

The Influence of the Social Pricing of Insurance on Road Safety in British Columbia

Abstract

British Columbia has one of the highest motor vehicle collision rates in Canada. This paper presents reviews the theory and evidence of insurance pricing and motor vehicle collision risk. The influence of insurance pricing incentives on the driving behaviour of high risk demographics is explored. We estimate that actuarial pricing would have saved up to 15,000 injuries in 1999.

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THE INSURANCE BUREAU OF CANADA

Canadians in all walks of life depend on insurance coverage for their cars, homes and businesses to protect themselves against accidental loss. Property and casualty (P&C) insurance plays a vital role in supporting a strong dynamic economy by providing greater peace of mind with respect to many of the risks involved in modern life. The P&C insurance industry also works to improve the quality of life in our communities by promoting loss prevention, safer roads, crime prevention, improved building codes, and co-ordinated preparation for coping with disasters.

Insurance Bureau of Canada is the national trade association representing the private general insurance industry. Members account for over 90 percent of the non-government, non-life insurance business in Canada. The P&C insurance industry is one of the largest employers in Canada, providing some 100,000 jobs. The industry pays close to \$14 billion in claims each year, including rehabilitation for those injured in accidents, replacement of stolen goods, and repairs to homes and vehicles damaged by accidents.

IBC HEALTH CARE ISSUES PROJECT

Our vision: Insurers working with other stakeholders to ensure confidence that our medical and rehabilitation resources are used efficiently to help victims of automobile accidents achieve their best possible health status as soon as possible.

Our issue: Insurers spend more than \$1 billion each year on medical fees and rehabilitation costs, yet there is little confidence within the industry about the results from this expenditure. The industry needs a system to ensure confidence that there is full value in the process of rehabilitation for accident victims.

Our objective: Establish confidence that insurers are securing value for their health care spending.

Our principles:

- The best approach to managing health care issues will be through co-operation with government, health care professionals, and consumers.
- Health care is an important issue and viable solutions in the near-term will have long-lasting benefits for all stakeholders.
- The industry is a key stakeholder and is in a position to make an important on-going contribution to the health care debate in Canada.
- Supporting the well being of automobile drivers and the reduction of automobile-related bodily injuries has positive social and economic benefits for Canadians.
- The industry will work within the framework of provincial health and insurance legislation to ensure that its products provide confidence and value for insurance consumers.
- Better predictability in the direction of health care policy can provide confidence to all stakeholders in health care.
- As a significant purchaser of health care services, the industry has an interest in supporting initiatives to advance learning on effective rehabilitation practice and management.
- Outcome-based research and practice can provide the basis for effective and timely treatment of bodily injuries.
- Effectively managed rehabilitation is a reflection of insurers' commitment to delivering quality insurance products and customer service to consumers using well-trained staff.
- The rehabilitation of accident victims and their return to a productive life as soon as possible is good for individuals, their families, and their communities.

Further information about the IBC Health Care Issues Project can be obtained by writing: Director, Health Care Issues Project, Insurance Bureau of Canada, 151 Yonge Street, 18th Floor, Toronto, Ontario Canada, M5C 2W7.

Introduction

Injury from motor vehicle collisions is one of the leading causes of morbidity and mortality in British Columbia. The losses caused to both individuals and society by motor vehicle collisions are generally believed to be substantial. This belief is reflected in the public support for road safety investments in the province. Despite this there is little information available regarding the costs of motor vehicle collisions. Studies that estimate these costs are still uncommon and relatively few countries have attempted to estimate these costs. The World Bank, as a rule of thumb, uses a figure of 2% of national income to estimate the economic burden of motor vehicle crashes.

There is little doubt that injuries from motor vehicle collisions are a leading cause of death and disability in British Columbia, particularly among younger age groups. In British Columbia, drivers aged 16 to 19 were involved in about one fifth of all injury collisions, well above the national average of 16.3%. Driver age is statistically one of the most important variables related to motor vehicle collision risk.

This report presents the results of analysis on the influence of the social pricing of insurance on the demand for insurance among high-risk drivers and provides an estimate of the consequences of motor vehicle collisions for the province of British Columbia. The theoretical foundations, supported by the available evidence, of insurance pricing suggest that the province's system of social pricing for automobile insurance creates incentives that encourage increased driving by higher risk drivers.

