Pay-at-the-Pump Auto Insurance

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Abstract

PAY-AT-THE-PUMP is a proposal to replace the current insurance system of lump sum payments for automobile insurance by a mechanism whereby motorists pay for their insurance as they buy fuel for their vehicles.

PAY-AT-THE-PUMP has several advantages. It reduces insurance cost and cross subsidies and enhances equity. It also benefits the environment, safety, balance of payments, and security.

In this paper we study limited but very important issues in the theory and implementation of PAY-AT-THE-PUMP insurance. We address issues of efficiency, subsidy, equity, externalities, safety, insurance cost and cost of insuring the uninsured motorist under a PAY-AT-THE-PUMP regime. We use the insurance industry's criticisms of mandatory auto insurance as a lens through which we view PAY-AT-THE-PUMP insurance and ask how PAY-AT-THE-PUMP fares by comparison. Finally we address one aspect of insurance that has been neglected in the current debate -- the human dimension of the problem of uninsured motorist and the contribution PAY-AT-THE-PUMP can make to solve this problem.

Key Words: converting fixed to variable cost; efficient pricing of auto insurance; environmental benefit of Pay-at-the-Pump; exposure risk; insurance cost; insurance externalities; mandatory insurance; safety; uninsured motorist; universal auto insurance

JEL Classification Nos.: L2, L9, M2, Q2, Q4, R4

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Last but not least, I wish to acknowledge the contribution of my wife Mairin.

Criticism appreciated.

J. Daniel Khazzoom
January 28, 1998

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PART ONE: EFFICIENCY, CROSS-SUBSIDY, EQUITY, EXTERNALITIES DUE TO ACCIDENTS AND THE ROLE OF VEHICLE FUEL EFFICIENCY

I. Efficiency, Cross-Subsidy, Equity and Transportation Externalities†

I.1 A System of One-Insured Motorist

Assume, for simplicity's sake, the marginal cost of driving, MC, is flat. (The results can be generalized in a straightforward manner to the case where the marginal cost rises or falls linearly or nonlinearly.) Consider first the case where the system consists of a single insured motorist, as shown in Figure I.1 (below). With MC = ak, the motorist drives ag miles.

Following Rea (1992), assume for simplicity's sake a constant exposure risk per mile, ρ (which in the diagram is represented by the segment kd), and an omniscient insurance company, who would charge the motorist the lump sum premium dkfe (= $\rho * ag$). Under this regime, the consumer surplus is

$$CS_{(\text{lump sum})} = ckf - dkfe = cdh - hfe \qquad (I.1.1)$$

where hfe represents the misallocation of resources associated with the motorist's VMT under the current regime of lump-sum payment.

In this section we abstract from the effect of varying vehicle fuel efficiency, and treat PAY-AT-THE-PUMP insurance as synonymous with VMT insurance -- i.e., insurance based on miles traveled. We discuss the subject of varying vehicle fuel efficiency in Section II.

Under PAY-AT-THE-PUMP, the new marginal cost facing the motorist is $ak + \rho = ad$. The motorist now travels $ai < ag$, and pays insurance premium klhd < kfed. The consumer surplus is now

$$CS_{(\text{PAY-AT-THE-PUMP})} = cdh \qquad (I.1.2)$$

which can be seen to exceed $CS_{(\text{lump sum})}$ by hfe. Not surprisingly, the increase in welfare, hfe, is simply the magnitude of resource misallocation eliminated under PAY-AT-THE-PUMP.

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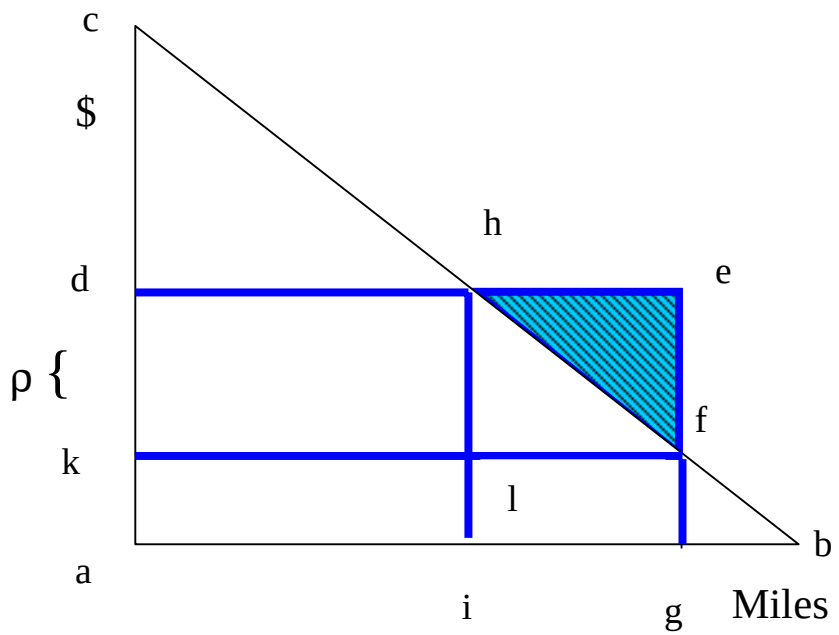
† This section benefited from extensive discussions with RFF's Matt Cannon. I am indebted to Matt for his insights.

Figure I.1

An Illustration of PAY-AT-THE-PUMP's Pricing Efficiency in a One-Insured-Motorist System



In summary, in a single-motorist system and with an omniscient insurance company, the installation of PAY-AT-THE-PUMP results in (1) reduction in miles traveled, implying increased safety (due to the reduction in exposure risk); it also implies a benefit for the environment; (2) elimination of resource misallocation with an equal increase in welfare; and (3) reduction in the insurance bill due to the reduction in miles traveled (and exposure risk).

One proviso.

The comparison of the outcome before and after the installation of PAY-AT-THE-PUMP has to take into account the fact that the demand curve of the insured motorist does not stay put during the transition. It will shift to the right when PAY-AT-THE-PUMP is introduced because of PAY-AT-THE-PUMP's income-feedback effect, which results from saving the lump-sum insurance premium. Hence VMT under PAY-AT-THE-PUMP will be somewhat greater than ai (but still less than ag). This means the extent by which safety is enhanced (and by which the insurance bill drops) will be smaller than depicted in Figure I.1. On the other hand, the gain in welfare will exceed the amount of resource misallocation that has been eliminated, due to the shift of the demand curve to the right. But regardless of the magnitude of welfare gain, the important point is that under PAY-AT-THE-PUMP the misallocation of resources will be eliminated.

I.2 A System of Two-Insured Motorists

We continue to make the same assumptions as before, except that we no longer assume the insurer is omniscient.

When more than one motorist are involved, our earlier three results for the one-motorist system will continue to hold. (1) There will be a reduction in miles traveled by every motorist and therefore safety will be enhanced as a result of the reduction in exposure risk, and the environment will benefit as well. (2) Resource misallocation will be eliminated and aggregate welfare will increase by an amount greater than the amount of resource misallocation that has been eliminated. (3) The average insurance bill per motorist will drop.

What is new in the multi-motorist case, however, is that the insurance bill will drop for some motorists and increase for others. This is so because under the current regime, some motorists subsidize others. Insurance companies act as the medium through which these cross subsidies get transferred. The insurance companies themselves may be the beneficiaries or the losers in this system of cross subsidies.[1] PAY-AT-THE-PUMP puts an end to all of that.

Additionally one other new factor enters the picture in the multiple-motorist case: equity. Equity is enhanced, because PAY-AT-THE-PUMP eliminates all cross-subsidization.

We illustrate these results for a system with two insured motorists. We consider the case where the lump-sum premiums charged by the insurance companies are on the average more than sufficient to cover the insurance cost. The case where the insurance companies charge on the average less than what is sufficient to cover the insurance cost can be analyzed analogously.

Suppose the insurer's premium schedule is a step-function of the distance traveled. For example, a motorist who expects to drive less than 10,000 miles annually is charged $ x; a motorist who expects to drive between 10,000 miles and 25,000 miles is charged $ (x+k), k>0; and so on. The insurer determines the premium for each range based on what the insurer views as the typical or the average number of miles driven within each range of the step function. Thus for the group of motorists who report they will be driving less than 10,000 miles, the insurer may set the premium based on, say, 8,000 miles, on the assumption that the average miles driven by this group will be 8,000 miles; and so on.

Consider now two motorists whose travel demand is given by ff' and gg', as shown in Figure I.2 (next page). Suppose both motorists reported their expected mileage falls within the same step function. The step may be as large as, or larger than Od_2 in the diagram. But the insurance company charges each motorist a premium based on OT miles traveled. On the assumption the two motorists have the same constant marginal cost, Op, and the same constant risk exposure ρ, motorist 1 travels Od_1 miles, motorist 2 travels Od_2 miles, and each motorist pays a lump sum = $ ephi = $ ihk'j'. For motorist 1, the consumer surplus is

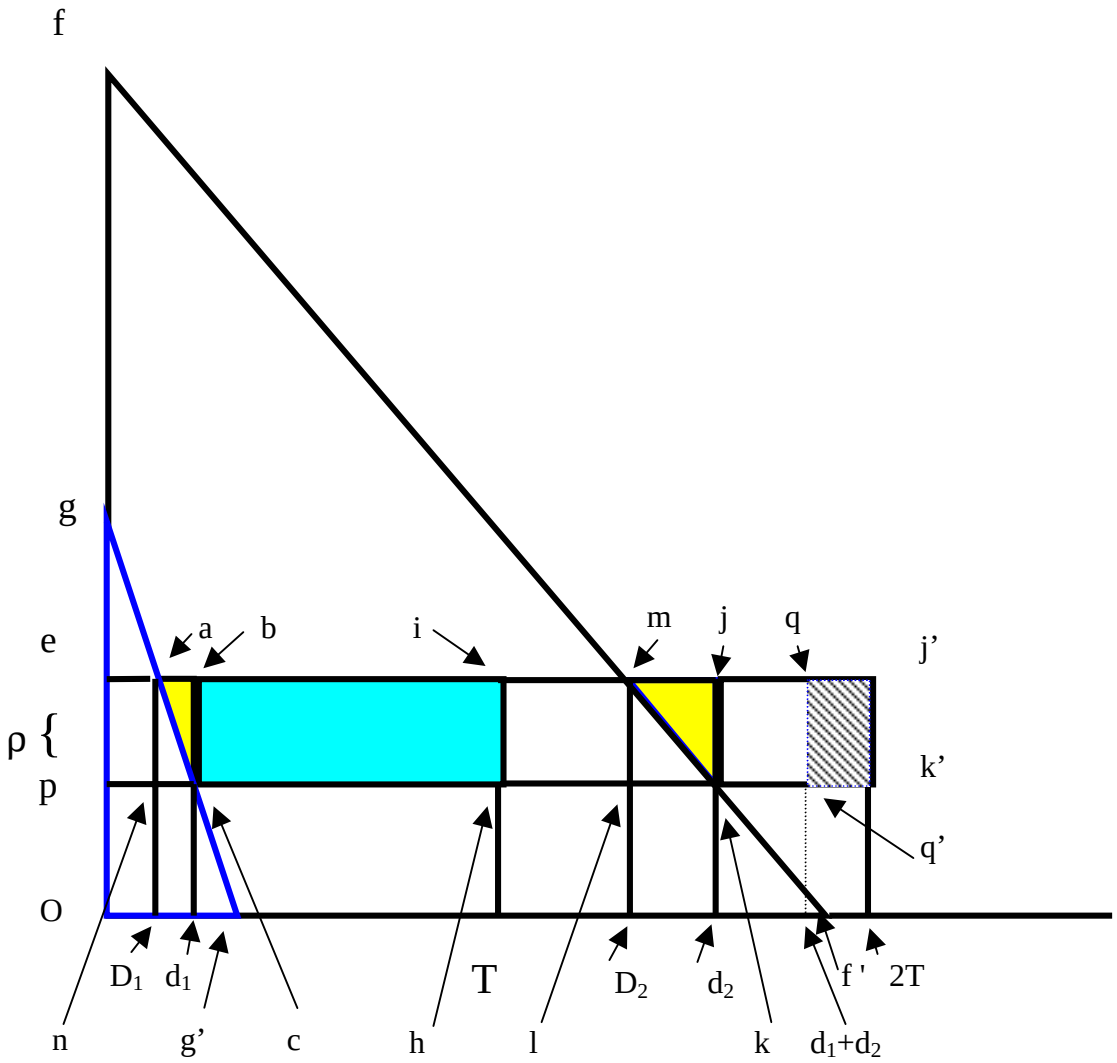
$$CS(1)_{(\text{lump sum})} = gpc - ephi = gea - acb - bchi \qquad (I.2.1)$$

---

[1] This can happen in the case of the one-motorist system, as well. Transfers to and from the insurer can occur by design. But they occur primarily because the insurer is omniscient.

