The Premium Structure . . . Promot[es] Excessive Use of a Given Stock of Cars and Undue Stinting on the Ownership of Cars—William Vickrey (1968): Truth and One Consequence

Patrick Butler[†]

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Abstract

This essay revisits William Vickrey's 1968 critique of automobile insurance. Absence of response to his powerful criticisms effectively denied their truth, but economists are now reacting to one of them: charging for insurance as an expense of car ownership fails to internalize the accident costs of using a car. Therefore recent studies recommend converting the premium unit from car-year to odometer-mile.

However, based on other criticisms by Vickrey this essay makes a case for some car owners to insist that insurers immediately offer the odometer-mile unit as an option. Both "stinting on ownership" and "excessive use" of cars, which car-year premiums promote, are in fact adverse selections. To reduce fixed insurance expense, owners selectively remove cars used less than average from insurance pools and increase the use of cars kept insured. Stinting-on-ownership is confirmed by negative effects of premiums on ownership. Excessive-use-of-cars is shown by more claims per 100 car years produced by the cars of low-credit-score owners. And no justification is found for frequent assertions that premiums incentivize less car use. Non-response of individual premiums to car use is shown by insurers' stated need to raise all premiums when a drop in gasoline prices induces greater car use by some owners.

One consequence of the adverse selections appears in every locality as large ranges in premiums charged for cars identically classified but distinguishable by owner financial status. Because the premium structure incentivizes using fewer cars more intensively, competition through selective underwriting means high premiums for owners on tight budgets. Therefore owners giving up cars only to face still higher premiums have principled economic justification for demanding premiums proportioned to car use instead of ownership.

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† Insurance Project Director, National Organization for Women Foundation, 1100 H Street, NW, 3rd Floor, Washington, DC 20005, 202-628-8669, x148, pbutler@centspermilenow.org

I. Truth

The title quotation comes from a 1968 law and economics paper by the late Columbia University professor and co-winner of the 1996 Nobel prize in economics, William Vickrey. The paper's title is "Automobile Accidents, Tort Law, Externalities, and Insurance: An Economist's Critique." Vickrey's paper was ignored at the time, but is now getting attention from transportation and environmental economists.[1] Vickrey identified problems caused by the premium structure still with us today[2] and concluded that "the basic difficulty is that the insurance premium appears to the individual automobile owner almost entirely as part of the fixed cost of owning a car."

Yet today's research on automobile insurance takes no notice whatever of this fixed-cost basic difficulty, an oversight which certainly cannot be from lack of consequences. Vickrey pointed to the externalization of the accident costs of driving because there is, as he put it, "the frequently overlooked fact that 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." Understandably, this uncompromising assessment from recognized authority has become a featured quotation in recent economics papers, notably by Edlin (2003, 2006). It was also quoted earlier in a report on an unsuccessful legal challenge alleging that premiums not proportioned to the individual car's odometer miles violates Pennsylvania's Casualty and Surety Rate Regulatory Act and Equal Rights Amendment (Butler et al., 1988).

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1. See, for example, Litman (1997) and Edlin and Karaca-Mandic (2006).

2. Operational tests to assay the current premium structure are apt because any car owner can perform them by consulting their own experience, with corroboration by an agent if need be. Premiums, like registration fees and car taxes, currently are expenses of car owning. Buy a car and by law these fixed charges must be paid regardless of whether the car is subsequently hardly driven, or driven many miles. Buy another car and the insurance premium increases proportionately by one car-year premium unit.

In contrast to insurance charged as an expense of car owning, gasoline is an expense of using a car. But it is just as impossible to drive a car a mile without producing accident risk (the cost of which is transferred to the car's insurer to the extent of coverage) as it is to drive a mile without consuming gasoline and producing exhaust gases. Nevertheless, under the current premium structure "all of the miles are free."

As the odometer-mile alternative to free miles, miles of coverage would be bought in advance—now the case for some fleets—at the insurer's going cents-per-mile rate for class and coverage, and added to the odometer reading. The car owner's responsibility would be to buy more miles before the odometer limit was reached and insurance lapsed, which is the standard insurance policy cancellation arrangement for non-prepayment of premium.

However, for the purpose of informing public policy research on enforcing mandatory auto insurance and on the merits of laissez-faire pricing versus mandated cross-subsidization of premiums for making compliance possible, I will argue here that more immediate than a generalized concern about economic efficiency—that premiums fail to internalize the accident costs of driving—should be concern over the perverse consequences of what premiums actually promote. Namely, the premium structure forces owners to give up cars for no apparent risk reduction or any other off-setting economic benefit. Vickrey's full statement of the title quotation above was: "The premium structure thus has the general effect of promoting excessive use of a given stock of cars and undue stinting on the ownership of cars (a fact, incidentally, which should engage the attention of the automobile industry)." According to this statement the two effects premiums promote are: 1) excessive use of a limited number of cars, and 2) undue limiting of the ownership of cars. Other than harm to automobile sales, Vickrey did not identify any specific harms from these effects.

However, in the following analysis, we will consider the premium for each class pool as proportional to a ratio of the two effects Vickrey named, as shown in the first equation below. In the numerator is the aggregate use of cars: zero miles of use means no claims, while a few million miles of use guarantees a dozen or so claims for the pool.[3] The denominator is the number of cars-years insured in the time block when the claims were incurred. The fact is that the class premium is proportional to this ratio, which also may be seen as the average miles for the cars in the pool. Insurers' costs which underlie their premiums must increase if either aggregate miles increase and the number of cars does not increase proportionally, or the number of cars decreases but the number of miles does not decrease proportionally.

$$Premium / CarYear = \frac{\Sigma Miles}{\Sigma CarYears} \times [K]$$

As shown in the next equation, the proportionality "constant" *K* includes the class pool's now-unmeasured claims-per-mile rate, which generally must be gradually decreasing as evidenced by small annual improvements in vehicle-mile accident rates reported by non-insurance studies. Next is the average dollars-per-claim (severity) insurers measure and report, which predictably increases with the annual inflation in car repair, medical, and litigation costs. Last is an insurer-adjustable premium factor (1/0.7

3. Middle-aged drivers are involved in 4 to 5 state-reported accidents per million driver-miles, according to Williams 1999.

here) to pay for sales, capital, and other expenses. (Note that the units for *K* are cents-per-mile.)