The construction of a hypothetical counterfactual scenario of actuarial pricing insurance suggests that the extra lives and injuries saved in motor vehicle collisions from risk-based pricing may have been up to 140 fewer lives lost and 15,000 fewer injuries.

The Influence of Social Pricing in Automobile Insurance

Overview

In standard economic theory the price of a product is the key determinant in the supply and demand of that product. In Canada there are two predominant systems of pricing automobile insurance. Actuarial pricing involves the pricing of insurance to the individual risk profile of the insured. Under an actuarial system, factors such as geography, climate, type and use of vehicle, insurance claims record, other drivers in the household who use the vehicle, driver age, driving record, driver gender and traffic congestion which affect the frequency and cost of collision and theft are used to price the insurance product. Actuarial or risk-based pricing attempts to have the price the insurance product reflect the risk associated with the insured. Risk-based pricing is the method of insurance pricing used in seven Canadian provinces and throughout the rest of the industrialized OECD.

Social pricing involves the pricing of insurance to the risk profile of the insured community. Such a pricing system uses environmental factors such as geography, climate, vehicle type and use, traffic congestion and driving record but excludes social factors such as age, gender and marital status in pricing the insurance product. The provinces of British Columbia, Saskatchewan and Manitoba use social pricing.

Individual decisions on whether to purchase insurance products are largely determined by the characteristics of individual risk aversion, expectations regarding the likelihood of loss through theft or collision and the price of insurance products. Insurance is purchased on the basis of rational economic considerations taking into account cost and benefit. Demand for insurance is a decision to purchase not only the apparent current condition of a product but also its possible future conditions. With the purchase of insurance a consumer widens their economic scope of discretion and opportunity by protecting themselves from financial loss in the event of collision or theft. Where the costs of acquiring additional insurance amounts or products is less than the expected increase in return from this additional scope, consumers demand for insurance will increase. The price of insurance is therefore an essential determinant in the level of insurance demand (Swiss Re, 1993). International comparisons of price elasticity for insurance products show that consumers determine the quantitative response to price and price adjustments (Swiss Re, 1993; Bradford, 1998).

Basic automobile insurance everywhere in Canada is compulsory to legally operate a vehicle. The characteristics of this compulsory coverage are determined by government policy. An individual contemplating operating a vehicle and purchasing auto insurance chooses from a menu of options: to purchase the compulsory insurance coverage as a principal operator; to purchase coverage as an additional (secondary) driver or to not purchase the compulsory insurance. Demand in this market is sensitive to price.

Price comparisons between social pricing and actuarial pricing jurisdictions have shown, on average, that in actuarial pricing systems younger drivers¹ pay more for automobile insurance than drivers over the age of 25.¹ The exclusion of social factors such as age, gender and marital

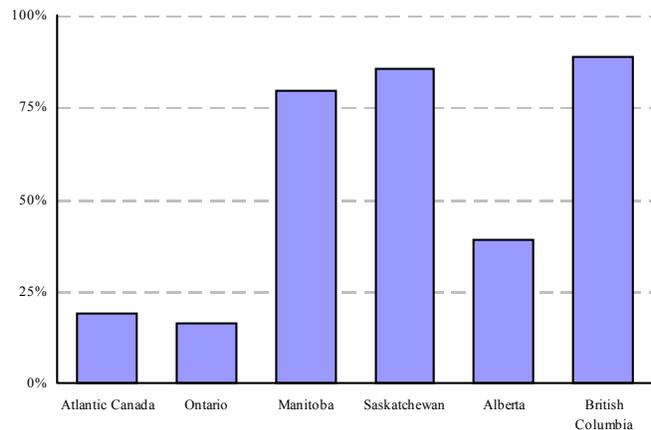
¹ However such comparisons are difficult to make and conclusions should not be overly generalized as there are numerous differences across jurisdictions that affect such comparisons. These differences include factors such as

status in pricing the risk of collision or theft under social pricing has meant that insurance for younger principal drivers (age 16 to 24) is less expensive than for younger drivers under actuarial pricing. Conversely, insurance for older drivers (age 25+) under social pricing is generally more expensive than it is for older drivers under actuarial pricing.