Figure I.2

Pricing Efficiency and Elimination of Cross Subsidy under PAY-AT-THE-PUMP in a Two-Insured-Motorist System



(which for the case depicted in Figure I.2 is negative). The triangle abc represents the amount of resource misallocation associated with motorist 1's VMT under the current regime of lump-sum payment, and the rectangle bchi represents the transfer from motorist 1 to the insurer (part of this transfer goes to subsidize motorist 2's travel demand, as we will see). Motorist 2's consumer surplus is

$$CS(2)_{(\text{lump sum})} = fpk - ephi = fem + ihkj - mkj \qquad (I.2.2)$$

where ihkj represents the subsidy, transmitted through the insurance company, that motorist 2 receives from motorist 1, and where mkj represents the magnitude of resource misallocation associated with motorist 2's travel under the current regime of lump-sum insurance payment.

The insurance company receives epk'j' = 2 ∗ ephi = 2OT ρ. With motorists 1 and 2 driving a total of $Od_1 + Od_2$, the insurer's cost is $(Od_1 + Od_2)\rho$, and the insurer's surplus is

$$\begin{aligned} Surplus(ins.)_{(\text{lump sum})} &= 2OT\rho - (Od_1 + Od_2)\rho \\ &= (OT - Od_1)\,\rho + (OT - Od_2)\,\rho \end{aligned} \qquad (I.2.3)$$

Depending on where T is set, (I.2.3) shows the insurance company may be in surplus, deficit or just in balance. In our case, $(T - Od_1) > 0$, $(T - Od_2) < 0$, but in the case illustrated in the diagram $|T - Od_1| > |T - Od_2|$ so that $Surplus(ins.)_{(\text{lump sum})}$ in (I.2.3) is positive. [2]

Under PAY-AT-THE-PUMP, the marginal cost of travel is $Op + \rho = Oe$. Motorist 1's VMT is now $OD_1 < Od_1$. Motorist 2's VMT is $OD_2 < Od_2$.[3] Motorist 1's and motorist 2's consumer surplus are now, respectively,

$$CS(1)_{(\text{PAY-AT-THE-PUMP})} = gea \qquad (I.2.4)$$

$$CS(2)_{(\text{PAY-AT-THE-PUMP})} = fem \qquad (I.2.5)$$

while the insurer's surplus is now

$$Surplus\ (ins.)_{(PATP)} = (OD_1 + OD_2) * ep - (OD_1 * \rho + OD_2 * \rho) = 0 \qquad (I.2.6)$$

---

[2] We note in passing that whenever $(T - Od_1) > 0$, we have a case of one motorist (in this case motorist 1) subsidizing the other. This is true regardless of whether Surplus(ins.) in (I.2.3) is positive, negative or zero. The same is true of the multi-motorist case -- i.e. $(T - d_i) > 0$, i=1,2,.,s is always indicative of cross-subsidy. This result assumes, however, that the insurer is charging the motorists an amount exactly equal to the common marginal exposure risk.

[3] The same remark we made in section I.1 above is applicable here, as well. The demand curves of the insured motorists shift to the right with the introduction of PAY-AT-THE-PUMP, so that the drop in travel demand is smaller than that depicted in the diagram.

It is of interest to examine the change that occurs for each one of the two motorists, as well as the insurer following the switch to a PAY-AT-THE-PUMP regime. Letting Δ denote the change in surplus following the switch to PAY-AT-THE-PUMP, we have for motorist 1, motorist 2 and the insurer, respectively

$$\Delta(1) = gea - (gea - abc - bchi) = abc + bchi$$
$$= abc + (OT - Od_1)\,\rho \qquad \text{(I.2.7)}$$

$$\Delta(2) = fem - (fem + ihkj - mkj) = mkj - ikhj$$
$$= mkj - (Od_2 - OT)\,\rho \qquad \text{(I.2.8)}$$

$$\Delta(Ins) = 0 - \{(OT - Od_1)\,\rho + (OT - Od_2)\,\rho\} \qquad \text{(I.2.9)}$$

From (I.2.8), we have

$$(Od_2 - OT)\,\rho = mkj - \Delta(2) \qquad \text{(I.2.10)}$$

and from (I.2.9) and (I.2.10) we have

$$(OT - Od_1)\,\rho = (Od_2 - OT)\,\rho - \Delta(Ins) = mkj - \Delta(2) - \Delta(Ins). \qquad \text{(I.2.11)}$$

Substituting from (I.2.11) into (I.2.7)

$$\Delta(1) = abc + mkj - \Delta(2) - \Delta(Ins) =$$
$$= abc + mkj + |\Delta(2)| + |\Delta(Ins)| \qquad \text{(I.2.12)}$$

where we preceded the absolute value of the last two terms by a plus sign, since their algebraic value is negative and they appear in the first row of (I.2.12) with a negative sign.

(I.2.8) shows that motorist 2's consumer surplus drops by an amount equal to the transfer she received from the insurer, net of the resource misallocation associated with her VMT. (I.2.9) shows the insurer loses the transfer she received from motorist 1, net of the transfer she made to motorist 2. (I.2.12) says that the change in welfare for motorist 1 equals the amount of resource misallocation that has been eliminated (represented by the sum of the first two terms in (I.2.12)), plus the cross subsidy motorist 2 received from motorist 1 via the insurer (but net of the resource misallocation associated with motorist 2's travel; this has been already included in the term mjk recaptured by motorist 1), plus the surplus accrued to the insurer under the regime of lump-sum payment.

In the multi-insured-motorist case, the benefit from the elimination of resource misallocation will not accrue all to one single motorist, as happens in this simple case. Here, all benefits accrue to motorist 1 because she is the sole source that financed the subsidies and footed the bill for the resource misallocation. But whatever the case may be, motorists privileged with subsidies under the lump-sum-payment regime will forfeit these privileges

under PAY-AT-THE-PUMP. Each motorist pays according to the risk to which she exposes herself and others, and there are no cross subsidies.

The elimination of these cross subsidies makes PAY-AT-THE-PUMP an equitable system of insurance.

One or two observations.

When $MC_1 > OP$ in Figure I.2, (where MC_1 denotes the marginal cost of motorist 1) while $MC_2 = OP$, motorist 1 will drive less than Od_1, and her transfer to the insurer under the current regime will be greater than that shown in Figure I.2 (but motorist 2 will receive the same transfer as before). Hence, motorist 1 has more to gain from the switch to PAY-AT-THE-PUMP than she does presently. Similarly, when $MC_2 > OP$, while $MC_1 = OP$, the transfer to motorist 2 will be smaller than before (although motorist 1 will still transfer the same amount as before, except that now more of that will be captured by the insurer). Hence, motorist 2 has less to lose now from the switch to PAY-AT-THE-PUMP than she did before.

Note, however, that once we are under a PAY-AT-THE-PUMP regime, the fact that $MC_i \neq MC_j$ does not affect any of the results on efficiency, equity, etc. under PAY-AT-THE-PUMP, so long as each motorist equates her marginal cost plus ρ to her marginal benefit.

In section I.5 we take up the question of unequal marginal exposure risk. But before we do that, we extend our analysis to the case of uninsured motorists. We do the analysis for a system of one uninsured motorist. (The extension to a system with many uninsured motorists is fairly straightforward, and will not be pursued.) Following that, we address briefly the question of externalities due to accidents.

I.3 A System with One Uninsured Motorist

The framework for the analysis here is similar to that for the case of the one-insured-motorist system. Figure I.3 (next page) shows the diagram for the case of the uninsured motorist. We label the risk as ρ_{UM} to allow for the fact that the uninsured motorist poses a different risk from that posed by the insured motorist. Otherwise we continue to make the simplifying assumption that the marginal cost of travel, as well as the marginal exposure risk is constant.

With the marginal cost of travel = ae, the uninsured motorist travel demand is aj miles. Consumer surplus is cef. But with the marginal exposure risk at ρ_{UM}, the uninsured motorist is receiving a transfer equal to defh paid for by taxpayers at large, as well as by insured motorists through premiums for uninsured-motorist, collision and medical coverage. Of this transfer, gfh is the amount of resource misallocation associated with the uninsured motorist's VMT.

The subsidy the uninsured motorist receives from the rest of society is another source of inequity in the existing system.[4]

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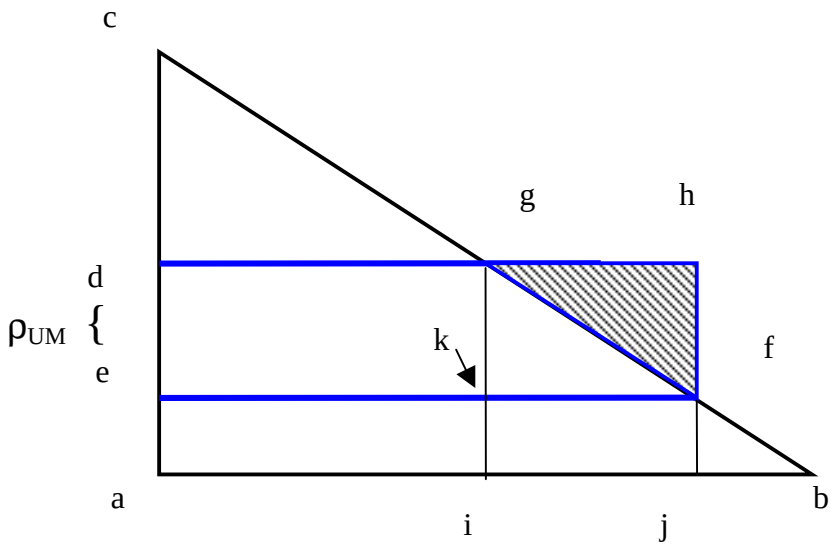
[4] The uninsured-motorist premium and part of the payment for collision and medical coverage made by the insured motorists to protect themselves from at-fault uninsured motorists is a source of inequity from a legal standpoint, as well, since tort's basic tenet is that those responsible for damages, not the victims, should be the ones to pay for those damages.

Figure I.3 Pricing Efficiency, Transfers and Welfare under PAY-AT-THE-PUMP in a System with One Uninsured Motorist



Under PAY-AT-THE-PUMP, the uninsured motorist's travel demand drops to ai. But unlike the insured motorist, the uninsured motorist's income does not increase with the switch to PAY-AT-THE-PUMP. Because of that, the uninsured motorist demand curve does not shift outward, and the drop in her travel demand will not be eroded subsequently as happens with the uninsured motorist.

The uninsured motorist now pays insurance at the pump costing $ dekg. The transfer to the uninsured motorist is thus eliminated, and the system is more equitable than before. The system is also efficient. The uninsured-motorist's consumer surplus is now cdg -- smaller than before, but the distortion due to resource misallocation is gone.

I.4 Allowing for Transportation Externalities Due to Accidents

The cost of accidents is only partially borne by motorists. Part of the cost of injuries is borne by the victims themselves either because the at-fault motorist is uninsured or because of inability to identify the guilty party, or generally because of the hassle and inconvenience involved in pressing a claim in court, valid as the claim may be. Another part of the cost is borne by entities other than the victim, such as the victim's employer, social security, medical insurance plan, and so on.

The existence of accident externalities means that if we were to use the records of the insurance companies to calculate the marginal exposure risk for good drivers, we would need to adjust our calculation upward to incorporate an appropriate estimate of the accident

externalities. Vickrey, for example, estimated the subsidy to motorists because of accident externalities at $1 to $3 billion per year (during the sixties) (Vickrey, 1969, p. 209).

The existence of accident externalities means also that the extent by which travel demand under the existing regime exceeds the optimal VMT is greater than the amounts depicted in Figures I.1, I.2 and I.3. It also means the magnitude of resource misallocation shown in these diagrams underestimates the full extent of resource misallocation. Clearly, the subsidy received by the uninsured motorist also exceeds the subsidy shown in Figure I.3. (While insured motorists pay partially for accident costs, the uninsured motorist contributes nothing.)

The remedy for the existence of accident externalities is to internalize those externalities. In the context of PAY-AT-THE-PUMP, this means boosting PAY-AT-THE-PUMP's surcharge by an amount that reflects the externality per mile. Travel demand and exposure risk will drop as a result. That should cause the insurance bill to drop some. But the main point is that resource misallocation will now be eliminated.

It is true that if the insurance companies were to tag on an additional lump-sum premium to capture the accident externalities there would have been some drop in travel demand, since the additional lump-sum charge, which is equivalent to a drop in income would have shifted the demand curve to the left. Nonetheless, VMT would still remain above the optimal VMT, and the distortions due to resource misallocation would still exist. Under PAY-AT-THE-PUMP, however, both of these problems would be eliminated: when the marginal cost facing the motorist includes the full marginal exposure risk, travel demand will equal the optimal VMT, and there will be no resource misallocation.