$$Premium/CarYear = \frac{\Sigma Miles}{\Sigma CarYears} \times \left[\frac{claims}{mile} \times \frac{dollars}{claim} \times \frac{1}{0.7} \right]$$

As a hypothetical example, the equation below is for property damage liability (PDL) coverage. For a given class and territory it assumes a ratio of miles to car-years of 10,000 to one, a PDL claim rate of 4 per million miles, and an average cost per claim of $3,000. These assumptions give a premium of $171 per car-year for this class and coverage. (Here $K = 1.71$ cents per mile.)

$$Premium\left(PDL, territory, class\right) = \frac{10^4\, Miles}{CarYear} \times \left[\frac{4\, claims}{10^6\, miles} \times \frac{\$3000}{claim} \times \frac{1}{0.7} \right] = \frac{\$171}{CarYear}$$

The practical consequence of offering inherently unverifiable "low estimated future miles" discount categories rather than proportioning premiums to odometer miles actually driven is that in setting future premium levels auto insurers must use surrogates to predict changes in aggregate miles of driving as an estimate of the number of accidents and claims to be expected. The main surrogates used are described by an Allstate vice president for research in a volume on risk economics (Gragnola 1984):

> Property damage frequency [claims per 100 car-years] . . . is a function of three factors: the price of gasoline, unemployment, and the percentage of young drivers in the population.
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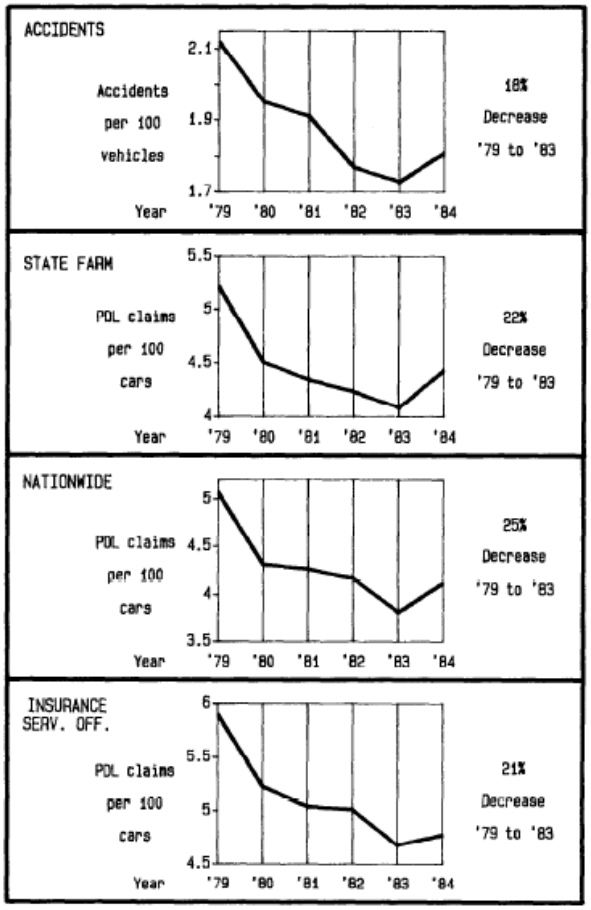
> . . . . While it is probably not surprising that the number of young drivers in the population influences auto frequency, it is not so obvious why unemployment and gasoline prices do so. The explanation is that people tend to do less pleasure driving when unemployment rises, cutting the accident rate. Similarly, as gasoline prices rise, miles driven falls, which again cuts the accident rate. In effect, both variables are surrogates for miles driven or exposure.

Figure 1 shows what these effects looked like for Pennsylvania from 1979 to 1984. Over the first four years accidents and claims decreased 18% to 25%, which, at a rate hearing, State Farm's actuary attributed to "reduced driving at that time." After rising in 1984 and subsequently, claims per 100 car years again decreased in 1990 and 1991, which insurers attributed to higher unemployment and higher gasoline prices. Having no way to determine which customers cut back on driving and which did not, State Farm made

Figure 1. Decrease in Accidents and Claims in Pennsylvania, Butler et al. 1988.



uniform refunds in a number of states ranging from 2 to 20 percent of the semiannual premium previously paid.[4]

The stated need of insurers to increase premium levels when low gasoline prices or low unemployment cause an increase in aggregate miles and claims is proof of the non-response of the premium structure to individual car use. If premiums actually were charged as an expense of driving instead of an expense of car owning, what insurers are

4. News report "State Farm to Refund Millions in Car Premiums," *The Journal of Commerce*, Dec. 18, 1991. All car owners in 12 states and Ontario Canada got the statewide refunds. Not listed was a refund in Texas and ones likely in other states. But no refunds were made in California and Pennsylvania where recently-enacted mandatory 15 to 20 percent premium rollback laws were being litigated. For the decrease in the company's claims in Pennsylvania, see my letter-to-the-editor "The Awful Truth at State Farm" published Dec. 24, 1991.

paid—by individuals and in aggregate—would be indexed to miles and would automatically fall and rise as the miles of driving decreased or increased, respectively.

Here insurers are concerned with predicting the numerator cost of the premium as proportional to the aggregate number of miles driven by the cars they insure. But there's also a tacit assumption that the number of cars—the denominator—used to drive these miles will not change significantly in the near future. Today, however, insurers are attributing a decline in claims per 100 car-years not only to higher gasoline prices but also to a decreasing ratio of drivers to cars, i.e., fewer drivers than cars. Spreading a driver's demand for miles over more than one car means fewer miles per car. The increase of cars in the denominator leads to a decline in the ratio of miles (and claims) to cars. For a household it represents an increase in the denominator stock of cars without a proportional increase in its numerator total miles.

There are two kinds of decisions facing drivers that Vickrey referred to: how much to drive and how many cars to use in doing the driving. Vickrey noted that premiums "provide incentives that are largely inappropriate at the margins where decisions are actually made as to whether to maintain a car and whether to make a given trip by car." In other words, the premium structure inappropriately deters car owning, an activity which produces no driving risk for insurers to cover, and at the same time it completely fails to deter using a car, the activity which does produce the risk transferred mile-by-mile to the car's insurer. Vickrey also noted that cars that are on the margin of being sold are cars that are driven less than inframarginal cars that will be kept. Thus the marginal cars are the ones overcharged. He observed that

> moderate discounts are often allowed by insurers for the insurance of a second car under the same ownership, but the discounts that could be offered on this basis, even if they could be made sufficient to reflect fully the difference in exposure for the classification as a whole . . . would still not eliminate the overcharge of the marginal car.