Economic theory suggests that lower insurance prices for young drivers would result in younger drivers in such an environment being more likely than younger drivers in a higher priced environment to own and be the principal

operator of a motor vehicle. As social pricing environments lower the price of insurance for younger drivers, it would be expected that jurisdictions with such a regime would have more younger drivers as principal drivers than an actuarial priced regime, *ceteris paribus*. Figure 1 supports this theoretical hypothesis. For Canadian provinces with social pricing of automobile insurance, the percentage of licenced drivers between the ages of 16 and 24 years of age who are the principal operator of a motor vehicle is over four times greater than that of actuarial priced provinces.

Figure 1: Proportion of licenced drivers (aged 16 to 24) as principal operators of a motor vehicle.



Source: IBC, with data from IID, SGI, MPI, and Statistics Canada

The influence of social factors in motor vehicle related risk

The rating criteria for automobile insurance premiums (prices) for drivers between a social pricing system and an actuarial pricing system differs in the main by the exclusion of age and gender in the estimation of the likelihood of being involved in a collision or having a vehicle stolen. The exclusion of these risk factors in the pricing of automobile insurance allows the cost of claims (from collisions and thefts) to be more uniformly distributed across the insured population.

In the jargon of the microeconomics literature the social pricing of automobile insurance can be described as a symmetric learning model with a pooling equilibrium, where some characteristics of the insured's risk are ignored. Initially all drivers, in the same geographic region and vehicle type, of different risk types pay the same level of insurance and over time they learn the outcome through the experience of collisions or theft (Chiappori, 2000). Since the insurer(s) does not differentiate by level of risk (by age and gender) it must offer everyone the same price – the price relating to the average risk. At that price, insurance is expensive to low risk drivers and a bargain to high-risk drivers. If the total level of insurance premiums is collected to cover all incurred costs then, a high-risk driver, paying the same average insurance premium as a low risk driver under a social pricing regime, does not pay the full cost associated with their risky behaviour (Dionne et al, 2000).

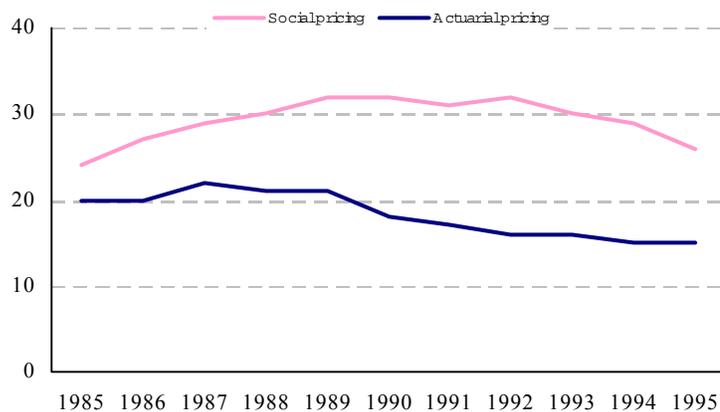
insurance legislation (tort, threshold no-fault, full no-fault), highway and traffic legislation (rules of the road), traffic enforcement, terrain (mountains, rivers, etc), climate, traffic density, urban/rural ratios, and average annual mileage.

An actuarial pricing regime is a separating equilibrium where drivers, of the same geographic region and vehicle type, of different risk types pay insurance premiums reflecting their level of risk. Actuarial pricing conditions premiums upon environmental and revealed characteristics (age, gender, driving record) that have been found to be statistically reliable in predicting levels of individual risk. Risk-based rating by statistically meaningful characteristics is an important factor in reducing adverse selection in automobile insurance (Dionne, 2000).² There is extensive microeconomic literature on incentive effects in insurance markets (Chiappori, 2000; Crocker & Snow, 2000; Varian, 1992).