I.5 Dealing with Unequal and Variable Marginal Exposure Risk

In deriving our results about PAY-AT-THE-PUMP's efficiency and equity characteristics, we assumed that the marginal exposure risk is flat for each motorist and that it is equal for all motorists. We now address those two assumptions -- first the assumption of equality of the marginal exposure risk.

i. Assumption of Equal Marginal Exposure Risk

Suppose $\rho_i \neq \rho_j$ (but retain the assumption that the marginal exposure risk is flat for each motorist), and suppose PAY-AT-THE-PUMP's surcharge is set equal to ρ, so that each motorist is now facing MC + ρ, where $\rho_i < \rho < \rho_j$. (We continue to make the assumption that MC is the same for all motorists. Recall this assumption does not affect the generality of our results on efficiency, equity and the absence of cross subsidy under PAY-AT-THE-PUMP.)

For simplicity's sake, assume there are only two motorists, i and j. Given that ρ is not equal to the exact exposure risk of either motorist, neither motorist will be facing the exact signal she should be facing. Thus the VMT of both motorists will be suboptimal: motorist 1 will drive less than her optimal VMT; motorist 2 will drive more than her optimal VMT. As a result, there will be misallocation of resources and cross subsidies among motorists and the

insurer. Depending on exactly where ρ is in relation to ρ_i and ρ_j, the insurer surplus may be negative, zero or positive, so that motorist i may be partially subsidizing motorist j (in which case, the insurer makes up for the rest of the subsidy), or fully subsidizing motorist j while at the same time she may or may not be subsidizing the insurer, as well. However, when ρ_i and ρ_j are different but close to each other, these complications may be relatively minor. The departure from optimality may be small and the resource misallocation and cross-subsidies may be negligible.

Qualitatively, the same will hold when the number of motorists is n instead of just 2, and ρ is some average of all ρ_s, s = 1,2, ..., n.

The question is what is the alternative?

One pricing strategy which would preserve much of PAY-AT-THE-PUMP's efficiency characteristics as when $\rho_k = \rho_l$, $\forall$ k, l, is to set $\rho = \rho_{good}$, where ρ_{good} is the exposure risk of the good drivers in the state. To illustrate from California's scene: good drivers comprise 92 percent of California's (insured) drivers (California Department of Insurance, 1994, p.41). Good drivers are those drivers who had no more than one moving violation within the last three years (excluding driving-under-the-influence, which counts for two moving violations), and who have not been at fault in any injury accident.[5] For all practical purposes, the marginal exposure risk for the good drivers may be taken to be the same, say, ρ.

If we set PAY-AT-THE-PUMP's surcharge at ρ, the marginal cost inclusive of the surcharge facing the typical good driver under PAY-AT-THE-PUMP would be ae as shown in Figure I.4 (next page), and the good driver's travel demand will be the optimal VMT, aj. Thus, for 92 percent of the drivers, there will be no resource misallocation or cross subsidies.

Assume now that the individual represented in the diagram is a bad driver. Her VMT will be aj, the same as for the good driver. But being a bad driver, she gets involved in accidents. Assume PAY-AT-THE-PUMP includes provisions (as most PAY-AT-THE-PUMP proposals do) for charging the bad driver a penalty to compensate the insurer for the extra loss cost incurred on the bad driver. In the diagram, we represent the lump-sum penalty by the rectangle dehf. Had the penalty been made an integral part of the per-mile charge for exposure risk faced by the motorist, the bad driver would have faced ad in the diagram, and driven ai < aj miles. The extra driving by the bad driver (the distance represented by the ij segment in Figure I.4) is what gives rise to the resource misallocation represented by the triangle ghf.

In fact, however, the bad driver will drive less than indicated by Figure I.4. because the lump-sum penalty payment dehf, which is equivalent to an equal drop in the driver's income, causes her demand curve to shift to the left -- to the dashed line in the diagram -- reducing her VMT to aj'. This is a welcome result, in light of the greater exposure risk associated with the bad driver, but the misallocation of resources will still remain. In fact, it can be shown that when the demand curve is linear and when it shifts parallel to itself, the triangle of resource misallocation will be exactly the same as before.

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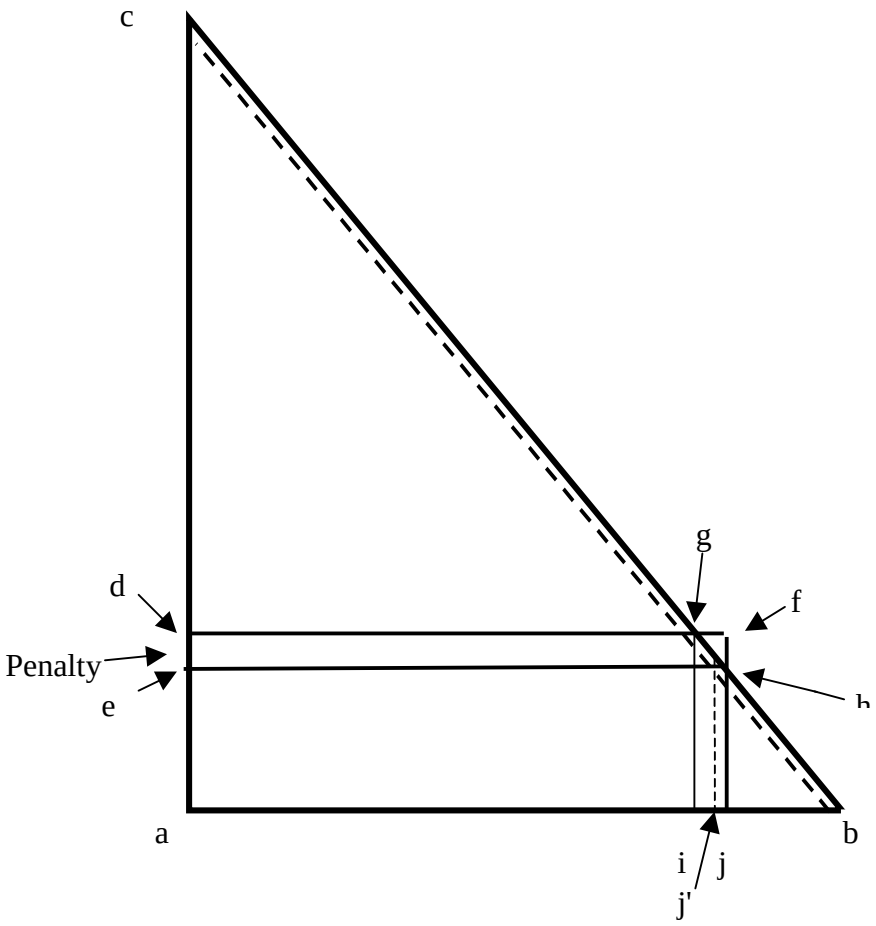
[5] California Regulation of Auto Insurance, section 2632.13.

Figure I.4 PAY-AT-THE-PUMP Pricing with a Penalty Applied Annually to "Unsafe" Motorist



In short, under the proposed strategy for setting PAY-AT-THE-PUMP's surcharge, some suboptimal driving will take place, some resource misallocation will take place, but these will be confined to the bad drivers -- in our example, only 8 percent of the motorists. For 92 percent of the drivers, PAY-AT-THE-PUMP's efficiency and equity (and, of course, the absence of transfers and subsidies) still hold up. Even for the 8 percent bad drivers PAY-AT-THE-PUMP's regime represents an improvement over what it would have been under the existing regime of lump-sum payment for all of the automobile insurance. Under the proposed strategy, part of the driving, possibly most of the driving by the bad drivers is determined at the margin in response to a price signal which includes a ρ component of exposure risk. Furthermore, cross subsidies, which are part of the existing regime of lump-

insurance payment, are not present for the good drivers (who constitute the majority), so the system is more equitable than before.

One more point: Bad drivers may be grouped into more than one category -- as will happen in practice if the proposed strategy is implemented. But qualitatively, the results in the preceding paragraph will remain unaltered.

So far our analysis assumed that the marginal exposure risk is flat for each motorist, and addressed the question of what happens when the marginal risk level varies among motorists. We now turn to the assumption of flat marginal exposure risk.

ii. Assumption of Constant Marginal Exposure Risk

If the marginal exposure risk were not flat it could, in principle, pose problems for the design of PAY-AT-THE-PUMP's surcharge. It might also have consequences for PAY-AT-THE-PUMP's efficiency and equity. However, much depends on the source or the nature of this departure from constancy. If the marginal exposure risk rises, say, linearly with VMT, then setting the surcharge at a constant level would cause VMT to diverge, up or down, from the optimal VMT (depending on where the surcharge is set in relation to the actual level of the marginal exposure risk), and results in resource misallocation. This follows even if the increasing marginal exposure risk rises uniformly for all motorists, so that the equality of ρ_i and ρ_j ,$\forall$ i,j is maintained throughout.

Evidence does not suggest that the marginal exposure risk varies with the distance but that it may vary with the environment, high-density versus low-density areas.

A proposal for dealing with this was made some three decades ago by William Vickrey, and the proposal seems to be as reasonable today as it was then. Vickrey suggested that for driving in uncongested areas where the incidence of accidents does not vary too widely, a gasoline surcharge would be a suitable means for assessing the marginal cost of risk exposure. But for driving in congested areas, "the added incidence of accidents over what is covered by gasoline tax could be added to the congestion costs proper in establishing the level of congestion tolls. . ." that Vickrey advocated (Vickrey, 1969, p. 211). The extra congestion charge levied in order to allow for the marginal exposure risk not covered by PAY-AT-THE-PUMP's surcharge would be channeled to the insurance companies.

It is not clear whether congestion tolls as proposed by Vickrey will ever be implemented. In the meantime, driving in congested areas will be greater than the optimal level, which translates into resource misallocation. The alternative is to raise the surcharge across the board by an amount which would cover, on the average, the extra cost of added incidence of accidents in congested areas. But it is not clear that the resulting resource misallocation will necessarily be smaller than the misallocation that prevails in the absence of this added adjustment. Much depends on the extent to which driving in congested areas exceeds the optimal driving for those areas.

A better strategy is to make greater use of the existing institutions in order to charge motorists for the full marginal exposure risk of driving in congested areas -- e.g. by raising the parking fee in congested areas by an amount that reflects the cost of the added incidence of

accidents in congested areas. The idea can be extended to highway tolls during congestion hours. That still leaves out congested stretches of highways that have no existing toll system on which to piggyback the added marginal cost of accidents. It also leaves out motorists who choose to drive through congested areas, but without parking in those areas.

II. The Role of Vehicle Fuel Efficiency

So far we have abstracted from vehicle fuel efficiency and conducted the analysis as if PAY-AT-THE-PUMP insurance were in fact VMT insurance -- i.e., insurance based on miles traveled. We now have to address the problem posed by fuel efficiency, which provides the link between VMT insurance and PAY-AT-THE-PUMP insurance.

But first, why switch from VMT insurance to insurance per gallon? There are two reasons.

One is that PAY-AT-THE PUMP insurance has advantages VMT insurance does not have:

- PAY-AT-THE-PUMP removes the uninsured motorists from the road. VMT insurance does not. Motorists who chose to drive uninsured under the current regime may choose to continue to do so under VMT insurance. Aside from the fact that this leaves unattended the human aspect of this problem (see section V below), this means that the reduction in insurance cost and other costs associated with the elimination of the uninsured motorist problem (such as uninsured motorist premium, enforcement cost, etc.) will not occur under VMT insurance.

- VMT insurance does not encourage the switch to more fuel-efficient vehicles. PAY-AT-THE-PUMP does, although its ability to do so at present is limited (see the discussion below). This means also that the environmental, balance-of-payments and security benefits of VMT insurance are likely to be smaller than PAY-AT-THE-PUMP's, particularly if the response of *ex post* demand for fuel efficiency to gasoline price turns out to be larger than we anticipate. The environmental, balance-of-payment and security benefits of VMT insurance will be confined to the contribution that the reduction in travel demand can make to the environment, balance of payment and security. PAY-AT-THE-PUMP's contribution will have that, plus the beneficial effects of the reduction in gasoline demand due to the switch to more fuel-efficient vehicles, (if the switch to more fuel efficient vehicles does take place).

The second reason for the switch from VMT insurance to PAY-AT-THE-PUMP insurance is that VMT insurance has implementation problems that PAY-AT-THE-PUMP does not have. The most evident of these is tampering with odometers and the enforcement cost required to combat it. It is also not clear that the annual or semi-annual payment of the insurance premium under VMT insurance will have the same restraining effect on travel

demand as the constant reminder of the need to economize on vehicle use every time the motorist pays for fuel under PAY-AT-THE-PUMP.

But while PAY-AT-THE-PUMP enjoys those advantages, the switch from a surcharge per mile to a surcharge per gallon poses a problem to the design of a surcharge per gallon that reflects accurately the motorist's marginal exposure risk. The problem is caused by vehicle fuel efficiency, and it occurs at two stages in PAY-AT-THE-PUMP's implementation: (a) at the stage when PAY-AT-THE-PUMP is initiated, and (b) in the years following the implementation of PAY-AT-THE-PUMP. Let me amplify.