But he did not note that if the overcharged marginal car is removed from the insurance pool, loss of the subsidy which the overcharging supplies would increase the premium for the cars remaining in the pool. Removal of the marginal car takes more premium than miles and their cost from the pool.

Vickrey's identification of insurance as an expense of owning a car was affirmed in 1970 by Calabresi in *The Costs of Accidents: A Legal and Economic Analysis*.[5] Calabresi used a hypothetical example to show the effect this expense has on consumer decisions.

> If the cost of all automobile accidents were suddenly to be paid out of a general social insurance fund, the expense of owning a car would be a good deal lower than it is now since people would no longer have to worry about buying insurance. The result would be that some people would buy more cars. . . . [T]hey might be people who could only afford a second car so long as no added insurance was involved. In any case, the demand for cars would increase, and so would the number of cars produced. Indeed, the effect on car purchases would be much the same as if the government suddenly chose to pay the cost of steel used by automobile manufacturers and to raise the money out of general taxes.

Unlike Vickrey, however, Calabresi does not point to any externalization of accident costs or other harm as a consequence of the car-ownership premium structure.[6]

Despite Vickrey's basic criticism, no discussion of automobile insurance in modern insurance and economics textbooks mentions that premiums are taken by car owners as a fixed expense of ownership. In research papers the usual practice of referring to "insured drivers" tends to remove from consideration the actual accounting unit that insurers use for costs and premiums which is the insured car year. Adding or removing drivers from a policy, as long as the household cars' classifications are unaffected, will not affect the premium. Furthermore, any permissive non-household driver of someone else's insured car is an insured driver of that car, whether or not they are a driver listed on any other auto insurance policy. But with insurance as an ownership expense, adding or removing a car from the policy will affect premiums, and its insurer's cost accounting, by one car-year unit. Although as an evident accommodation to customers, excess liability and physical damage insurance on owned household cars generally follows drivers listed on a policy to rental cars, the insurance does not follow drivers from insured cars to uninsured cars in the same household.

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5. The continuing influence of this book was formally recognized on its 35th anniversary in 2004 by the University of Maryland School of Law and Maryland Law Review Symposium "Calabresi's The Costs of Accidents: A Generation of Impact on Law and Scholarship," Maryland Law Review, 2005. See Butler 2006a for consideration of the key role that automobile insurance plays in the book's analysis.

6. Calabresi published a paper in the same symposium issue of *Law and Contemporary Problems* in which Vickrey's paper appeared. While Vickrey's 1968 paper is noted by Calabresi 1970, its criticisms of automobile insurance are not noted.

Table 1. Effects of Premium and Income on Car Ownership

Response Variable	Describing variables		Location & Year	Source
	Premium per car year	Income		
Insured cars per household	-0.57	0.48	Massachusetts, all 294 "towns," 1988	Blackmon & Zechauser (1991)
Insured cars per household	-0.63	0.31	California, all 58 counties, 1990	Jaffee & Russell (1998), same specifications as B & Z above.
Car registrations per capita	-0.46 to -0.56	0.44 to 0.67	48 states, 1986	Pritchard & DeBoer (1995), 3 models.

Over the years economists have not entirely ignored the negative influence of fixed premiums on the demand for cars, Table 1. Blackmon and Zeckhauser, 1991, found in Massachusetts that a ten percent premium increase reduces insured cars per household nearly 6 percent, while a ten percent decrease in income cuts insured cars nearly 5 percent.[7] Similar effects were confirmed for California by Jaffee and Russell (1998). In a study across states of the influence of car taxes and insurance premiums on per capita car registrations, Pritchard and DeBoer (1995) found a ten percent rise in premiums reduces car registrations by 4.6% to 5.6% percent, while a ten percent decrease in income predicts a decrease by 4.4% to 6.7% in registrations. But despite these findings of the effect premiums—and income—have on car owning, the premium structure has been until recently rarely criticized for being inappropriate.

Blackmon and Zeckhauser (1991) argue that requiring insurers to cross-subsidize premiums across insurance classes and territories distorts both downward and upward the expense of driving to consumers relative to the cost driving transfers to insurers.

> [T]hese subsidies generate allocative inefficiency: those who pay the subsidies restrict their consumption of automobile insurance, by not driving or by driving without insurance. Those receiving the subsidies increase their consumption. A deadweight loss results as some consumers are deterred from driving even though they would pay the cost and others drive when they would not if prices reflected costs.

As noted here, driving consumes insurance protection because each mile a car is driven produces risk. But according to the elasticities in Table 1 reported by these and other authors, what premiums actually deter is car owning, not driving as the authors assert here. The possibility that cross-subsidies can create incentives for subsidy-recipients to use their cars more and for subsidy-payers to use their cars less contradicts Vickrey's

7. "The demand for insured vehicles per household was estimated as a log-linear (constant elasticity) function of income, price, and household density." "Our estimated coefficients were income 0.477, price –0.569, and density –0.044."

observation that "[t]he amount of the premium, given the coverage [the car owner] selects, is fixed by factors largely independent of most of the decisions that are at all marginal as to how much he will use his car." What Vickrey concludes here is that there is no marginal cost of an additional mile or trip to a car owner by way of insurance expense. Regardless of whether a class's average cost per car year to an insurer is high or low, and whether or not the class's premium receives or contributes to a cross-subsidy, the marginal insurance expense of an additional mile to owners of the class's cars is still zero.

Presumably on the basis of general observations that some cars are hardly used while others are kept constantly in use, Vickrey concluded that "[e]ven to the extent that the premium might in principle be affected by the usage decided upon, the differences in premiums are minor relative to the possible differences in exposure." Since publication of Vickrey's paper, observations on how much cars are used have been given quantitative meaning by periodic federal transportation surveys beginning in 1969 (Hu and Reuscher, 2004). An idea of the large differences that informed Vickrey's conclusion may be seen by a comparison based on one survey: in 1995 15% of household cars were used less than 2,500 odometer miles while 14% were used more than 20,000 odometer miles, an exposure eight times greater. Nevertheless the existence of the surveys is ignored and their relevance is thereby effectively denied in today's academic research on differences among car and driver groups in claims per 100 car years. The words "mile" and "mileage" do not appear in a majority of academic studies about automobile insurance costs.