Among all age groups, young drivers between the ages of 16 and 24 are the most likely to be injured in motor vehicle accidents. International empirical research has found that youthful age in a driver is a major risk factor for motor vehicle collisions. There is considerable international research (Ferguson et al, 1996; Kim et al, 1998; Miller et al, 1998 etc) on the influences of social factors such as age and gender on probability of being involved in a motor vehicle collision. This research generally concludes that driving involves both a level of physical co-ordination, judgement and decision making that improve with experience. Younger drivers are more likely to overestimate their driving capability and underestimate the likelihood that they will be involved in a motor vehicle collision (Deery, 1999; Finn & Bragg, 1986).

The empirical research has found that younger drivers are disproportionately involved in motor vehicle collisions (CCMTA, 1999; ICBC, 1999). Young drivers are up to three times more likely to be at fault in the event of a motor vehicle collision than older drivers (Ferguson, 1996, Kim, 1998, Williams, 1999). Further, males in all age categories have a higher collision involvement than do females of the same age demographic (Williams, 1994). Provinces with social pricing insurance regimes historically have higher rates of motor vehicle collisions among younger drivers (aged 16 to 24) than actuarial priced provinces. Figure 2 shows, from 1985 to 1995, the motor vehicle collision rates among younger drivers per 1000 of the population aged 16 to 24 years of age.³ The pooled social pricing provinces had a collision rate that was on average 64% above that of the pooled actuarial provinces. Collision rates not involving younger drivers (per 1000-population aged 25+) between social and actuarial pricing environments experience less divergence.

Figure 2 Motor vehicle injury collisions & youth
(injury collisions involving young drivers per 1000 pers.)



Source: IBC, with data from Transport and Statistics Canada

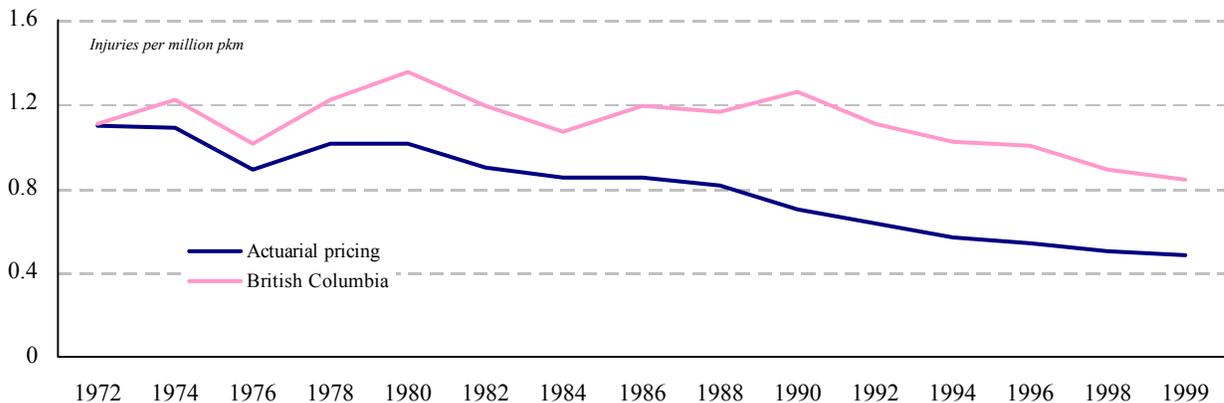
² Adverse selection occurs when prospective insureds are heterogeneous and the risk class that they belong to cannot be determined *a priori* so that all insureds pay the same price. Low risks subsidize higher risks.

³ Data reporting changed after 1995 in British Columbia reducing the effectiveness of comparisons over time. Despite this, following 1995 social pricing provinces continued to have higher collision rates involving younger drivers.

The National Private Vehicle Use Survey October 1994 – September 1996, prepared by Natural Resources Canada, collected data on the average quarterly distance traveled per vehicle by age and gender of the principal driver. The data from this survey indicates that over the survey period principal operators (drivers), aged 16 to 24, drove nearly the same number of kilometers on average as drivers aged 35 to 49 and more than any other age group.⁴ Male drivers were also more likely to drive more kilometres on average than female drivers were.