(a) The fact that there are differences in vehicle fuel efficiency at the time of PAY-AT-THE-PUMP's initiation means that for a good motorist who happens to own a very efficient (or a very inefficient vehicle), there will be a discrepancy between the surcharge the motorist pays on the one hand and the motorist's marginal exposure risk, on the other.

To illustrate, suppose the marginal exposure risk for the good motorist is 2c/mile. Suppose that PAY-AT-THE-PUMP's surcharge was set at 50c/gallon. If the fuel efficiency of the good motorist's vehicle is 25 miles/gallon, the good motorist would be paying in effect 2c/mile, which is exactly equal to her marginal exposure risk. But if her vehicle's fuel efficiency is, say, 27.5 miles/gallon, then she would be paying only 1.82c/mile, which is less than her marginal exposure risk. Conversely, if her vehicle fuel efficiency is 22.5 gallons, she would be paying 2.22c/mile.

In summary, high vehicle fuel efficiency means the owner of the more fuel-efficient vehicle pays less than her marginal exposure risk, and will therefore drive more than is warranted optimally. The opposite is true when the vehicle fuel efficiency is low.

(b) Over time, the increase in gasoline price induced by PAY-AT-THE-PUMP's surcharge prompts a switch to more fuel-efficient vehicles in two ways. (1) It encourages individuals with more than one vehicle to drive the more fuel-efficient vehicle relatively more than the less fuel-efficient vehicle. (2) It increases the demand for new fuel-efficient vehicles. Individuals who planned to replace their vehicles with newer ones will now have an incentive to buy the more fuel-efficient new vehicles. Additionally, individuals who did not plan on replacing their vehicles will have now an incentive to advance their replacement time, and purchase fuel-efficient new vehicles.

As a whole, the effect of increased fuel efficiency over time is to erode the surcharge for the marginal exposure risk and encourage driving in excess of the optimal level. This has adverse implications for the efficiency of resource allocation. (Note in passing, enhanced fuel efficiency encourages additional driving due to the drop in the marginal cost of driving, which moves the optimal VMT to the right. But that increase in VMT does not cause distortions.) It also poses a problem to the financial integrity of the system.

On the other hand, PAY-AT-THE-PUMP's stimulating effect on the demand for fuel efficient vehicles over time may have a salutary effect, in the sense that it may reduce the disparity in the distribution of vehicle fuel efficiency in the fleet of vehicles. It is possible that the stimulus to switch to more fuel-efficient vehicles will be greater among motorists with very inefficient vehicles than with motorists with efficient vehicles, simply because the

former have more to gain from the switch to a fuel-efficient vehicle than the latter. If this does happen, the resulting greater uniformity in the distribution of fuel efficiency would mean that a higher PAY-AT-THE-PUMP surcharge (intended to counter the eroding effect of enhanced fuel efficiency) will equal the marginal exposure risk of a greater percentage of the motorists than before.

Unfortunately, it is not very likely that this happy evolution will take place, simply because it is not likely that PAY-AT-THE-PUMP will result in a substantial switch toward more fuel efficient-vehicles -- at least not if PAY-AT-THE-PUMP were to be put into effect today. There are two reasons for that:

(1) As some researchers have found, the substitution of vehicles by households (that own more than one vehicle) when gasoline price rises is likely to be small. For example, Krupnick et al who studied the impact of an increase in the Federal gasoline tax found that while the total miles traveled dropped by 1.87 percent, the total gasoline consumption by households dropped by just about the same amount: 1.89 percent (Krupnick et al., 1993, p.3). If vehicle substitution were extensive, the drop in gasoline consumption would have been much greater than the drop in miles traveled.

(2) The sale of new fuel-efficient vehicles is not likely to increase substantially in response to the increase in gasoline price prompted by PAY-AT-THE-PUMP. Elsewhere I elaborated on this point (see Khazzoom, 1997). But for the sake of completeness, I lay out here the main points behind this result.

Over the last few years, several surveys of the available estimates of the elasticities of demand for fuel efficiency, travel and gasoline with respect to gasoline price were published. The most exhaustive of these are Dahl (1986) and Dahl (1994). A main finding is that the elasticity estimates reported by the more recent studies tend to be much lower than those estimated earlier. For the demand for fuel-efficiency, Dahl reports average estimated elasticities with respect to gasoline price that range between .10 and .12 for the short run (with standard error as large as or larger than the average estimate) and estimates of .08 to .21 for the long run (Dahl, 1994, Table 6).

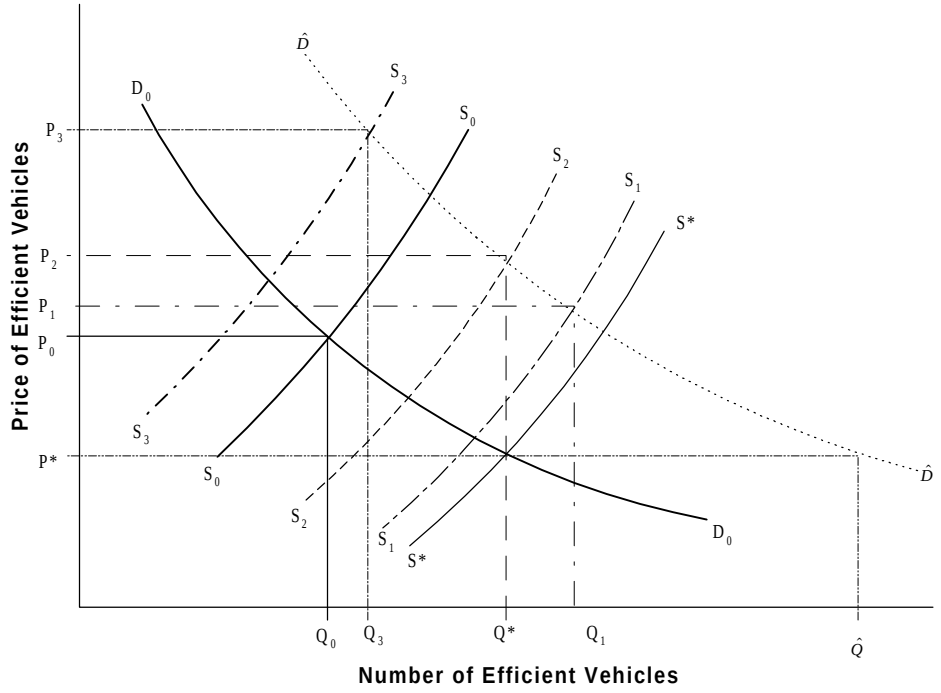
These estimates suggest the true elasticity of the demand for fuel efficiency with respect to gasoline price is small. In fact, the true price elasticity is likely to be even smaller than these small estimates suggest. Some recent studies even suggested it might be negative (Dahl 1994, Table 6). There are two reasons for this:

A) CAFE standards have been binding for some time (for a discussion see Greene, 1990). Yet, none of the available studies incorporate this constraint in their econometric estimation. Consequently, their results overstate the impact of gasoline price on the demand for fuel-efficient vehicles. Figure II.1 (next page) illustrates how CAFÉ standards, when binding, erode (and may even pervert) the effect of gasoline price on the demand for more fuel-efficient vehicles.

Figure II.1 plots the demand and supply for fuel-efficient vehicles against the price of these vehicles. For simplicity's sake, we assume there is only one level of efficient vehicles, say, 30 MPG and only one level of inefficient vehicles, say, 20 MPG.

At P_0, the demand for efficient vehicles is Q_0. But suppose that in order to meet CAFE's standards, the manufacturer needs to sell Q* units of efficient vehicles. Assume further the manufacturer finds it more profitable to adopt promotional pricing strategies (e.g. discounts) to stimulate the demand for efficient vehicles and meet CAFE's standards, than to pay the penalty for failing to meet the standards. In that case, the manufacturer's strategy can be represented by a shift of the supply curve to the right, from S_0S_0 to S*S*, which results in the equilibrium pair (P*,Q*). This pricing strategy will generally translate to a lower profit margin on the sale of efficient vehicles (and most likely a higher profit margin on the sale of inefficient vehicles).

Figure II.1 An Illustration of the Impact of Gasoline Price on the Demand for Fuel-Efficient Vehicles when CAFE Standards are Binding.



When PAY-AT-THE-PUMP is installed gasoline price goes up. This leads to a drop in the total demand for automobiles. But, *ex ante,* it will also lead to an increase in the demand for fuel-efficient vehicles. D_0D_0 will shift upward to $\hat{D}\ \hat{D}$. At P*, the new demand for efficient vehicles, $\hat{Q}$, exceeds Q* substantially. But the producer is not likely to be eager to sell more fuel-efficient cars than she actually has to at the low (or depressed)

profit margin built into P*. Even at the higher price determined at the intersection of the new demand curve $\hat{D}\,\hat{D}$ with S*S*, the demand for efficient vehicles exceeds Q*, which is the output of fuel-efficient vehicles the manufacturer needed to sell (prior to the increase in gasoline price) in order to meet CAFE's standards. The manufacturer can now cut back on the extent of her promotional activity, and move the supply curve to S_1S_1. This results in a price P_1 that is higher than the old price P*. The sale of efficient vehicles, Q_1, is still greater than Q*, but not by as much as it would have been had S*S* remained unchanged.

But S*S* can actually shift as far back as S_2S_2 , with a resulting equilibrium pair (P_2,Q*), without reducing the sale of efficient vehicles below Q*. In fact, because the total automobile sale is lower now than before (due to the higher gasoline price), the manufacturer can meet CAFE's standards with an even smaller volume of sale of fuel-efficient vehicles than before. If profit optimality warrants it, the manufacturer may choose, for example, to shift the supply curve to S_3S_3 , where the sale of efficient vehicles is now $Q_3 < Q^*$. At the corresponding price P_3, the household is paying a higher price for the fuel-efficient vehicles than P*. *Ex post* demand for fuel-efficient vehicles is now less than before, even though gasoline price went up in the meantime.[6] The depressing effect of the higher price of fuel-efficient vehicles has more than offset the saving achieved by the purchase of the more fuel-efficient vehicles.

This can change with time if real gasoline price increases substantially, in which case the price elasticity of the demand for fuel-efficient vehicles may very well go up again. But it will remain so, so long as the Congress does not act to lower CAFE's standards substantially and so long as real gasoline price in the future will not exceed substantially its present level. The latter is unlikely to happen for some time to come, given that the market may have to absorb additional supplies of oil from Iraq and possibly Iran, as well. If these supplies materialize, they are likely to exert a downward pressure on gasoline price and aggravate further the hold that CAFE's binding standards have over the impact of gasoline price on the demand for fuel-efficient vehicles.

B) The implementation of PAY-AT-THE-PUMP triggers an income effect that is unique to PAY-AT-THE-PUMP, and which does not occur when the increase in gasoline price is induced by, say, a fuel tax. PAY-AT-THE-PUMP's surcharge is associated with the elimination of the insured's lump sum insurance payment, which is equivalent to a lump sum increase in the insured's disposable income. The effect (of this increase in income) is to reduce the sting of the higher gasoline price associated with PAY-AT-THE-PUMP and mute the incentive to compensate for the higher price by the purchase of more fuel-efficient vehicles. We do not have direct estimates of the impact of this income- feedback factor on the demand for fuel-efficient vehicles. But in the case of travel demand in California, for example, preliminary estimates of the Personal Vehicle Model of the California Energy Commission show the income feedback effect erodes approximately a third of the drop in

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[6] Note this result follows so long as higher gasoline price causes the total demand for cars to drop even if it turns out, in the end, that the proportion of fuel-efficient vehicles in the total ends up being the same as before.

travel demand that would have resulted from a comparable increase in gasoline price induced by a gasoline tax.

Where does that leave us? We start with a disparity in the level of vehicle fuel efficiency, which is not likely to be substantially reduced by the switch to fuel efficient vehicles over time, at least if PAY-AT-THE-PUMP were to be implemented today and if PAY-AT-THE-PUMP's surcharge is not very large. Hence, there will be a discrepancy between the exact marginal exposure risk and the actual level of surcharge per mile.

Yet in spite of this discrepancy, the system retains the fundamental advantage it has over the current regime -- travel demand is determined at the margin, although not by exactly the marginal exposure risk, and (given the car fuel efficiency) the payment for insurance varies with the distance traveled (and hence with exposure risk).

PART TWO: MANDATED AUTO INSURANCE VERSUS PAY-AT-THE-PUMP

III. Mandating Auto Insurance as a Way of Eliminating the Uninsured-Motorists Problem

In this and the following section I will take a tack not taken by others. I would like to start out with mandatory auto insurance, which has the common mission with PAY-AT-THE-PUMP insurance of getting the uninsured motorists off the road. I would like to go briefly over the insurance industry's criticism of mandatory insurance and use this criticism as a frame of reference or as a lens through which we can view PAY-AT-THE-PUMP, and ask: How does it fare by comparison?