With respect to a major public policy dilemma regarding mandatory auto insurance, studies that treat the ownership expense of premiums as an expense of car use are incorrectly specifying the problem that insurance represents for many car owners. In making a case that mandatory insurance is "taxing low income households in pursuit of the public interest," Harrington (1994) misidentifies a low-income car owner's law-abiding choice as "pay or take the bus," i.e., pay the premium or give up driving. Instead, premiums actually act as a tax on cars, not as a tax on driving. Therefore the law-abiding choice that the premium structure actually offers car owners is not giving up *driving* and taking the bus, but giving up *cars* and driving remaining ones more miles each. One consequence of car owners doing what the premium structure incentivizes can explain the apparently irresolvable conflict between mandating insurance on all cars and the inability of many car owners to pay the premiums that insurers make available to them. Currently the implied reasoning is that if these owners are able to pay the "other" operating expenses of the cars they use, they should also be able to pay the insurance premiums.

Although the mandatory-insurance versus ability-to-pay dilemma is the subject of continuing debate in all state capitals,[8] the question of who pays what premium and why gets virtually no notice in current research. But the answers can be tied to a consequence of the premium structure.

II. One consequence

A. Adverse selection by customers

Neither Vickrey's analysis nor the recent analyses by economists who recommend changing the premium unit from car year to odometer-mile includes the *feedback effects* that the car-year premium structure must have on the size of the premiums themselves. The first theoretical explanation of how undue stinting on ownership of cars and excessive use of a given stock of cars must lead to high premiums charged in low income zip codes was published in a report to Texas legislators by Butler (2000). Car owners who want to economize on auto insurance buy less of it. Since the premium unit is a car year (divisible into car days), these owners (however reluctantly) first take their less-used, less-essential marginal cars out of insurance pools and then (despite inconvenience and extra trips) they share cars kept insured. But each action constitutes adverse selection against the pools: first by taking more premium than miles out of the pools, and then adding miles without premium to the pools by sharing cars kept insured. When insurers react to more claims per 100 car years by raising premiums in what they term "hard-to-serve" or "nonstandard" markets, the increases can set off an upward spiral of fewer insured cars (smaller denominator in the premium formula, on page 3 above), the same or even more miles in the numerator, more claims per 100 car years (larger numerator over smaller denominator), and further increases in per-car premiums.

The evidence of adverse selection involves finding out what are the ranges in premiums charged by different insurers to customers with identically-classified cars, which customers are charged the highest premiums and for what reason, and how insurers are recognizing these customers. Plentiful, easily-accessible key evidence consists of real

8. Although almost all states now require car owners to insure their cars, initiatives to increase enforcement and raise the required minimum liability limits continue despite opposition by automobile insurers. Inability-to-pay is the main concern of insurers, legislators, and governors (who sometimes veto bills that would raise minimum liability limits). After a number of legislative sessions, constituent pressure to increase enforcement usually prevails.

premiums charged by real insurers. Based on the previous section, and reinforced where appropriate in further discussions, the following approximations are assumed to be true. For cars identically classified but placed in pools charged different premiums, the premium differences proxy for pool differences in claim numbers per 100 car years, which differences, in turn, proxy for differences in pool-average miles per car year. This relationship means that a pool charged double what another pool of cars in the same class is charged is assumed to be producing twice the number of claims per 100 car years as a consequence of averaging twice the miles per car-year.

B. Evidence of adverse selection

While Vickrey criticized the narrow premium ranges across the car-use classes of single companies in 1968, he did not take note of the wide premium ranges across companies for the same car-use classes. But a concern to policymakers at the time, and still is, was high premiums charged by nonstandard insurers to car owners who had been refused the premiums of standard insurers. Ability-to-pay was a major concern for legislators when deliberating proposals to require all owners to buy liability insurance for their cars. Researchers were beginning to report on the range in premiums paid to different insurers by owners of cars with the same classification and coverage, as shown in Table 2 below. In two early studies 14 years apart Jung (1963, 1978) reported on the range in premiums different insurance companies charged for identically classified cars in Chicago. He noted the ratio of highest to lowest premium went from 1.4 in 1962 to 2.7 in 1976, but found no company size or type associated with higher or lower premiums. He concluded that "there is no simple reason for the increase in the range." Premium data from later studies suggest that this range generally has continued to increase. For each year in the period 1974-81, Dahlby and West (1986) reported the premiums charged by 50 to 60 insurance companies in the Canadian Province of Alberta. Although not noted by the paper, the size of the premium range for a major class profile (said to be typical of the ranges in the others) increased from a highest to lowest ratio of 1.6 in 1974 to 2.5 in 1981, Table 2.

Table 2. Premium ranges from published papers, with updates by this study.

LOCATION	Year	Highest / Lowest premium	SOURCE
Illinois - Chicago	1962	1.4	Jung, 1963 (liability & physical damage)
	1976	2.7	Jung, 1978 (liability & physical damage)
	2002	6.0	State guide, Ill. Ins. Dept. website (required liability and med pay) (guide discontinued after 2002)
Alberta – Edmonton & Calgary	1974	1.6	Dahlby & West 1986, Fig. 1(required liability for largest class, 02)
	1981	2.5	
Pennsylvania - Philadelphia	1982	1.6	Berger et al., 1989
	2007	6.1	State guide, Pa. Ins. Dept. website
Pennsylvania -territory w/ lowest premium	1982	3.3	Berger et al., 1989
	2007	4.8	State guide, Pa. Ins. Dept. website
New Jersey - Camden suburbs	1999	3.2	Worrell, 2002, Terr. 12, profile 3-A
	2007	3.7	State guide, NJ Dept. of Ins., Terr. 12, profile 2-A*
California - Berkeley	1999	4.2	Jaffee & Russell, 2002, profile 32A, (reproduced as Figure 2 below)
	2007	4.2	State guide, Calif. Dept. Ins. website, Profile 38A*
* The earlier profile is no longer used. This one is close to it.			

The cost basis of the large range in premiums has been subject to two explanations: one is that the high premium companies have high operating costs relative to the low premium companies. Dahlby and West (1986) attribute the survival of the high-cost companies to search costs that deter consumers from finding companies with lower premiums. The other explanation is that the premium differences match real differences in claim-costs-per-car-year experienced by the different companies. These cost differences are produced by class pools of cars assembled by companies using different customer selection criteria. Therefore, the same classifications produce different numbers of claims per 100 insured car years for each company.