The social pricing of automobile insurance, increasing the proportion of high motor vehicle collision risk young drivers as principal operators of motor vehicles, therefore suggests a higher incidence of motor vehicle collisions and injuries than would be expected to occur under an insurance regime of actuarial pricing. Full social pricing in automobile insurance in British Columbia, through the Fundamental Auto Insurance Rating (“FAIR”) program, was implemented in 1980. The FAIR program phased out the rating factors of age, gender and marital status in the province. A review of motor vehicle injuries per million passenger kilometres shows unambiguously that in aggregate, social pricing jurisdictions in Canada had higher rates of injury per million passenger kilometres than actuarial priced jurisdictions (see Figure 3).⁵

Figure 3: **Road Safety in Canada**
- Actuarial and Social Pricing of Automobile Insurance -



Source: IBC, with data from Transport and Statistics Canada

Injury data from Transport Canada and trip data from Natural Resources Canada show that the number of injuries per million passenger kilometres has been declining throughout Canada since the 1970s. This downward trend in motor vehicle related collisions reflects improved motor vehicle design, the introduction of graduated licensing programs, improvements in driver training, programs to reduce impaired driving and increased seatbelt use by drivers and passengers (ICBC, 2001; CCMTA, 1998; Blincoe, 1996). Nevertheless, inspection of Figure 3 shows that in social pricing jurisdictions injuries per million passenger kilometres remained roughly constant throughout the 1980s.

⁴ Over the 8 quarters of the survey a principal operator between the ages of 16-24, 25-34, 35-49, 50-64 and 65+ on average drove 4,673; 4,652; 4,716; 4,290; 3,474 kilometres, respectively, every three months.

⁵ Individually, each of the socially priced provinces of British Columbia, Manitoba and Saskatchewan had higher rates of injury per million passenger kilometres over the period than actuarial priced provinces.

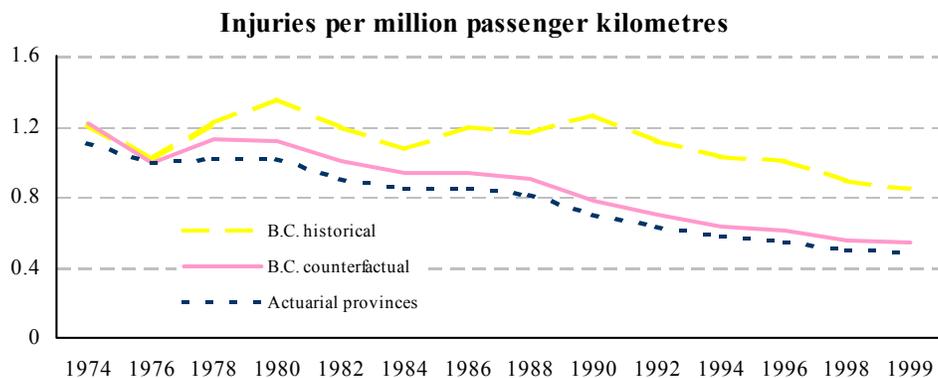
The availability of data constrains the application of econometric analysis to test the hypothesis that social pricing of automobile insurance creates incentives (making it cheaper for high-risk drivers and more expensive for low risk drivers) for increased high risk driving. Nevertheless the available evidence suggests that principal drivers, aged 16 to 24, on average, drive more kilometres than drivers of other age groups and are statistically higher risk drivers. In addition, for Canadian provinces with social pricing of insurance:

- A greater proportion younger drivers are principal owners (drivers) of vehicles;
- Injury collision rates among youth are higher than in other provinces, and
- Rates of injury per million passenger kilometres are consistently higher than those of actuarially priced provinces.

A Counterfactual Case: Actuarial Pricing

Motor vehicle collisions and injury rates across Canada have been declining throughout the 1990s. Nevertheless, this sustained downward trend in motor vehicle related injury and injury severity occurred nearly a decade later under social pricing than under actuarial pricing. The sustained decline in motor vehicle injury rates (per million passenger kilometres) began around 1980 (varies slightly by province) in actuarially priced environments and in the early 1990s for socially priced provinces. The Canadian automobile insurance market remains the only such major insurance market that continues to have socially priced insurance. Three provinces (British Columbia, Saskatchewan and Manitoba) socially price their automobile insurance product.⁶ Young drivers in these provinces are more than four times more likely to be the principal operator of a vehicle and twice as likely as their peers in actuarially priced provinces to be involved in an injury collision.