But first brief discussions of the emergence of mandatory auto insurance.

III.1 Historical Background

During the early years of the advent of the automobile, uninsured motorists did not pose a major problem. Typically, car owners were affluent individuals who had the means to pay for damages resulting from accidents found to be their fault. But as car ownership spread to individuals who had little or no property that could be used to pay for damages they caused to others, mandatory insurance emerged as one solution to the problem.

Beginning with the second decade of the century compulsory insurance bills were introduced in several state legislatures. In 1927 Massachusetts became the first state to put into effect a compulsory bodily injury law, making the purchase of insurance a prerequisite to motor vehicle registration. In 1957 New York became the second state to enact compulsory auto insurance laws. North Carolina followed suit in 1958.[7] In the meantime, most other states took the financial-responsibility route -- i.e. requiring the driver to show proof of ability to pay for third-party losses caused by the driver or for major traffic violations committed by the driver, such as drunk-driving or hit-and-run driving. The proof of financial responsibility could be

[7] For a brief history of compulsory insurance in the US and Europe, see Hashmi (1965), pp. 1 ff. See also Insurance Service Office, Inc. (1992).

demonstrated by purchasing a liability insurance policy that met a certain minimum coverage; by posting a bond for a specified amount (which was generally the same amount stipulated for the liability insurance coverage); or by depositing cash or securities in the same amount.

All along, the insurance industry opposed the enactment of compulsory auto insurance laws, favoring financial-responsibility laws. One important reason behind the industry's opposition to compulsory insurance is the industry's fear that sooner or later following the enactment of compulsory insurance, state governments might take over the insurance business.[8] Government takeover never came to pass with the enactment of mandatory auto insurance. But the argument resonates to-day in the industry's opposition to another new idea -- PAY-AT-THE-PUMP (see, for example, American Legislative Exchange Council, 1995a, 1995b; American Insurance Association, 1995, p. 2).

Despite earlier success in retarding the adoption of compulsory insurance, the insurance industry has been ultimately unsuccessful, for the most part, in defeating the enactment of such laws. At present, liability insurance is mandatory in 44 states and DC. The remaining six states (Alabama, Mississippi, New Hampshire, Tennessee, Virginia, and Wisconsin) have financial responsibility laws (see American Insurance Association, 1997).

State compulsory insurance laws vary in the specifics as they do in the enforcement methods. Some states require self-certification (the motorist certifies in writing at the time of the registration that she carries liability insurance). Others require evidence of insurance to be carried permanently in the vehicle and to be shown to the police officer whenever an officer stops the motorist. Some require evidence of insurance to be submitted to the DMV at the time of the registration, as a condition for registration renewal. Some require evidence of insurance to be submitted prior to the issuance of a driver's license, as in the case of minors in North Carolina. Some do random checks on insurance by sending out insurance status inquiries to insurance companies and automobile owners chosen at random. Some require the insurance companies to submit to DMV, within a specified time, termination and renewal notices whenever a policy lapses, is canceled or renewed. More recently some states have turned to database matching. But this seems to be meeting intensive opposition from the insurance industry in some states, as for example, in Utah (see Hunter, 1997, p.5).

There is also a great deal of diversity among states in the vigor with which suspected violators are pursued.[9] In some states the law may not have real teeth in it, and the follow up

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[8] Hashmi cites a quote from an address by the General Manager of the Association of Casualty and Surety Companies presenting the industry's view: " ' I am most sure most of you must fear, as I do, that if the present crusade to enact more compulsory automobile insurance laws succeeds, automobile liability insurance may well be written by the states instead of the free enterprise insurance companies. When a substantial number of states have placed statutes upon their books which say to every motorist that they must carry insurance, it won't be long before the people reply: All right, but you write it for us at cost.' " (Hashmi, 1968, p. 27).

[9] For a general discussion of the compulsory insurance laws and their enforcement in various states, see National Association of Insurance Commissioners (1989a), p. 164 ff., and Fannie Weinstein (1991).

For a summary of the insurance requirements and enforcement procedures, a listing of the agencies responsible for administering the compulsory laws, as well as the types of exempt vehicles, etc. in the US and Canada, see NHTSA (1990), section I. See also Attachment I "Summary of Uninsured Motorists/Compulsory Auto Liability

may be done almost perfunctorily. In Utah, for example, when database matching reveals a discrepancy, the state sends a notice to the motorist asking her to correct the problem or to explain the reason why the problem exists. If the motorist does not respond within a specified time, the state follows up with a second notice, this time a sterner one, reminding the motorist that she is in violation of the law and urging her to take the necessary steps to correct the situation. If the motorist chooses to ignore the second notice, that ends the story. The state takes no further steps.

Similarly, in New Mexico, vehicles of convicted uninsured drivers are towed away. But the state does not require the owners to show evidence of insurance before releasing their cars back to them. To get her car back, the only thing the owner needs to do is to pay the towing fees (Insurance Information Institute, 1997, p.4).

Other states, however, follow up more vigorously when non-compliance is suspected. The prime example is North Carolina, a state with strict enforcement and proactive procedures for search and confiscation of license plates from uninsured vehicles. When an insurer notifies DMV of a termination of coverage, DMV contacts the motorist by mail and provides a form on which she must supply information about new coverage. If the motorist's report shows there was a lapse, she must remit $50. If she does not respond within 10 days, a second notice is sent out by the DMV asking her to either respond within 10 days or forfeit the license plate. If she does not respond, an officer is sent to retrieve the license plates. Once the plates are retrieved, the motorist must park the vehicle without tags for thirty days, pay a $50 fine, $50 restoration fee and purchase new plates for an additional $20. For those who manage to evade this system, the law stipulates tough punishment. An uninsured motorist involved in an accident due to her fault loses her driving privilege for 10 years. She can make amends by arranging to refund the insurer for the whole cost of the damage and by showing evidence of insurance and paying the fine. That will still not entitle her to drive until she pays an additional fine and serves an additional waiting period, if she has been found to ignore a second DMV notice to surrender her plates.[10]

III.2 Insurance Industry's Arguments against Mandatory Auto Insurance

The argument made by the insurance industry in opposition to mandated auto insurance revolves primarily around five points:

1. Feasibility of removing the uninsured motorists from the road.

2. Administrative and enforcement costs for the insurers and for the state.

Report," in National Association of Insurance Commissioners (1989b), and "Enforcement of Compulsory Auto Liability Insurance Laws as of July 1997" in Insurance Information Institute (1997). For detailed tabulations of auto insurance laws by state, see American Insurance Association (1997).

[10] Discussion with Nitsi Powell and Betsy Privet of North Carolina's DMI. Tel (919) 733-2403.

3. Adverse effect on the insurance cost of the priors, i.e. motorists who maintained insurance.
4. Adverse effect on highway safety.
5. Hardship for low-wealth uninsured motorists.

As we noted earlier, for several decades since the idea of compulsory auto insurance laws was proposed in this country, the industry opposed these laws on one more ground -- takeover by the state. We no longer hear this argument in connection with compulsory insurance, but we hear echoes of the same argument in the industry's opposition to PAY-AT-THE-PUMP insurance.

Following a brief elaboration on the five points above, we ask the question: How does PAY-AT-THE-PUMP, as a medium for universal insurance, measure up in light of the problems encountered by mandatory insurance laws?

i. Feasibility of Removing the Uninsured Motorists from the Road

The industry argues that mandatory insurance laws cannot be enforced well enough to remove the uninsured motorists from the roads, partly because of the nature of liability insurance and partly because of the nature of the group that makes up a substantial fraction of the uninsured motorists (State Farm, 1997, p.2). Liability insurance protects the policyholder's assets and income, if she is at fault in an accident. Motorists who have no assets or little or no income to protect have no incentive (at least no economic incentive) to incur the expense of buying insurance. Even when they are convicted of violating the insurance laws, they usually face little risk. Legislators and (overloaded) courts tend to be generally lenient with those who "did nothing worse than refuse to buy insurance" (State Farm, 1997, p. 3).

Moreover, drivers determined to evade the law can usually find ways for doing so. The revolving-door practice (sometimes referred to as insurance dodging) is not uncommon: a motorist gets insurance coverage to fulfill the requirement for registering or re-reregistering the vehicle, but once the vehicle has been registered, the motorist drops out of the insurance system either by canceling the policy or by failing to pay the balance of the premium. Tuma (1993) reports that a 1992 State Farm study of new policyholders found that the no-priors -- i.e., those who were previously uninsured -- canceled their policies more than three times as frequently as the priors -- i.e., those who previously maintained insurance: 42 percent for the no-priors, as opposed to 13 percent for the priors (see also Wirth, 1991). The pronounced tendency of the no-priors for lapse-and-reinstate based on the no-priors' need for license plates or driver's license has been reported by other insurance companies, as well.

Critics point to other stumbling blocks that make it nearly impossible for mandatory auto insurance to reach every motorist. These include cases such as:

1. The driver has no license or vehicle registration (or both). This deprives the state of the two main entry points -- i.e. the time of vehicle re-registration and the time of license renewal -- at which it can intercept drivers and check on their compliance with mandatory insurance. Drivers in this category include, among others, uninsured motorists whose licenses have been suspended (Myers, 1993).
2. The driver is a newly arrived resident whose automobile is still registered in another state which does not have compulsory insurance and/or who still uses an out-of-state driver's license.
3. The driver is a resident of another state where auto insurance is not mandatory.
4. The driver operates a stolen vehicle.

In addition, even if mandatory laws were successful in getting everyone to be insured, some accident victims injured by insured drivers in compulsory states would be unable to collect damages from the injuring party, as in the case of hit-and-run accidents (All Industry Research Advisory Council, 1989, p. 33; National Association of Insurance Commissioners, 1989b, p.1).

Opponents of mandatory laws argue the most damning evidence that compulsory insurance fails in its mission of getting the uninsured motorists off the road is that all states with compulsory insurance laws require insurers to offer uninsured-motorist coverage. Some do not give the motorist the choice of waiving the offer (State Farm, 1997, p. 2).

ii. Administrative and Enforcement Costs for Insurers and for the State

Insurers incur up-front administrative expenses when they issue new policies. But when the policyholder cancels early, the insurer must refund the unearned premium. This means the insurer is exposed to up-front costs, but does not get the full premium to cover these costs. The same thing happens when the policyholder fails to pay the premium balance.

Additionally, states with compulsory insurance laws generally require the insurer to notify the regulatory authorities whenever policyholders terminate their coverage, fail to pay the premium balance on an existing policy or fail to renew the policy. This requirement is a component of most mandatory systems. But it adds expenses to the insurers' costs.

Also, enforcement generally requires the state to follow up -- possibly track down and penalize the violator, once the regulatory agency has been notified by the insurer of a lapse or termination. This is a costly aspect of mandatory insurance, both for the state, as well as the public. Often it is made more burdensome by new problems that mandatory insurance spawns. For example, not long after a Texas law requiring proof of liability insurance before registering a car went into effect, a market for fraudulent identification cards emerged. State law enforcement agencies were faced also with a rash of stolen license plates and stickers. (The Austin Press reported that a man had his plates stolen so many times that he started

taking in his license plates at night.[11] (Johnson, 1991).) To deal with these problems the state needs to dedicate resources to law enforcement. To illustrate the magnitudes involved: in the first nine months of 1966, the state of New York ordered 110,521 drivers to turn in their plates because they failed to comply with the state's mandatory auto insurance law. Of those, only 12,134 (11.0 percent) complied voluntarily. That left 98,387 individuals to be tracked down for non-compliance. The police were successful ultimately in tracking down 269 and picking up their plates. That left 98,118 motorists (88.8 percent) of the original list still at large (Presnal, 1977, p. 4).

Even a major investment in enforcement effort may not be able to eliminate the problem of uninsured motorists. North Carolina, which devotes extensive resources to the enforcement of mandatory insurance laws, has been successful in keeping the number of uninsured down to 3-5 percent, but it has not been able to eradicate it.

iii. Adverse Effect on the Insurance Cost of Priors

Insurance companies point out that both the frequency and severity of losses they incur insuring the no-priors tend to be much greater than for the priors. See, for example, the testimony of Charles Wirth on behalf of State Farm in hearings on the implementation of a uniform insurance premium in Texas (Wirth, 1991, pp. 3-4), and the Table at the end of the testimony, titled "Bodily Injury and Property Damage"; see also Cleveland, 1991, p. 1. Allstate Insurance reported a similar experience. Allstate stated also that based on its experience in Maryland, Virginia and Ohio it expected to pay $1.60 in losses for every dollar of premium it received from the no-priors at the average premium rate (see Kron, 1991, and attachment).

The industry argues that the increased loss cost and subsidy that result from insuring the no-priors together with the increased administrative and enforcement cost incurred by the insurance companies (as discussed in the preceding section) affect the rating structure adversely, and result in an overall rate rise for everyone, including those who maintained insurance before.