In a follow-up study to Dahlby and West, Berger et al. (1989) continued the examination of the consumers' search cost explanation applied to New York and Pennsylvania premiums reported in official state buyer's guides. Their results for Pennsylvania showed similarly large ranges within each territory across the state, even though premiums charged by individual companies were several times larger in a company's urban territories than in its rural territories.

Apparently responding to the search cost explanation, many states over the last three decades have started publishing premium surveys for car owners. Citing the premium-survey examples given by two recent papers listed in Table 2, Cummins (2002) notes that

several states "provide access to insurance price and consumer complaint data on their websites. This is helpful because it reduces search costs for consumers." However, neither of these papers offers an explanation for the striking ranges in premiums the surveys show for single representative classifications and coverages. Such a range is shown in the California Department of Insurance website example published by Jaffee and Russell (2002) and reproduced below as Figure 2. Annual premiums in this survey (apparently for two cars with full coverage) range from $6996 (Infinity) down to $1663 (Wawanesa), a high to low ratio of 4.2. The current survey for Berkeley shows that the large range in premiums is a stable feature of the market (Table 2).

The long term persistence of large premium ranges suggests that the cost of shopping is not the main reason why large premium ranges occur. Rather, as suggested in earlier studies by Jung (1976) and Berg et al. (1989), a more plausible explanation is that insurers are screening and selecting car owners for acceptance or refusal at the company's premium level for the car's class. Furthermore, the persistence of the ranges shows that the selection criteria are sufficiently successful at predicting differences in annual cost per car year so that the differences in car-year costs insurers experience support the range in premiums. In fact, high premiums resulting from underwriting selection had started to be a problem in the 1960s and led to Congressionally-mandated federal studies. An academic review[9] of one of the 1970 studies on "Price Variability in The Automobile Insurance Market" concludes that "[p]rice variability in the auto insurance market is an interesting and significant economic problem. This study, due no doubt to the limitations of time and money, did not come to grips with it." Nevertheless, this and a companion study give an early characterization of auto insurance underwriting and its effects on premiums.

9. J. J. Launie, 1972. *Journal of Risk and Insurance*, v.39 , 287-90.

Figure 2. Premiums for Berkeley, California, from Jaffee and Russell, 2002

1999 Automobile Insurance Survey

California Department of Insurance

RESULTS

Based on the information you entered, the following profile and results most closely resemble your situation. Please contact a company representative for an actual quote. Please note: THIS IS NOT A PREMIUM QUOTE.

Standard Coverage Married Couple (no children driving),
Husband & Wife have no violations or accidents,
Berkeley

Company Name	Annual Premium	Company Name	Annual Premium
21st Century:	1,846	Hartford:	2,252
AAA:	2,464	Infinity:	6,996
Allstate:	2,248	Liberty Mutual:	3,395
California Capital:	2,686	Mercury:	2,672
Civil Service Employee:	2,100	Millers Ins:	3,813
Clarendon:	6,132	National General:	3,338
CNA Personal:	2,839	Nationwide:	2,324
Coast National:	2,494	Pacific Specialty:	N/A
Colonial Penn:	2,314	Progressive:	2,243
CSAA:	2,496	Safeco:	1,893
Explorer:	3,264	State Farm:	3,048
Farmers:	6,407	Sterling Casualty:	N/A
Financial Indemnity:	5,004	Superior Ins:	3,033
Fireman's Fund:	3,052	Travcal:	2,846
Galway:	4,039	USAA:	1,941
GEICO:	3,684	Viking of Wisconsin:	6,994
Generali US Branch:	4,032	Wawanesa:	1,663

Profile (32A)

C. Underwriting selection by insurers

The Federal Trade Commission summary[10] of its 1970 study provides a good description—when accompanied by several caveats—of what compels automobile insurers to use underwriting selection. One caveat is that the summary misleadingly implies that "drivers" are the premium unit, although the problem being addressed actually involves per-car, not per-driver, premiums and the report itself provides insurance data correctly in terms of the car-year cost unit and claims per 100 car years. Note that, contrary to widespread public and academic belief, the summary affirms that driving record is not a major discriminator. Furthermore, although not noted in this summary, when accident involvements are used, insurers do not distinguish between not-at-fault and at-fault accidents.[11]

> The major finding of this report was that the hard-to-place driver problem is not confined to those with the poorest driving records. Both theory and market data indicate that the hard-to-place problem is a byproduct of underwriting competition and an integral part of the competitive functioning of the automobile insurance industry. Insurers do not find it profitable to grant coverage to all applicants because even with the most highly developed rating classification systems, there are still some drivers within individual classifications who have distinctly higher than average loss potential. Insofar as the rating system fails to account for these differences, there is an opportunity for insurers to increase their profits through selective underwriting. Refusals to insure new applicants, refusals to renew, and cancellations are manifestations of these efforts.

Another point needing qualification is, that as any underwriting variable that correlates with differences in claims per 100 car years becomes known, underwriting must also be defensive, according to the principle "select or be selected against." A last point is that public acceptability is a major constraint on choice of classification and underwriting variables for all companies, which explains why insurers' use of credit scores (discussed below) in underwriting and pricing has only recently been broadly and openly used.[12]

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10. Annual Report 1970, Federal Trade Commission.

11. The predictive value for insurers in doing this is explained by Butler, 2006b.

12. Lack of acceptability explains why insurers do not use other correlations in underwriting or pricing. For example, because they average more miles, newer cars produce more liability claims per 100 car years than older cars, but it would be hard for insurers to explain to customers why a liability premium increases when an older car is traded for a newer one. The public has been encouraged to believe that the reason for premium differences is differences in driver negligence, but a change to a newer car generally entails no change in drivers. See Butler, 2006b.

In view of the large range in premiums listed by state surveys for each locality, class, and coverage, a key question is the economic reality of car owners who are charged each locality's highest premiums. It is therefore appropriate to examine the variables used for rejecting applicants by companies charging less than the highest premiums. Descriptions of the situation today fully conform to the studies nearly 40 years ago. As then, insurers in each locality that charge the seemingly uncompetitive high premiums are called nonstandard companies. A study by Conning Research (2008) summarizes their market:

> Financial results for this segment are characterized by higher average premiums, higher claim frequencies [claims per 100 car years], lower claim severities,[13] higher underwriting expenses, and lower account retention than in the standard or preferred segments.

