

ADVERSE SELECTION CLASS PROBLEM

by James R. Garven
Finance 4335

October 12, 2021

The Veritas Insurance Company (also known as “VIC”) does business in the country of Georgia, where automobile liability insurance is not compulsory; i.e., licensed drivers are allowed to (as a matter of their own volition) decide whether or not to purchase such insurance. However, the Georgian insurance commissioner requires that VIC must offer full coverage and charge the same premium to all of its policyholders. Furthermore, the premium must be set such that the dollar value of VIC’s expected profit from selling insurance is equal to \$0.

VIC estimates that the accident probabilities for the following five driver types are as follows (for simplicity, assume that there is only one of each driver type):

Driver Type	Probability of Accident
Cautious Chloe	5%
Nervous Nichole	25%
Average Anna	30%
Aggressive Asher	35%
Hot Rod Hudson	40%

The dollar value of initial wealth and loss due to an accident for all driver types are \$100,000 and \$40,000 respectively. This implies that if an accident occurs, then the dollar value of uninsured wealth falls to \$60,000. Furthermore, utility $U = W^{0.5}$ for all driver types. All drivers can pay the same insurance premium (P) which will fully cover accident-related loss.

- Suppose that VIC initially sets the premium at $P = \$10,800$. This premium will enable VIC to comply with Georgian insurance regulations, so long as all five driver types purchase insurance. Calculate 1) the cross-subsidies that are implied by such a pricing scheme if all five driver types purchase coverage, and 2) expected utilities for all five driver types.

Driver Type	Probability of Accident	Expected Loss	Subsidy	EU(uninsured)	EU(insured)
Cautious Chloe	5%	\$2,000	-\$8,800	312.66	298.66
Nervous Nichole	25%	\$10,000	-\$800	298.41	298.66
Average Anna	30%	\$12,000	\$1,200	294.84	298.66
Aggressive Asher	35%	\$14,000	\$3,200	291.28	298.66
Hot Rod Hudson	40%	\$16,000	\$5,200	287.72	298.66
Total Expected Loss		\$54,000			
Combined Premium		\$10,800			

Figure 1: Cross-Subsidies when all 5 driver types purchase coverage for \$10,800

- Note that Cautious Chloe has higher expected utility if she opts out of purchasing coverage for a price of \$10,800. Since the expected loss costs for the remaining four clients now total \$52,000, the new combined premium will be $\$52,000/4 = \$13,000$. Calculate 1) the cross-subsidies that are implied by such a pricing scheme if the four remaining driver types purchase coverage, and 2) expected utilities for the four remaining driver types.

Driver Type	Probability of Accident	Expected Loss	Subsidy	EU(uninsured)	EU(insured)
Nervous Nichole	25%	\$10,000	-\$3,000	298.41	294.96
Average Anna	30%	\$12,000	-\$1,000	294.84	294.96
Aggressive Asher	35%	\$14,000	\$1,000	291.28	294.96
Hot Rod Hudson	40%	\$16,000	\$3,000	287.72	294.96
	Total Expected Loss	\$52,000			
	Combined Premium	\$13,000			

Figure 2: Cross-Subsidies when the 4 remaining driver types purchase coverage for \$13,000

3. Note that Nervous Nichole now has higher expected utility if she opts out of purchasing coverage for a price of \$13,000. Since the expected loss costs for the remaining three clients now total \$42,000, the new combined premium will be $\$42,000/3 = \$14,000$. Calculate 1) the cross-subsidies that are implied by such a pricing scheme if the three remaining driver types purchase coverage, and 2) expected utilities for the three remaining driver types.

Driver Type	Probability of Accident	Expected Loss	Subsidy	EU(uninsured)	EU(insured)
Average Anna	30%	\$12,000	-\$2,000	294.84	293.26
Aggressive Asher	35%	\$14,000	\$0	291.28	293.26
Hot Rod Hudson	40%	\$16,000	\$2,000	287.72	293.26
	Total Expected Loss	\$42,000			
	Combined Premium	\$14,000			

Figure 3: Cross-Subsidies when the 3 remaining driver types purchase coverage for \$15,000

4. Since Average Anna now has higher expected utility if she opts out of purchasing coverage for a price of \$14,000, this leaves only Aggressive Asher and Hot Rod Hudson in the risk pool. Since expected claims costs now total \$30,000, the new combined premium will be $\$30,000/2 = \$15,000$. Calculate 1) the cross-subsidies that are implied by such a pricing scheme if the two remaining driver types purchase coverage, and 2) expected utilities for the two remaining driver types.

Driver Type	Probability of Accident	Expected Loss	Subsidy	EU(uninsured)	EU(insured)
Aggressive Asher	35%	\$14,000	-\$1,000	291.28	291.55
Hot Rod Hudson	40%	\$16,000	\$1,000	287.72	291.55
	Total Expected Loss	\$30,000			
	Combined Premium	\$15,000			

Figure 4: Cross-Subsidies when the 2 remaining driver types purchase coverage for \$15,000

The situation depicted by Figure 4 depicts a stable equilibrium, in the sense that neither client has incentive to defect. Even though Aggressive Asher cross-subsidizes Hot Rod Hudson's premium cost by \$1,000, he still prefers "unfair" coverage over no coverage at all.