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[11] Similarly, some people began to make slits near the validation part of the sticker so that the people who try to peel off the sticker would not be able to get the whole sticker. But while that will frustrate the thief, it will not quite protect the policyholder since she would have to replace (for a fee) the sticker that was tampered with.

In Virginia, the state has devised a sticker that crumbles when one tries to peel it off. (From a conversation with Rebecca Nichols, Virginia State Corporation Commission. Tel (804) 371-9331.) Again, this frustrates the thief but it does not protect the innocent. Car owners were advised to park their cars backed up to a building so that the thief would not be able to slip easily behind and remove the plates or peel off the renewal sticker. Nowadays, Texas has a large sticker color-coded by year and month of expiration placed inside on the left-hand side of the windshield, instead of the rear end on the license plate. It is so designed that if someone tries to peel it off from the inside, the top layer stays on the windshield and the layer that peels off reads Void. (From a phone conversation with Bennett Younger, of the Texas Department of Insurance, Tel (512) 463-6575.) Under the new arrangement, the driver is given a greater protection against theft, but the task of the highway patrol is made harder, since it is easier to identify from the distance invalid stickers stuck on the rear plate than on the windshield. (An earlier proposal by Delaware for a similar sticker concept, that would have placed the sticker inside the rear left window to make it visible from behind the vehicles never made it through the legislature.) The point is that some of the problems spawned by enforcement can be overcome, but the solutions may be costly, may take time to find, and may still not be foolproof.

iv. Adverse Effect on Highway Safety

For some time since the idea of adopting mandatory insurance laws in the US was proposed, the insurance industry opposed the enactment of such laws on the ground that they affect highway safety adversely. The premise is that the enactment of such laws fosters the development of a carefree attitude among drivers, which translates into increased accidents and death on the highways. In the late sixties, Hashmi investigated the accident and the death rate in the three states that were the first to enact compulsory insurance laws -- namely, Massachusetts, New York and North Carolina. His findings did not support the industry's claim that compulsory insurance reduces highway safety. He noted that, on the contrary, one of the three states, Massachusetts, has won several awards for highway safety (Hashmi, 1968, pp. 6-8).

The industry continues to-day to make safety arguments, except that they are now directed against the more recent newcomer -- PAY-AT-THE-PUMP insurance. I will address these in a later section.

v. Hardship for Low-Wealth Uninsured Motorists

Mandatory insurance laws force low-income drivers to devote a large share of their household budget to pay for automobile insurance, thus restricting their access to food and other basic necessities. The National Association of Independent Insurers commissioned a study to investigate the impact of Arizona's mandatory auto insurance laws on a random sample of low-income families drawn from Maricopa County. Many individuals included in the sample reported that they had to postpone paying for health services, housing, and food in order to pay the insurance premium. The study found that the poorest members of his sample paid an average of 32 percent of their annual household income in order to have their vehicles insured (Maril, 1994, p. 1). This compares with a national average of about 2 percent (Bureau of Labor Statistics, 1995, Tables 1, 2). The next poorest group in the sample paid 14 percent of their annual income. The rest of the sample who earned appreciably more when compared to the poorest group of the sample paid 7 percent of their annual income for car insurance -- still over three times the national average (Maril, 1994, p.1).

vi. Conclusion

While some of the arguments the industry made against the existing regime, notably government takeover and highway safety were not borne out, the rest of the arguments against the existing regime of mandatory insurance are compelling. The question is: How does PAY-AT-THE-PUMP as a method of getting the uninsured motorists off the highway measure up by comparison?

IV. How Does PAY-AT-THE-PUMP as a Medium for Universal Coverage Measure up in Light of the Problems Encountered by Mandated Auto Insurance?

IV.1 Removing Uninsured Motorists from the Road

PAY-AT-THE-PUMP as an alternative[12] for getting all drivers to be insured is free of almost all of the problems that beset mandatory insurance. At the same time, it does achieve universal coverage, which compulsory auto insurance does not. Universal coverage is not only feasible under PAY-AT-THE-PUMP; it is the only possible outcome under PAY-AT-THE-PUMP. If you want to drive, there is no escape from paying the insurance. No trick will do -- no lapse-and-reinstate, no stealing of registration plates, no peeling off of renewal stickers of other motorists, and no fraudulent identification card. You cannot evade the insurance by driving without a license or without a car registration. It makes no difference that you are a newly-arrived resident whose automobile is still registered in another state. You cannot escape it even though you are an out-of-state resident. And you cannot evade it even if you drive a stolen vehicle. Just as nothing can change the immutable fact that the car cannot move if it does not have fuel, nothing can change the immutable fact that the car will not move unless it carries liability insurance. Under PAY-AT-THE-PUMP, fuel and insurance are inputs with zero rate of substitution in the production of driving services. Both are equally the lifeblood of driving.

Pedestrians, peddlers, cyclists and other non-car owners who cannot collect for damage to-day when they become victims of uninsured motorists, will collect under PAY-AT-THE-PUMP. Victims of hit-and-run will collect.

No need any more for enacting No-pay-no-play laws to shore up the coverage of mandatory laws.

IV.2 Enforcement Made Unnecessary; Cost Reduced

No need for regulatory agency staff to draft letters and send notices to 110,521 drivers to surrender their plates. No need for a police force to track down 98,387 drivers who choose to ignore the order. No need for jamming further an already crowded court system. The

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[12] Another proposal that is being discussed in some publications under the heading "Alternative to Compulsory Insurance" is the No-pay-no-play concept (see, for example, State Farm Insurance, 1997, p. 3). The idea is to limit the right of the uninsured motorist to collect losses from an insured at-fault motorist -- primarily, by prohibiting the uninsured motorist from bringing lawsuits for non-economic damages, such as pain and suffering. Strictly speaking, No-pay-no-play is a supplement, not an alternative, to mandatory insurance. It does not replace mandatory laws. Its main purpose is to shore up these laws by persuading motorists, through penalty, to comply with these laws. It does have a beneficial side effect -- namely, it lowers the liability premium for those who maintained insurance before, since it eliminates the exposure to claims for pain and suffering from the uninsured.

So far, Michigan, California, Louisiana and New Jersey have enacted (various versions) of No-pay-no-play laws. The Legislature in several other states is presently considering similar measures (Insurance Information Institute, 1997, p.2). For an analysis of the proposal, see O'Connell (1995), Part I. O'Connell proposes to disallow the uninsured motorist, as well as her dependent family members from tort claims for pain and suffering.

saving to the state coffers and the saving of time, money and aggravation to the citizen every time she has to shuttle to DMV to replace a stolen plate or a mutilated sticker would be welcomed by all.

Insured car owners will no longer pay an additional premium for uninsured motorists (UM), as they do presently in states that have mandatory insurance laws (and in other states, as well). Many will additionally save themselves the hidden extra costs they incur currently for insuring against UM. These additional costs are included in their premium for collision and personal-injury insurance to cover the revenue shortfall, which the insurance companies sustain on UM premium.[13]

We note in passing that the current system of uninsured-motorists coverage, which the insurance companies designed and promoted as the preferred way of dealing with the uninsured-motorists problem, is inherently inequitable. As pointed out in section I.3, under the current system of financing the uninsured-motorists coverage, those who buy insurance subsidize those who do not. They pay for damages inflicted on them by at-fault motorists who drive illegally, when under the tort system the presumption is that those responsible for damages, not the victims, should pay for those damages. PAY-AT-THE-PUMP does away with this inequity and with the "free rider" problem built into the uninsured-motorists coverage.

Similarly, under PAY-AT-THE-PUMP insurance companies no longer need to incur the administrative and enforcement expense they are saddled with under mandatory insurance laws, and policyholders would be spared the higher rates they presently have to pay to cover these extra costs.

IV.3 Improved Welfare of Low-Wealth Individuals

Low-wealth groups are not likely to suffer as big a financial sacrifice as they do under the current regime, where the premium is decoupled from the intensity of car use. Under PAY-AT-THE-PUMP, low wealth individuals need not pay all $1,000 or maybe even more[14]

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[13] For example, Smith and Randall (1992), p. 759 point out that in Philadelphia, each $1 of UM premium results in $1.33 of losses. The insurer must cover the $0.33 loss from other parts of the policy in order for the entire insurance package to be actuarially fair. Since in many states UM coverage applies only to bodily injury, the damage to one's car is covered by collision insurance. Hence, the presence of uninsured motorists must increase the collision premium. This is so because if an uninsured motorist hits the car of a policyholder, the insurance company will pay the policyholder for the damage but, in general, the company cannot then collect from the party at fault. Similarly, the presence of uninsured motorists must increase the premium for medical coverage. This is so because if an uninsured motorist injures a policyholder and her medical outlay exceeds her UM coverage, her medical coverage is then used to defray the extra costs. See also Marowitz (1991), p. I.

Part of the reason why the revenue shortfall exists in the UM category is apparently political: Regulators are generally reluctant to allow insurance companies to recover the full cost of insuring against uninsured motorists. To be actuarially fair, insurers are forced to spread the shortfall over other categories. (From a discussion with Mike Miller of Miller, Rapp, Herbers and Terry; 2817 Reed Rd; Suite 2; Bloomington, Ill 61704; Tel 309-662-0102.)

[14] Many of the poor live in urban areas where the insurance premium is typically higher than in suburban or rural areas. In Los Angeles, for example, many poor people face liability insurance premiums in the range of $1000. to $ 1500. for the minimum required protection.

to be insured, but can tailor their insurance outlay to suit their ability to pay. It is no longer an either-or proposition -- either you pay the full fixed premium or else you do without insurance. The poor can pay for their insurance in affordable increments at the pump. By choosing how much driving to do, low-wealth individuals will have a say in how much to pay for auto insurance. They still have a difficult choice to make between paying for the insurance and driving, on the one hand, and paying for the other necessities, on the other. But the choice is not as stark, as black and white as before. There is now a range of car-use intensity from which to choose. In short, the choice set is bigger than before, and a fortiori the welfare level of the low-wealth individual must be at least as high as, but more likely higher than under mandatory insurance laws. It is also of more than passing interest to note that several low-income and minority organizations in California were and still are among PAY-AT-THE-PUMP's strongest supporters.

IV.4 Enhanced Highway Safety

There is nothing inherent in PAY-AT-THE-PUMP that should lead us to expect it to affect safety adversely. In fact, PAY-AT-THE-PUMP is most likely to result in enhanced safety compared to the current regime. Perhaps it is best to broach the subject by starting with the industry's criticism of PAY-AT-THE-PUMP's safety aspects.

The industry argued that, on three grounds, the implementation of PAY-AT-THE-PUMP will affect safety adversely.

(1) The industry's first argument focuses on the driver. It argues that PAY-AT-THE-PUMP imposes a statewide uniform rate which ignores the varying risk among individuals (Wilson, 1990; Aceiturno, 1990).

There is no question that a bare-bones PAY-AT-THE-PUMP with a flat surcharge that does not recognize variations among individuals will have the adverse effect described by the insurance industry.[15] However, no PAY-AT-THE-PUMP was ever proposed as a bare-bones flat surcharge at the pump. All have built into them incentives for safe driving, that take these concerns into account. Some include very stringent provisions to confront potential safety problems that originate with the driver. Sugarman's VIP proposal for California, for example, includes sliding-scale charges imposed on drivers based on their driving record and experience (Sugarman, 1994, p.3). VIP stipulates that the fees on car registration and on driving licenses must be "adjusted to reflect both past driving behavior and the likelihood that someone will be in an auto accident in the future. . ." (Sugarman, 1990).[16]

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[15] In her study of the impact of Quebec's auto insurance on safety, Devlin estimates that if the premium were allowed to vary across individuals to reflect experience rating, there would have been nine fewer deaths, one hundred and forty-eight fewer bodily injuries and three hundred and nineteen fewer property-damage accidents (Devlin, 1990, p. 200).

[16] A valid criticism of Sugarman's proposal is that it may induce drivers not to register their vehicles in order to avoid paying the penalty. One remedy is to limit the benefits to the owners of registered vehicles, a la No-pay-no-play passed in California, Michigan, New Jersey and Louisiana.

It may very well be that the system of financial rewards and penalties built into the various PAY-AT-THE-PUMP proposals (which is also the same system of reward and penalty in current use by the insurance industry) may not elicit the desired safe-driving response. It is possible that an alternative system may have to be devised to achieve sharper results, such as a system of points on the driver's license. For example, a study by the Institute for Highway Safety and the University of North Carolina's Highway Safety Research Center reports that two-thirds of the motorists sampled in North Carolina and who do not use seat belts said that no amount of fine (or, they did not know how big a fine) would convince them to use seat belts every time they drive. (North Carolina has a $25 penalty for not buckling up.) On the other hand, two-thirds of the motorists said they would use seat belts if the penalty involved points on their licenses (IIHS, 1995, p. A-9; and IIHS, 1994, p.4). North Carolina suspends the license of motorists who accumulate 12 points within three years.[17]

In short, all PAY-AT-THE-PUMP proposals have been concerned with safe driving and safe drivers much more than their critics would lead one to believe. All have proposed various incentives to accomplish that. Even if the proposed financial incentives do not achieve the desired safety results, it may be that a modified system of rewards and penalties may be able to accomplish the task better. But in either case, the wholesale criticism of PAY-AT-THE-PUMP, on the grounds that it ignores the factors that prompt motorists to drive safely is unfounded.