This description also validates using the ratios of high to low premiums as proxy measures of the ratios of claim numbers per 100 car years produced by cars insured at the high and low premiums. Furthermore, the differences in claim size averages (severities) the study shows are minor, while the large differences in claim numbers approximate the differences in pool premiums insurers charge for cars in the same class.

Description of the customers of nonstandard companies by Conning Research 2008 indicates that information costs of shopping do not explain why these customers are paying nonstandard premiums.

> It is not unusual for a large portion of the business to turn over within one year due to the price sensitivity of the typical customer. The premium for a nonstandard policy often represents a nontrivial portion of the potential insured's disposable income, making him/her very susceptible to price shopping.

Although some dispersion of premiums in the standard market is likely because customers typically have more discretionary income so that information cost at a higher value of time may be a deterrent to shopping, in view of this description of the typical nonstandard customer, information cost is an unlikely explanation for the high premiums of the nonstandard market.

Table 3 lists the variables insurers use in decisions to accept or reject customers at the company's premium level. All are reported on by the trade press when they receive regulatory or legislative attention, which is often instigated by civil rights and consumer

13. Since the average size of claim—severity—is smaller, it means that the number of claims represented by the higher premiums is even greater than for the lower-premium companies.

organizations. Descriptions by the Federal Trade Commission (FTC) 1970 and Conning Research 2008 of variables used to relegate car owners to the nonstandard market illustrate the enduring nature of these variables. Preferred and standard companies use these variables to deny applicants their lower premiums with the result that the rejected applicants can only insure a car at the higher premiums charged by nonstandard companies.

Table 3. Predictors of claims per 100 car-years

PREDICTOR VARIABLE	Correl-ation	NOTES	Identifying nonstandard car owners	
			Federal Trade Commission 1970	Conning 2008
Location: Zip code income	–	Harrington & Niehaus 1998, claims/100 car-years	Only inter-territory differences considered	Only indirectly as "immigrant population"
Credit score	–	Miller & Smith 2003, claims/100 car-years	"credit worthiness" and "retail credit report"	Correlation with "poorer credit scores."
Education & Occupation level	–	News reports in 2006 assaying the effects of Geico's selection variables in NJ	Notes proportion of occupations in high premium pools	"certain occupations [correlate] with higher loss frequencies"
No prior (not continuous) or nonstandard prior insurance on car	+	"Losses nearly 2.5 times higher," 2003 insurer testimony in Texas		"driving without insurance . . . is indicative of risk taking"
Liability limits	–			
Pay by installment	+	Legislators accuse standard insurers of not offering plan as way to reject certain applicants.	Recommends that installment plans be made available.	"Need for flexible payment plans"

The first variable in Table 3 is residence location, which historically has gotten the most public attention through studies, lawsuits, and regulations on premium differences across zip codes. The conventional explanation for why the location variable works is that it ties premium differences to different driving environments, which has some basis in non-insurance accident data differences for rural and urban settings and different road types. But environment cannot be the explanation for premium differences across zip codes within the same insurance territory. In all territories, insurers report the most liability, collision, and uninsured motor vehicle claims per 100 insured car years—and therefore charge the highest area premiums—for covering the cars of those owners residing in the territory's low-income zip codes. In their study of Missouri zip codes, Harrington and Niehaus (1998) report that the cars of residents of zip codes with higher black ethnicity, lower educational level and concurrently lower-income produce 36% more liability claims and 48% more collision claims per 100 insured car years than the cars of residents of other zip codes.

On a territorial level that includes multiple zip codes, SRI International (1979) summarizes the findings of an MIT doctoral thesis: "In Massachusetts, the correlation between territorial rate relativities and median income is –0.978; between such relativities and percent black, 0.532; both sets of figures are stunningly high." The negative correlation of insurer costs per car year with income in Massachusetts was also indicated by Blackmon and Zeckhauser (1991) in observing that the state-required "subsidy of Boston and other cities tends to flow from high-income towns to low-income towns." Thus at both zip code and territorial levels, the cars of lower income owners produce more claims per 100 car years. Therefore insurers to the degree permitted charge these owners higher premiums per car year.

Insurers use the next variable in Table 3, credit scores,[14] for customer selection and premium charges at all income levels. For years insurers have been using credit measures as selection variables (Federal Trade Commission 1970), but only in the last decade, has it become controversial, resulting in the availability of quantitative data. In a study sponsored by insurers of nearly 2.6 million car years of claims experience, Miller and Smith 2003 report that property damage liability claims per 100 car years were 2.5 times greater for the cars of owners with the lowest credit scores than for the cars of owners with the highest credit scores.[15]

The rest of the variables used to set cutoff points for refusing to accept customers at given premium amounts are also indicative of an owner's financial condition. Negative correlation of premiums with educational and occupational levels was demonstrated through investigative reporting on the criteria a major insurer uses to assign customers to its high-premium or low-premium affiliates. Reporters found that a janitor with a high school degree would be charged 71% more for an otherwise identical profile than a lawyer with a master's degree living at the same address.[16] The final variables used by

14. Insurers now call these "credit-based insurance scores," which are proprietary insurer-specific variables based on the same information used by vendors for calculating credit scores. The scores use roughly the same range in score values (from 500 to 1,000), so that little is lost in using the credit-score term. See Miller and Smith 2003 for further discussion.

15. In contrast average claim size was virtually the same for all credit-score categories, which further confirms that differences in premiums insurers charge for the same classification and coverage can be taken to reflect difference in number of claims per 100 car-years rather than significant differences in the average size of claims.

16. Joe Donohue, "Geico's two rates: white-collar and blue-collar: Auto insurer charges more to consumers with less formal education and job status," *Star-Ledger* (Newark, NJ), February 27, 2006. Geico has since persuaded regulators that the difference reporters found was inflated by omission of credit scores from the test because the credit score variable cannot be determined for a fictitious individual without a

insurers in selecting customers are owning a car not kept continuously insured, owning a car previously insured by a nonstandard insurer, insuring a car with just the legal minimum liability limits, and needing to pay premiums in monthly installments.

