-year. This has not been widely proposed (most advocates recommend that PAYD be implemented as a consumer option) and has not been implemented.
9. Implement Pay-At-The-Pump insurance, so basic vehicle insurance coverage is funded through a vehicle fuel surcharge. Various individuals and organizations advocate this approach (Tobias, 1993; Wenzel, 1995), but it has not been implemented.

Some current regulations and regulatory practices unintentionally limit PAYD implementation. A survey of U.S. states, found that current insurance regulations prohibit PAYD in more than a third of the 43 responding jurisdictions (Guensler, et al., 2003). One state prohibits policies that expire before completion of the term, and therefore would only allow PAYD if coverage applies to prepaid miles. Another state requires an "upfront statement of the premium charge," which might preclude PAYD, depending on interpretation. Most jurisdictions require proof that rates are "fair and equitable" based on claims data, which may create problems introducing new price units that lack claims history. Some states require establishing a new company to offer a new rate structure. Some regulators raised objections to PAYD based on misunderstandings of the concept, such as an assumption that it cannot incorporate other rating factors.

In summary, many jurisdictions have regulations and practices that create barriers to initial PAYD implementation. A few jurisdictions have policies that encourage PAYD, but to date insurers have only implemented a few pilot projects. No jurisdiction currently requires PAYD.

Conclusions

PAYD pricing ties insurance premiums directly to a vehicle's mileage during the policy term. This can provide the following benefits.

- *Increased actuarial accuracy.* There is abundant evidence that within a rate class, annual claim costs increase with annual mileage. Incorporating mileage in addition to existing rating factors therefore increases actuarial accuracy. As insurer gain experience with this rate structure they will be able to improve actuarial accuracy further, since they will have better data on per-mile crash rates than has previously been available.

- *Consumer benefits*. PAYD offers motorists a new opportunity to save money. Mileage reductions represent net consumer surplus benefits.
- *Increased insurance affordability.* PAYD allows even lower-income, higher-risk motorists to afford vehicle insurance, provided that they limit their annual mileage to their budget. Unlike other affordability strategies, it reduces total crash costs rather than simply shifting costs or limiting compensation to injured parties.
- *Increased traffic safety.* By giving motorists, particularly higher-risk motorists, a new incentive to reduce annual mileage, PAYD can provide significant traffic safety benefits, both to motorists who insure with such policies, and to other road users. Crash cost reductions of 10-16% per participating vehicle are expected, although only experience can determine the actual impacts.
- *Vehicle travel reduction benefits.* PAYD is predicted to reduce participating vehicles' average annual mileage by 10-12%, providing benefits from reduced traffic congestion, energy consumption, pollution emissions, and other transportation costs.

By virtually any definition, PAYD increases equity. It makes premiums more accurately reflect the claim costs of an individual motorist. It should provide significant affordability benefits and financial savings to lower-income motorists. It reduces the weight placed on rating factors considered inequitable, such as gender, age, and territory, and increases the weight applied to a factor that motorists can control.

Insurers only retain a small portion of the total benefits that result from PAYD pricing. Other benefits consist of consumer cost savings, claim cost savings to other insurers, and various economic, social, and environmental benefits from reduced vehicle traffic. As a result, the insurance industry is unlikely to implement PAYD pricing to the degree that is justified from society's perspective. This suggests that regulators could choose to encourage or require PAYD implementation in order to promote the public interest.

If implemented as described in this article, using odometer audits to collect credible mileage data, PAYD has minimal incremental costs. Although there are some legitimate concerns about PAYD, virtually all can be addressed with a sufficient program design.[5] When first implemented, PAYD may introduce uncertainty that could expose insurance companies to financial risks, but these can be managed by first implementing small pilot projects. After a few years there should be no greater financial risk than with vehicle-year pricing.

5. For more discussion of concerns about PAYD see Litman, 2001, Appendix 5.

References

Balkin, Sandy and Ord, J. Keith, 2001. "Assessing the Impact of Speed-Limit Increases on Fatal Interstate Crashes," *Journal of Transportation and Statistics*, Vol. 4, No. 1 (www.bts.gov), April 2001, pp. 1-26.

Bath, Stephen, 1993. *Influence of Socioeconomic Factors on the Exposure to Crash Risk for Young Drivers*, Traffic Safety Research Dept., Insurance Corporation of British Columbia (www.icbc.com).

Butler, Patrick, 1992. *Operation of an Audited-Mile/Year Automobile Insurance System Under Pennsylvania Law*, National Organization for Women Insurance Project (www.now.org); available at www.centspermilenow.org.

Butler, Patrick, 1996. "Automobile Insurance Pricing," National Organization for Women (www.now.org), presented at National Conference on Women's Travel Issues, Baltimore, 23-26 October 1996; available at www.centspermilenow.org.

Butler, Patrick, 2000. *Why The Standard Automobile Insurance Market Breaks Down In Low Income Zip Codes*, Report to the Texas House Committee on Insurance; available at www.centspermilenow.org.

Butler, Patrick and Twiss Butler, 1989. "Driver Record: A Political Red Herring That Reveals the Basic Flaw in Automobile Insurance Pricing," *Journal of Insurance Regulation*, Vol. 8, No. 2, Dec. 1989, pp. 200-234; available at www.centspermilenow.org.

Butler, Patrick, Twiss Butler, and Laurie Williams, 1998. "Sex-Divided Mileage, Accident, and Insurance Cost Data Show that Auto Insurers Overcharge Most Women," *Journal of Insurance Regulation*, Vol. 6, No. 3&4; available at www.centspermilenow.org.