(2) The second criticism of PAY-AT-THE-PUMP focuses on vehicle safety. The argument is that under PAY-AT-THE-PUMP "motorists face diminished incentives to buy safer cars" (American Petroleum Institute, 1994, sections VIII; Chilgren, 1990).

Except in the case of Karcher's proposal for New Jersey, this criticism is not valid (Karcher, 1986). If anything, the implementation of the rest of PAY-AT-THE-PUMP proposals are likely to result in a much safer fleet than to-day's fleet of vehicles. All PAY-AT-THE-PUMP proposals, except for Karcher's, go to great lengths to address the incentives for buying and driving safer vehicles. Sugarman's VIP, for example, gives motorists a direct financial reason for buying cars that are crashworthy. It imposes two types of charges on the ownership of the vehicle. On the annual registration of an auto, the owner is required to pay a sum based on the model's safety record. On the purchase of a new car, a one-time safety fee is imposed on a sliding scale. The new-car charge is to be posted on the sticker, and is varied to reflect the accident history of the model in question. The purpose is to "reward manufacturers and consumers of safer cars and impose higher costs on cars that are more often involved in accidents and tend to lead to more bodily injury when they are involved in

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Tobias (1994) proposed to stiffen the traffic fines to make the unsafe drivers bear a cost. One can extend this idea by stipulating that the surcharge on traffic fines be diverted to the insurer to compensate the latter for the additional cost the unsafe driver causes the insurer to incur. This should provide the insurer the equivalent of the higher premium the insurer imposes to-day on unsafe drivers.

[17] The suspension is for 60 days for the first time, 180 days for the second time, a year for the third time and ten years for the fourth time. Conversation with Jackie Sloan, Drivers' License Section, DMV, North Carolina. Tel 919-715-6912.

accidents." The reward to the motorist is motivated by the argument that the owners of safer vehicles deserve to pay less, because they and their passengers are likely to suffer both fewer and less damaging accidents (Sugarman, 1990). Sugarman's VIP also proposes "to offer whistle-blowers financial awards. . . [to] bring vehicle dangers to the attention of. . . [the program's governing] board, which information could then be used by the board in constructing. . . vehicle safety charges" (Sugarman, 1994, p. 22).

The contrast with the existing insurance regime is instructive. Under a regime of compulsory third-party liability, such as what we have in most states, the purchaser of a safer vehicle does not, in general, get a reward from the insurer for operating a safer vehicle.[18] The benefit of a safer vehicle does not accrue to the insurer of the injured motorist who owns the safer vehicle. It accrues instead to the insurance company of the at-fault motorist, since the at-fault motorist will do less harm and her insurance company will be less liable financially for compensating the occupants of the safer vehicles involved in accidents. Under third-party liability insurers will encourage vehicle safety features only to the extent that these features will contribute to a lowering of the number of accidents in which the insured will be at fault. A premium discount for the owners of cars with antilock brakes is such an example (see Sugarman, 1992, p. 297, footnote 33). But insurers will not lower the liability premium for a vehicle with passive restraints, because passive restraints do not reduce the risk of injuring others, which is what third-party liability insurance pays for. As another instance, consider an example discussed by Sugarman (Sugarman, 1994, p. 54). Suppose you buy a car with air bags. If you are in a crash, the likelihood is that you will suffer a less serious injury as compared to driving a car with no air bags. But the insurance you pay for third party bodily injury depends on the harm you are likely to inflict on others, which air bags will do little to reduce.

Some authors have called attention to this manifestation of market failure under third party liability with regard to vehicle safety (see American Enterprise Institute, 1978, p. 31; Rea, 1986-1987, pp. 455-456; Mashaw and Hafst, 1990, pp. 242-243; see also the review of Mashaw and Hafst's work in Sugarman, 1992, p. 297 ff). The existence of market failure under third-party liability is a major drawback of the existing insurance system. Like other negative externality, it results in fewer safe vehicles than would have been the case otherwise. Few critics of PAY-AT-THE-PUMP seem to be aware of this drawback of the existing system.

PAY-AT-THE-PUMP's attempt to tie the charges for new and old vehicle ownership to vehicle crashworthiness sharply changes that. The charges imposed on the vehicle, which are based on the model's safety features as well its crashworthiness record, are likely to encourage motorists to purchase and manufacturers to produce safer vehicles much more so than under the current regime. If anything, this should result in a safer fleet of vehicles under PAY-AT-THE-PUMP than under to-day's regime.

There are some difficult issues associated with differentiating reliably among new vehicles for the purpose of determining the safety allowance. In particular, crash-worthiness

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[18] Except for a minimal discount that she would get if she happened to have opted for collision and/or medical coverage.

data for new vehicles are largely unavailable at the time when the initial insurance on a new car is issued. Using past data as an indicator of safety may not always provide a reliable guide for car safety, because the safety characteristics of new automobiles may fluctuate, sometimes even with relatively minor changes in continuing models (Mashaw and Hafst, 1990, pp. 242-243).

But even with these difficulties, it seems any encouragement given to the buyer of new vehicles to think in terms of vehicle safety is a welcome improvement over the practices under the current regime (of third-party liability). This is a far cry from the industry's criticism that under PAY-AT-THE-PUMP motorists face a diminished incentive to buy and drive safe vehicles.

(3) The third criticism of PAY-AT-THE-PUMP centers on its stimulating effect on the demand for fuel-efficient vehicles. The argument is that in order to make the car more fuel-efficient, the manufacturer has to reduce its weight. Critics argue that heavier vehicles are safer than lighter vehicles in the event of a crash. Hence, they argue, the increased sale of fuel-efficient vehicles will affect safety adversely. They predict "carnage and destruction" on the highways.

We have just addressed the main point of the industry's argument here, namely vehicle safety. We pointed out that PAY-AT-THE-PUMP is likely to result in a safer fleet of vehicles. But for the sake of completeness, we will address here the specific criticism which revolves around vehicle fuel efficiency.

The industry's criticism is not valid for three reasons:

- Evidence suggests the response of *ex post* demand for fuel-efficiency to the higher gasoline price induced by PAY-AT-THE-PUMP is likely to be very small. This is so because of the low elasticity of ex ante demand for fuel efficiency with respect to gasoline price, coupled with the effect of binding CAFE standards, as well as the eroding effect of the income feedback effect of PAY-AT-THE-PUMP. See the discussion of these points in section II. The fact that the sale of fuel-efficient vehicles will not increase much, if at all, makes moot the industry's predictions about the adverse safety consequences of PAY-AT-THE-PUMP. In fact, Khazzoom's results suggest that under current conditions, when the increase in gasoline price is small, *ex post* demand for fuel-efficient vehicles may even fall, because of the binding effect of CAFE's standards (Khazzoom, 1997).

- Evidence does not support the hypothesis that the increase in fuel-efficiency affects safety adversely. It may in fact enhance it. This result follows partly because recent evidence (which is based on studies that are better designed than the earlier ones) does not support the theory that reducing car weight is a detriment to safety. Additionally, even when increased fuel efficiency involves downweighting, it need not be accompanied by downsizing -- hence, the household can purchase a vehicle built with lighter material, that is both lighter and larger, which makes it both more fuel-efficient and safer because of the

- extra crush space it provides. Finally, enhanced fuel efficiency can be achieved by means that involve neither downweighting nor downsizing. All that needs to be done is to reduce car performance. High performance vehicles are gas-guzzlers. They are also deadly. Reducing performance improves fuel efficiency. That has also the potential side effect of reducing highway fatalities. The last decade has seen a steep increase in car performance (see Murrell et al., 1990, and Heavenrich et al., 1996). According to IIHS, four out of the five cars with the highest death rate are high performance vehicles (IIHS, 1990, p. 9). Similarly, Khazzoom's estimates show increased engine size (which also implies increased performance) exerts a significant upward pressure on highway fatalities (Khazzoom, 1994b).

- New cars do not come only with higher fuel efficiency. They come with a bundle of attributes that affect safety, of which enhanced fuel efficiency is only one. Some of these new-car attributes include safety features not possessed by the vehicle they replace. These attributes cannot be unbundled. They come together, and together they shape the overall safety of the vehicle. If we are concerned with safety, we cannot arbitrarily zero in on fuel efficiency and exclude the rest of the attributes from consideration. Even if we grant, for the sake of the argument, that enhanced fuel efficiency is bad for safety, it does not necessarily follow that the accelerated replacement of vehicles induced by PAY-AT-THE-PUMP is also bad for safety. What we want is to find out is what happens to safety when we take into account the combined effect of all of the attributes that affect safety, not just one attribute. When we do that, we find the results are just the opposite of what critics would lead us to expect. The acceleration of auto replacement, if indeed such an acceleration takes place as critics claim, results in a safer fleet than the fleet under a regime where no PAY-AT-THE-PUMP is in place. Simulation results also suggest that the faster the accelerated vehicle replacement proceeds the safer the resulting fleet is compared to the fleet under a no-PAY-AT-THE-PUMP regime (Khazzoom, 1997). These results hold actually with a greater probability than the simulations would suggest, since they were derived on the assumption that enhanced fuel efficiency is at odds with safety, when in fact available evidence does not support that assumption in the first place.

These results also suggest that if current conditions change and PAY-AT-THE-PUMP does indeed result in a substantial increase in the demand for fuel-efficient vehicles then the implementation of PAY-AT-THE-PUMP will result in a substantially enhanced safety of the fleet of vehicles, as well.

IV.5 Implications of the Cost of Insuring the No-Priors for Savings Achieved under PAY-AT-THE-PUMP

In the past, several insurance companies reported that their experience with motorists who have not been previously insured (no-priors) indicates that these motorists are less safe drivers than those who maintained insurance (priors) are. Hence insurance companies argued

that they would incur losses on insuring the no-priors if the latter were to pay the same insurance rate as the rate paid by the priors, as in the case of PAY-AT-THE-PUMP (Cleveland, 1991, p. 1; Wirth, 1991, pp. 3-4).

If the insurance companies do incur losses on insuring the uninsured motorists, part of the savings achieved under PATP would be eroded. And if the losses are high enough, then all the savings would be wiped out, in which case PATP may not be worthwhile. The question is what level of loss will actually offset all of the savings?

To make the task of answering this question manageable, I restricted attention to the savings achieved as a result of the elimination of the uninsured motorist premium. There are of course other savings and benefits, tangible and intangible that result from the implementation of PATP -- e.g., the saving on insurance cost due to the reduction in exposure risk or due to enhanced vehicle safety, the saving on enforcement cost and court congestion, environmental benefits, benefit of greater pricing efficiency, balance of payments benefits, etc. But the idea is that if the savings achieved from the elimination of the uninsured motorist premium alone are substantial enough to more than offset the losses incurred on insuring the no-priors, then clearly the case for PAY-AT-THE-PUMP becomes that much stronger. And this indeed turned out to be the case. More on that shortly.

The safety and cost implications of drawing in the uninsured motorists under a PAY-AT-THE-PUMP regime are two-pronged:

(1) Under PAY-AT-THE-PUMP, the uninsured motorist pays an insurance surcharge, which makes driving more expensive than before. Hence, the uninsured-motorist's VMT may be expected to go down. This reduces exposure and the consequent risk of accident and fatality. Moreover, there is no bounce-back for this VMT reduction, since there is no income feedback for the no-priors. So the reduction in the no-priors' VMT and accident risk may be substantial, which translates into a substantial downward pressure on exposure risk and insurance cost. This increases the likelihood the insurance companies will make a profit instead of incurring losses on insuring the no-priors.

(2) On the other hand, once insured, the no-prior may be subject to a greater risk of accidents per VMT than before. This does not mean necessarily that the no-prior would drive more recklessly once she is insured or that she would take risks she would not have taken before -- although this could happen. It does mean, however, that the driving strategy of the uninsured motorist is likely to change once she is able to drive more openly. I suspect that will result in an increase in the likelihood of accidents per VMT, as well the likelihood of losses on insuring the no-priors. Maril's survey results are instructive here. Maril reports that one strategy used by some of the uninsured motorists he surveyed is to avoid being noticed as much as possible while driving the uninsured vehicle. For example, families who have two vehicles, one insured and the other uninsured, will use the uninsured vehicle only at night or drive it only a few blocks away to a convenience store, say, to pick up groceries (Maril pp. 26-27). Driving at night may not be very convenient, but it may be necessary in order to avoid being noticed. But once the uninsured motorist is able to drive openly, it is likely that her driving pattern will change: less driving at inconvenient hours and more at regular times

during the day. Most likely, those will also be the times when the opportunity for road conflicts and accidents is greater.