All of the variables insurers use for their underwriting selection decisions are proxies for claims per 100 car years. Concurrently, all of these also appear to be measures of car-owner finances. The correlation direction is consistently that the cars of owners showing fewer financial resources and more strained budgets produce more claims per car year. The only accepted academic interpretation of these correlations is that car owners who are negligent with their finances are also negligent in using cars, as argued by Brockett and Golden 2007. That is, despite economic theory that people with fewer resources have greater reason to be more risk averse and therefore less negligent in the use of cars which represent major investments, the interpretation explains the correlations as greater driver negligence.

But it should not be supposed that all selections by insurers are intended to minimize each pool's claims per 100 car years through minimizing the pool's average miles per car-year. Instead in most markets the aim of insurers is to broaden the company's pools by balancing high-use with low-use cars. Therefore, only in markets where there are few owners financially able and willing to keep low-use cars insured does selecting against high-use cars become a defensive competitive necessity for insurers. Each variable proxies for an individual owner's financial ability variously to insure multiple cars for exclusive use, to insure just one car for exclusive use, or, for financial reasons and despite inconvenience, to have share their car with others who do not own insured cars.

D. New York City premiums

The combined effects of driving environment, income, parking cost, ownership expenses and the adverse selections induced by the premium structure may be considered within and across different territories of official premium surveys. An idea of the feedback effects of the premium structure is illustrated by the long term pattern of premium relativities in the New York City area. Table 4 provides a combined example selected from four of the 13 New York City area territories and the ten companies (of 28 listed) with the most market share in the state. From Manhattan to Brooklyn within each company (horizontally in the table) across what would appear to be similar traffic

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Social Security number. *See* New Jersey Department of Banking and Insurance, April 2008, *The Use of Occupation and Education Factors in Automobile Insurance.*

environments, premiums increase by a factor of two.[17] The uniformity of environment and insurance claim cost factors such as local medical and car repair costs, makes apparent remarkably uniform premium ratios. Within each company the highest to lowest premium ratio *across territories*, generally the company's Brooklyn premium to its Manhattan premium, is about 2. Then within each territory, the high to low premium ratio *across companies* is from 3.3 to 5.1. This within- and across-territory pattern has been stable for at least 15 years, to judge from occasional observations on the state premium surveys over this period. This pattern indicates that in using proprietary underwriting criteria to select customers, insurance companies are independently experiencing real differences in costs per car year. Yet the seemingly large two times difference in premiums between Brooklyn and Manhattan does not seem so large if we suppose that the typical Brooklyn car is in daily use for a total 16,000 odometer miles over a year, while the typical Manhattan car is used only on weekends for, say, 8,000 odometer miles in a year.

Table 4. New York City Premiums by the state's largest insurers, effective July 1, 2006†

State Market Share %	COMPANY	TERRITORY				High / Low
		Manhattan	Queens Urban	Queens Suburban	Brooklyn	
19.1*	Allstate	$ 494	$ 780	$ 986	$ 860	2.0
19.8*	Geico	672	795	769	1,290	1.9
9.0	Progressive	864	1,017	1,126	1,539	1.8
3.6	NY Central Mutual	981	1,028	1,214	1,571	1.6
6.1	Liberty Mutual	955	1,191	1,379	1,696	1.8
11.9	State Farm	864	1,114	1,521	1,998	2.3
**	Geico Indemnity	1,133	1,383	1,412	2,221	2.0
6.5	Travelers	1,253	1,618	1,637	2,224	1.8
3.3	Auto-One	2,111	1,931	2,668	3,711	1.9
**	Allstate Indemnity	2,542	2,568	3,265	4,309	1.7
79.3						
	High / Low	5.1	3.3	4.2	5.0	8.7

† Premium for 1 car-year, age 35 driver, no violation or claim points, required insurance only (liability, UM, and PIP), available at http://www.ins.state.ny.us/auto/2006/auto0617.htm (July1, 2007 premiums are now available at http://www.ins.state.ny.us/auto/2007/auto0717.htm)

* Includes market share of the subsidiary "Indemnity" company shown below

** Market share is included in the Allstate or Geico parent company shares shown above

17. Differences in premium fraud (e.g., undisclosed drivers) and claim fraud (inflated or fake claims) may be contributing factors but probably not major causes of the persistent territorial differences.

E. Demand for change of premium unit

Under the per-car premium structure, underwriting competition compels insurers to charge the highest premiums to those who show signs of having the least ability to pay. Concurrently, the premium structure compels car owners who must economize to minimize ownership and maximize use of cars that are insured at the highest premiums. For decades the policy concern with automobile insurance has been with mandatory insurance in conjunction with the ability to pay for it. However, the implied problem has always been that car owners on tight budgets have greater difficulty paying the *same* premium as people with larger discretionary incomes, i.e., that premiums are regressive. But the prices of milk, bread, and gasoline are also regressive. The inherent perversity of the premium structure is that the adverse selections the structure incentivizes causes premiums per car-year to increase as ability-to-pay decreases.

As a final point, analysis of the consequence of the two types of adverse selection Vickrey described (but did not identify as such) predicts that currently-increasing enforcement initiatives for mandatory insurance will worsen the ability-to-pay dilemma. Many states are implementing insurance database systems that allow police patrols to check the insurance status of cars on-the-road. These systems are eliciting serious proposals to confiscate license plates or impound uninsured cars. But increasing the risk of using uninsured cars will shift even more miles of car use to cars kept insured and add more upward pressure on premiums. Owners giving up cars only to face still higher premiums have principled economic justification for demanding premiums proportioned to car use instead of ownership. These owners are entitled to prompt attention by heretofore neglectful scholarship to the premium structure Vickrey described and its consequences.

References

AEI-Brookings Joint Center for Regulatory Studies, 2002. *Deregulating Property-Liability Insurance*, J. D. Cummins, editor.

Blackmon, Glenn, and Richard Zeckhauser, 1991. "Mispriced Equity: Regulated Rates for Auto Insurance in Massachusetts," *American Economic Review*, 81:65-69

Berger, Lawrence A., Paul R. Kleindorfer, and Howard Kunreuther, 1989. "A Dynamic Model of the Transmission of Price Information in Auto Insurance Markets," *Journal of Risk and Insurance*, March, 1989, Vol. LVI., No. 1, pp. 17-33.