A counterfactual case of actuarial automobile insurance for British Columbia was constructed to investigate injury frequency and severity of motor vehicle collisions under such a regime and to compare with the historical case. Without sufficient data to econometrically estimate the relationship between insurance pricing regimes and motor vehicle collisions the counterfactual case was constructed using British Columbia’s historical data in 1974 and was adjusted from 1975 to 1999 using the average trend in motor vehicle injuries per million passenger kilometres for actuarial provinces.



Source: IBC, with data from Transport and Statistics Canada

⁶ In recent years modifications such as British Columbia’s years of driving experience (a proxy for age) rating criteria have been introduced.

The counterfactual case as constructed closely follows the trend of Canada's actuarially priced provinces but retains a level difference that reflects provincial characteristics. It is commonly argued that British Columbia's motor vehicle collision rate is naturally higher than that of other provinces due to its mountainous terrain. The constructed counterfactual case lies near the lower bound of the potential for reduced motor vehicle injury rate as a result of actuarial insurance pricing. Therefore the difference between the historical and counterfactual cases represents the set of potentially saved injury. The useful range for Pareto improvement is therefore the range between the counterfactual and historical cases.⁷

Using the counterfactual estimates of injuries per million passenger kilometres and the historical estimates of passenger kilometres driven in British Columbia, the total number of injuries were estimated for each year. As injury severity is a function of physical factors such as speed, safety belt use, terrain and vehicle manufacture rather than of insurance pricing, trends in injury severity were treated as constant between the historical and counterfactual cases. There is however considerable evidence that in addition to being more likely to be involved in a motor vehicle collision, younger drivers also have collisions involving more severe injuries (Ferguson et al, 1996; Li et al, 2001; Miller et al, 1998; Williams, 1995). Risky driving behaviour that results in greater collision frequency, such as driving at higher speeds and driving while impaired also increase the likelihood of increasing injury severity (Kim et al, 1998; Miller et al, 1998).

Actuarial pricing by creating incentives that reduce driving by younger, high risk, drivers and which reward good driving behaviour among all drivers may actually reduce both the level and the severity of motor vehicle collisions and injury. By holding injury severity constant between the historical and counterfactual cases, any estimation of injury severity associated with motor vehicle accidents in British Columbia under an actuarial pricing regime may contain an upward bias in these estimates.

The counterfactual actuarial insurance pricing case suggests that had injury per million passenger kilometer rates in British Columbia followed the trend experienced in actuarially priced provinces, in 1999, the province may have experienced up to 28,000 motor vehicle related injuries, down from the 43,913 persons reported injured. Motor vehicle related hospitalizations of a day or more would have fallen by an estimated 1,800 persons.

Summary

Motor vehicle collisions in British Columbia result in hundreds of fatalities annually and mean serious short or long-term disabilities for thousands of others. In 1999, one in every 92 people in British Columbia was injured in one of the estimated 112,000 motor vehicle collisions that occurred in the province. More than 5,100 of these people were hospitalized for more than a day. Canadian and international research is unambiguous in identifying youthful driving as a major contributor to motor vehicle collision risk.

In Canada more than one fifth of the population, in three provinces, drive under a regime of socially priced automobile insurance. These three provinces have historically have experienced the highest rates of motor vehicle related injury per million passenger kilometres in the country. Driver age is statistically one of the most important variables related to motor vehicle collision

⁷ A Pareto improvement occurs when social welfare is increased by a change that makes at least one individual better off, without making anybody else worse off

risk. There is considerable theoretical work that suggests that the social pricing of automobile insurance would be expected to provide incentives for increased driving by high-risk types. The available empirical evidence in Canada supports these theoretical conclusions.

Risk-based pricing creates incentives that reduce driving by younger, higher risk, drivers and rewards good driving behaviour among all drivers. These incentives reduce the frequency and severity of motor vehicle collisions. We estimate that an actuarial or risk-based pricing system for British Columbia's automobile insurance system would have saved up to 140 lives and resulted in up to 15,000 fewer injuries in 1999 alone over that of a social pricing insurance system.

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