"Cents Per Mile For Car Insurance" (www.centspermilenow.org). Accessed 30 June 2004.

Cooper, Peter, 1998. ICBC Research Manager, quoted in *Times Colonist*, 29 June, p. A1.

ICBC Research Services Data, 1998. Insurance Corporation of British Columbia.

Dougher, Rayola, and Thomas Hogarty, 1994. *Paying for Automobile Insurance at the Pump: A Critical Review*. Research Study #076, American Petroleum Institute (www.api.org), 1994

Edlin, Aaron, 1999. *Per-Mile Premiums for Auto Insurance*, Dept. of Economics, University of California at Berkeley (http://emlab.berkeley.edu/users/edlin).

"Environmental Defense PAYD Website" (www.actionnetwork.org/campaign/payd). Accessed 30 June 2004

Funderberg, Keri, Michael Grant and Ed Coe, 2003. "Changing Insurance One Mile At A Time," *Contingencies* (www.contingencies.org/novdec03/changing.pdf), Nov./Dec., pp. 34-38.

GMAC, 2004. *GMAC Insurance And Onstar Create Innovative Insurance Products: Press Release*, GMAC Insurance (www.gm.com/cgi-bin/pr_display.pl?5205), January.

Guensler, Randall, Adjo Amekudzi, Jennifer Williams, Shannon Mergelsberg and Jennifer Ogle, 2003. "Current State Regulatory Support for Pay-as-You-Drive Automobile Insurance Options," *Journal of Insurance Regulation*, National Association of Insurance Commissioners (www.naic.org) Volume 21, No. 3, Spring.

Janke, Mary, 1991. "Accidents, Mileage, and the Exaggeration of Risk," *Accident Analysis and Prevention*, Vol. 23, No. 3, pp. 183-188.

Litman, Todd, 1997. "Distance-Based Vehicle Insurance as a TDM Strategy," *Transportation Quarterly*, Vol. 51, No. 3, Summer, pp. 119-138. An updated version of this paper is available at Victoria Transport Policy Institute (www.vtpi.org).

Litman, Todd, 2001. *Distance-Based Vehicle Insurance Feasibility, Benefits and Costs: Comprehensive Technical Report*, Victoria Transport Policy Institute (www.vtpi.org).

Litman, Todd, 2002. "Evaluating Transportation Equity," *World Transport Policy & Practice* (http://ecoplan.org/wtpp/wt_index.htm), Volume 8, No. 2, Summer, pp. 50-65; also available at Victoria Transport Policy Institute (www.vtpi.org).

Litman, Todd, 2004. *Pay-As-You-Drive Pricing For Insurance Affordability*, Victoria Transport Policy Institute (www.vtpi.org).

Litman, Todd, 2005. *Safe Travels: Evaluating Mobility Management Traffic Safety Impacts*, Victoria Transport Policy Institute (www.vtpi.org).

Lundy, R. (1964), "The Effect of Traffic Volumes and Number of Lanes on Freeway Accident Rates," *Traffic Bulletin*, No. 11, July 1964, California Division Of Highways.

McDonald, Caroline, 2000. "Study: Regulation Hikes Insurance Costs for Good Drivers," *National Underwriter* (www.nunews.com), May 10.

Mercer, G. William, 1987. "Influences on Passenger Vehicle Casualty Accident Frequency and Severity: Unemployment, Driver Gender, Driver Age, Drinking Driving and Restraint Device Use," *Accident Analysis and Prevention*, Vol. 19, pp. 231-236.

NAIC, no date. *Mission Statement*, National Association of Insurance Commissioners (www.naic.org/about/mission.htm). Accessed 30 June 2004.

Nedbank, 2004. *PAY PER K Coverage* www.nedbank.com/website/content/products/product_overview.asp?productid=331. Accessed 30 June 2004.

Pay As You Drive Website (www.serconline.org/payd/index.html), by the Wisconsin State Environmental Resource Center. Accessed 30 June 2004.

Polis Direct, 2004. *Kilometre Policy*, Polis Direct (www.kilometerpolis.nl)

Progressive, 1999. *Progressive Autograph*, Progressive Mutual Insurance, (www.progressive.com).

Schwartz, Andrew, 2004. *Evaluating Insurer Compliance with Proposition 103: Promoting Fair and Affordable Auto Insurance Pricing in California*, Goldman School of Public Policy, University of California at Berkeley, for the U.S. Environmental Protection Agency.

TRL, 2004. *The Demand for Public Transit: A Practical Guide*, Transportation Research Laboratory, Report TRL 593 (www.trl.co.uk). Available at www.demandforpublictransport.co.uk. Accessed 30 June 2004.

Tobias, Andrew, 1993. *Auto Insurance Alert*, Fireside (New York).

USEPA, 1998. *Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions*, US Environmental Protection Agency, Report #231R98006 (www.epa.gov/clariton).

VTPI, 2004. *Online TDM Encyclopedia*, Victoria Transport Policy Institute (www.vtpi.org).

Vickrey, William, 1968. "Automobile Accidents, Tort Law, Externalities and Insurance: An Economist's Critique," 33 *Law and Contemporary Problems*, pp. 464-470. Available at the Victoria Transport Policy Institute website, www.vtpi.org.

Wenzel, Tom, 1995. *Analysis of National Pay-As-You-Drive Insurance Systems and Other Variable Driving Charges*, Energy & Environment Division, Lawrence Berkeley Laboratory (Berkeley).