Brockett, Patrick L., and Linda L. Golden, 2007. "Biological and Psychobehavioral Correlates of Credit Scores and Automobile Insurance Losses: Toward an Explication of Why Credit Scoring Works." *Journal of Risk and Insurance*, 74: 23-63

Butler, Patrick, Twiss Butler, and Laurie L. Williams, 1988. "Sex-Divided Mileage, Accident, and Insurance Cost Data Show That Auto Insurers Overcharge Most Women," *Journal of Insurance Regulation*, 6: Part I, 243-284 and Part II, 373-420.

Butler, Patrick, 2000. *Why The Standard Automobile Insurance Market Breaks Down In Low-Income Zip Codes: A Per-Mile Analysis*, A report to Texas legislators by the Texas National Organization for Women: 37 pp. Available at www.centspermilenow.org

Butler, Patrick, 2006a. "Driving with the Brakes On: Guido Calabresi's Failed 1970 Automobile Insurance Case against Safety-Device Mandates." 2006 Annual Meeting of the American Risk and Insurance Association. Available at www.aria.org and http://law.bepress.com/alea/16th/bazaar/art21/

Butler, Patrick, 2006b. "What Negligence Theory Needs to Learn from Auto Insurance: 'Fault is Predictively Irrelevant' and Why." Working paper. Available at http://law.bepress.com/alea/16th/bazaar/art13

Butler, Patrick, 2006c. "Letter: Current Insurance Pricing Unduly Limits Car Ownership," on Edlin 2006. "If Voters Won't Go for Taxing Oil to Conserve Energy, How Do We Do It?" *Economists' Voice*, December 2006.

Calabresi, Guido, 1970. *The Costs of Accidents: A Legal and Economic Analysis*. Yale University Press, New Haven.

Conning Research & Consulting, 2008. *The Nonstandard Auto Insurance Market: Evolutionary Challenges.* [On file with author.]

Cummins, J. David, 2002. "Property-Liability Insurance Price Deregulation: The Last Bastion?" in *Deregulating Property-Liability Insurance*, J. D. Cummins, editor, AEI-Brookings Joint Center for Regulatory Studies: 1-21.

Dahlby, Bev G., and Douglas S. West, 1986. "Price Dispersion in an Automobile Insurance Market," *Journal of Political Economy* 94, 418-438.

Edlin, Aaron S., 2003. "Per-Mile Premiums for Auto Insurance," in *Economics for an Imperfect World*, Richard Arnott, Bruce Greenwald, Ravi Kanbur, and Barry Nalebuff, editors, MIT Press, Cambridge, Massachusetts: 53-82.

Edlin, Aaron S., 2006. "If Voters Won't Go for Taxing Oil to Conserve Energy, How Do We Do It?" *Economists' Voice*, November 2006. Available at www.bepress.com/ev

Edlin, Aaron S., and Pinar Karaca-Mandic, 2006. "The Accident Externality from Driving," *Journal of Political Economy*, 114: 931-955

Federal Trade Commission, 1970. *Insurance Accessibility for the Hard-to-Place Driver*, Report to the Department of Transportation.

Federal Trade Commission, 2007. *Credit-Based Insurance Scores: Impacts on Consumers of Automobile Insurance*, Report to Congress.

Harrington, Scott E., 1994. "Taxing Low Income Households in Pursuit of the Public Interest: The Case of Compulsory Automobile Insurance." In Sandra Gustavson and Scott Harrington, eds. *Insurance, Risk Management, and Public Policy*. Boston, Kluwer Academic Publishers.

Harrington, Scott E., and Greg Niehaus, 1998. Race, Redlining, and Automobile Insurance Prices, *Journal of Business,* 71:439-469

Hu, Pat S. And Timothy R. Reuscher (2004), Summary Of Travel Trends, 2001 National Household Travel Survey, Fed. High. Admin., available at *http://nhts.ornl.gov/2001/pub/STT.pdf* , Table 1.

Jaffee, Dwight, and Thomas Russell, 1998. "The Causes and Consequences of Rate Regulation in the Auto Insurance Industry," in David Bradford, ed., *The Economics of Property-Casualty Insurance*, 81-112.

Jaffee, Dwight, and Thomas Russell, 2002. "Regulation of Automobile Insurance in California," in D. Cummins, ed., *Deregulating Property-Liability Insurance*, AEI-Brookings Joint Center for Regulatory Studies, 195-236.

Jung, Allen F., 1963. "Rate Variations Among Suppliers of Automobile Insurance," *Journal of Insurance* 30:573-576.

Jung, Alan F., 1978. "Automobile Insurance Rates in Chicago, Illinois," *Journal of Risk and Insurance*, 45:507-515.

Litman, Todd. 1997. "Distance-Based Vehicle Insurance as a TDM Strategy," *Transportation Quarterly* 51 (Summer): 119–37.

Maryland Law Review, 2005. "Symposium: Calabresi's The Costs of Accidents: A Generation of Impact on Law and Scholarship," *Maryland Law Review* 64:1-754

Miller, Michael, and Richard Smith (2003), The Relationship Between Credit-Based Insurance Scores to Private Passenger Automobile Insurance Loss Propensity. Bloomington, IL: Epic Actuaries, LLC. http://www.ask-epic.com/Publications/Relationship%20of%20Credit%20Scores_062003.pdf

Pritchard, Tim, and Larry DeBoer, 1995. "The Effects of Taxes and Insurance Costs on Automobile Registrations in the United States," *Public Finance Quarterly*, 23:283-304.

SRI International, 1979. *Choice of a Regulatory Environment for Automobile Insurance,* Stanford, Ca. (Prepared for Commercial Union Assurance Companies, Boston, Ma.) [On file with author.]

Vickrey, William, 1968. "Automobile Accidents, Tort Law, Externalities, and Insurance: An Economist's Critique," *Law and Contemporary Problems* 33:464-487. Reprinted (with English meanings of Latin legal phrases and a short biography added) at: http://www.vtpi.org/vic_acc.pdf

Williams, Allan, 1999. "Licensing Policies for Young Drivers in the United States," in *Automobile Insurance: Road Safety, New Drivers, Risks, Insurance Fraud and Regulation*, edited by Georges Dionne and Claire Laberge-Nadeau, Kluwer Academic Publishers, Boston: 215-220.

Worrell, John D., 2002. "Private Passenger Auto Insurance in New Jersey: A Three-Decade Advertisement for Reform" in *Deregulating Property-Liability Insurance*, J. D. Cummins, editor, AEI-Brookings Joint Center for Regulatory Studies: 81-147.