The impact of insuring the uninsured motorist on safety and cost will depend on the net effect of these two tendencies -- reduced VMT and changed driving strategy. Offhand, we do not know which of these will prevail.

The published evidence on risk exposure and insurance cost once the uninsured motorist is drawn into the insurance system is very limited, and what is known is not all that firm either. Indirect evidence from the Quebec scene suggests that the inclusion of the uninsured motorist in the insurance system, when the system is devoid of any incentives for safe driving, is likely to affect safety and insurance cost adversely (see Gaudry, 1986; see also Trebilcock, 1989). But while the results of the Quebec study are intuitive, they are confounded by the fact that the transition to the new Quebec insurance system covered by the study was accompanied by a major insurance reform -- from tort to pure no-fault. Pure no-fault (Quebec is the only jurisdiction in North America that has no-fault of the pure variety) has its own major safety issues, which are not easy to disentangle from the safety issues connected with insuring the uninsured motorists (see Khazzoom, 1996).

In hearings on the impact of a uniform insurance premium in Texas, Allstate reported the results of calculations it made based on its experience in Maryland, Virginia, and Ohio. They showed that if Allstate were to charge the no-priors the average premium rate it charges the priors, then for every dollar of premium it receives from the no-priors, Allstate would pay $1.60 in loss cost. But Allstate never revealed much about the assumptions behind its calculations. In particular we know nothing about the assumptions about the no-priors' travel demand and the impact this has on their exposure risk, or the extent to which their unsafe driving persisted past the first six months, year or two years after their initiation into the insurance system. Allstate did concede that while its calculations imply that the no-priors cause more accident losses than the priors, it made no attempt at finding out why this is (see Kron, 1991, and attachment). Other insurance companies made similar claims although none of these companies reported a loss cost ratio (i.e. ratio of the loss cost to the revenue) anywhere as high as the 1.6 calculated by Allstate. For example, State Farm's calculations show a loss cost ratio of 1.30 (Wirth, 1991).

In summary, while there are some studies that suggest that the insurance cost may be subject to an upward pressure when the uninsured motorists are drawn into the insurance system, none of the results reported in these studies seems to be firm enough to extrapolate from for the case of PAY-AT-THE-PUMP.

To examine the historical relationship between the revenue and loss cost generated by the no-priors one inevitably has to turn to the insurance companies' internal files to search the safety records of policyholders who were once no-priors, and track their performance back to the time when they were uninsured motorists. But there are two problems with that. One is cost. The required data have to be ferreted out from the file of each individual policyholder. Sometimes the insurance history of one motorist requires searching the files of several insurance companies (policyholders often change insurers). Even if we assume that insurance

companies would be willing to open their files for such an undertaking (based on a few queries we made, they are not), the cost of such an operation is enormous. Two, the results of any such sample are bound to suffer from self-selection bias.

Fortunately, a simple alternative exists. It will not give us the wealth of information we would have liked to get in an ideal world. Nonetheless it gives us useful insights.

We start with a worst-case scenario. We assume, to begin with, that the loss cost ratio for insuring the no-priors exceeds 1. We also assume the third-party liability insurance premium is the same for all motorists, priors and no-priors, and that the insurance system contains no provisions to penalize unsafe drivers and compensate the insurance companies for the extra cost of insuring the unsafe drivers. We derive an expression that determines the break-even point at which the losses incurred on insuring no-priors are large enough to neutralize all the savings achieved by the elimination of the uninsured motorist premium. We express this break-even point in the form of a lower bound on the insurance companies' loss ratio (i.e. the ratio of the loss to revenue). Assuming data are available on the parameters that determine the break-even point, we can calculate illustrative values for the break-even loss cost ratio for a few states. As it is, data in the exact breakdown we require are not available from published sources. We rely on reasonably good approximations to do our calculations.

Let M, τ, UMP and LIP denote the number of motorists, proportion of uninsured motorists, average uninsured-motorists premium and average third-party liability premium (hereafter referred to simply as liability premium), respectively. Assume that all priors maintain uninsured-motorists coverage. The implementation of PAY-AT-THE-PUMP will result in a saving of $(1 - \tau)\, M * UMP$ for the priors on their uninsured-motorist premium. The insurance companies will receive $\tau\, M * LIP$ of new revenue from the no-priors. Suppose the insurers' loss cost on the no-priors is $(1 + \zeta)\, \tau\, M * LIP$, $\zeta > 0$, resulting in a loss of $\zeta\, \tau\, M * LIP$. The savings by the priors will be offset or more than offset when

$$\zeta\, \tau\, M * LIP \geq (1 - \tau)\, M * UMP$$

$$\Rightarrow \quad \zeta \geq ((1 - \tau) / \tau) * (UMP / LIP)$$

$$\Rightarrow \quad \xi \geq 1 + ((1 - \tau) / \tau) * (UMP / LIP) \qquad \text{(IV.5.1)}$$

where $\xi = 1 + \zeta$.

(IV.5.1) says, other things being equal, the higher the uninsured-motorists premium, the greater the savings achieved by the switch to PAY-AT-THE-PUMP, and therefore the higher the break-even loss cost ratio must go before it neutralizes the savings achieved by the priors from the elimination of the uninsured-motorist premium. Similarly, other things being equal, the smaller the proportion of uninsured motorists, the smaller the total loss cost suffered by the insurance companies, and hence the higher the loss cost ratio can get before it neutralizes the priors' savings.

One observation.

We derived (IV.5.1) on the assumption that all priors carry uninsured motorists premium. This is true in the twenty states where uninsured motorists coverage is mandatory. In the rest of the states, insurers are required to offer uninsured-motorists coverage, but the motorist is not obligated to accept the coverage. In California, for example, 12 per cent of the motorists have waived the uninsured-motorists insurance (Sommer et al., 1995, p. 363). One may conclude that in such cases, using the average uninsured-motorists data for these states requires adjusting the calculated ζ by the ratio of the priors who have uninsured-motorists coverage to the total number of priors. However, that deflation is not necessary. It is true that the subset of priors that had no uninsured-motorists coverage derives no financial benefits from the elimination of the uninsured-motorists premium (in the sense that they did not save an outlay they incurred for certain). Nonetheless, they save the expected value of the damage they were exposed to -- i.e., bodily as well property damage that an at-fault uninsured motorist could have inflicted on them. We approximate that average saving by the average uninsured-motorists premium. Hence no adjustment of the calculated ζ is necessary for those states that have no compulsory uninsured-motorists coverage.

Using data on the ratios UMP / LIP and $(1 - \tau) / \tau$ for different states one can calculate values for ξ that satisfy the bounds in (IV.5.1) for various states. However, UMP and LIP data are not available by state from published sources. The California Department of Insurance was kind enough to make these data for California available to us from their files for 1992, 1993 and 1994. Using these data together with IRC's average proportion of uninsured motorists for California for 1981-1986, we get the following values of the loss cost ratio for California: 1.81 for 1992 and 1993; 1.83 for 1993.

From published sources we can get data on pure premium and loss cost for liability as well as uninsured motorists bodily injury and property damage (NAIC, 1993). On the assumption that in the long run costs and revenue track well each other, we use the cumulative 1986-1990 liability cost of bodily injury and property damage along with the cumulative cost of uninsured-motorists bodily injury and property damage in calculating ξ. As a check, we calculated ξ for 1986-1990 for California and got 1.91, which is close to the values we calculated for 1992-1994 using the premium data.

The following table shows the results of our calculations, using NAIC published data.

Table IV.1 ξ : Ratio of Cost to Revenue (from Insuring the No-Priors) Required to Neutralize the Savings on UM Premium, 1986-1990

CA	1.93	NC	2.00
FL	2.18	PA	2.91
NM	2.29	RI	3.33
NY	1.80	US	2.24

For the states shown in the table, the loss cost ratios range between 1.80 and 3.33, with the average for the US estimated at 2.24. This means that on the average for every dollar of revenue form the no-prior, the insurance companies' cost of insuring the no-prior must exceed $2.24 before the resulting losses can wipe out the savings achieved by the elimination of the uninsured-motorist premium. In some states the break-even value is smaller, in others it is larger than the US average. But even the smallest ξ in the table exceeds the highest hypothetical loss cost ratio (1.60) estimated by any member of the industry (Allstate) to result from insuring the no-priors at the same rate paid by the priors.

When we add to the leftover of the saving, the savings and benefits other than those resulting from the elimination of the uninsured motorist premium, the case for PAY-AT-THE-PUMP insurance becomes that much stronger. Clearly, the benefits of installing PAY-AT-THE-PUMP outweigh the additional costs that may result from drawing the uninsured motorists into the insurance system, even under a worst-case scenario.

PART THREE: THE FORGOTTEN DIMENSION: THE HUMAN ASPECT OF THE UNINSURED-MOTORIST PROBLEM

V. PAY-AT-THE-PUMP's Contribution to the Human Aspect of the Uninsured-Motorist Problem

Finally, and not the least important from society's point of view, is PAY-AT-THE-PUMP's contribution to the human aspect of the uninsured motorist problem, which we tend to overlook when we are all engrossed in grinding numbers and calculating percentages. PAY-AT-THE-PUMP corrects a social ill which mandatory insurance initiates, but which is unduly enlarged and aggravated by the rigidity of the current method of pricing the insurance service. Without this rigidity, as I pointed out earlier, it is doubtful that the uninsured-motorist problem would have reached the proportions it has reached today.

Inner cities, where most uninsured motorists reside, have the highest insurance rates. But, at the risk of being repetitive, what makes those rates particularly unbearable is the fact that auto insurance cannot be broken up into affordable increments, and that as a result the motorist's required payment for insurance is totally unrelated to her ability to pay.

We all face prices or rates that we take as given. However, we normally control how many units we buy, and what we spend on any item is governed by our ability to pay. The motorist may want to regulate the amount of driving she does by limiting her car use only to the essential -- for example, driving to work only -- in the same way we regulate the amount of food we buy to make our food expenses fit our budget. But under the current regime she is not allowed that choice. She is not allowed to buy only what she can afford to pay for. She either pays for the full insurance, regardless of whether or not she needs it all, or else goes uninsured. Nothing in between. It is as if you either find the money to buy all the food in the grocery store or go without food.

The sacrifice this imposes on the motorist is thus made unnecessarily onerous by the inflexibility of the method used by the insurance companies in pricing the service -- requiring

the mandatory insurance to be acquired in one huge block rather than in affordable increments. This sets the threshold higher than many can reach and puts the insurance payment beyond the reach of a larger segment of the population than otherwise would have been the case.

PAY-AT-THE-PUMP brings back to the ranks of law-abiding citizens a segment of the population who is driven by the inflexibility of the current insurance system to live under the stigma of scofflaws. The special significance of this societal and in a very real sense human dimension of the problem does not seem to have been appreciated by the public in general and the insurance companies in particular.[19] The following is an excerpt from a quote cited in O'Connell (1995), pp. 40-41, that should help shed some light on this aspect of the problem. O'Connell reports the original appeared in 1994 as an editorial in an African American Philadelphia newspaper. " 'If you just listened to the candidates for election . . . you would easily think that the only issue of importance is crime. . . . Because state law mandates that all motor vehicle owners must have insurance to drive those vehicles . . . many Philadelphians are committing a crime because they are driving without the legally required auto insurance. Curiously, none of those tough-on-crime candidates is addressing the issue of . . . auto insurance rates which [have] turned thousands of otherwise law abiding Philadelphians into criminals. . . . Candidates need to get real and use their clout to assist in reforming auto insurance laws which force decent citizens to become criminals.' "

PART FOUR: CONCLUSION

VI. A Concluding Quote

I would like to conclude with a quote from an article written by members of the insurance industry, who published the results of a study in which they evaluated the criticisms of PAY-AT-THE-PUMP insurance. " . . . the premium to be levied at the pump makes basic insurance sense: No premiums are avoided. No driver of a vehicle goes without paying into a pool that insures his or her basic liability to others . . . . This essential point to the PAY-AT-THE-PUMP system appears to have been lost on all the critics of the plan, no matter their special interests. For years, the insurance industry has been lamenting the cost of uninsured motorists, for which insured persons have been paying through uninsured motorists premium, and taxpayers have been paying for emergency room health care through local and state taxes . . . Rather than falling back on old habits and negative knee-jerk reactions to change, the insurance industry needs to take a closer look at the idea, for its own good as well as the good of the driving public at large" (Berg CPCU, Dunnbier CPCU and Litwinko CPCU, 1994, pp. 143-144, 149).

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[19] Remarkably, when confronted with the newcomer PAY-AT-THE-PUMP, some members of the industry appear to have decided on a 180-degree turn to declare the "existing system is quite healthy" (American Insurance Association, 1995, p. 1). It is not clear what is so healthy about a system whose practices and mode of operation force a substantial segment of the population to live as law breakers.

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