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A review of recent theoretical and empirical analyses of asymmetric information in road safety and automobile insurance

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ABSTRACT

Road safety policies and automobile insurance contracts often use incentive mechanisms based on traffic violations and accidents to promote safe driving. Can these mechanisms improve road safety efficiently? Do they reduce asymmetric information between drivers and insurers and regulators? In other words, is there residual asymmetric information in observed distributions of accidents and infractions? We answer these questions in this article by reviewing recent theoretical and empirical results that rest on various data and methodologies. We present recent tests related to the identification of residual asymmetric information in road safety management and in automobile insurance contracting. We also propose a theoretical analysis of the foundations of point-record driver's licenses observed around the world.

1. Introduction

Asymmetric information problems are common in insurance markets. Usually, insured are better informed about their own characteristics or actions than their insurer is. The two best-known information problems discussed in the economics literature are moral hazard and adverse selection (Arrow, 1963). Moral hazard is the effect of contracts on individuals' unobserved behavior while adverse selection is explained by unobserved differences among individuals that affect the optimality of insurance contracting. Asymmetric learning is another information problem that can degenerate into adverse selection over time. Asymmetric learning is present when insured individuals learn about their risk (by observing their accidents) more rapidly than the insurer (which observes only the claims). Symmetric learning, in contrast, may lead to a full information environment between the parties after a given number of periods.[1] Doing statistical tests on the presence of a given asymmetric information problem is therefore very complicated, because the same correlation between contract characteristics and observed risk can be attributed to more than one information problem. It may also be attributed to other partially unobserved characteristics that are not well controlled in the statistical test (e.g. risk aversion, time preference). The predictions must then be carefully established in a theoretical model to distinguish the effect of each information problem.

Many theoretical contributions were published in the 1970s to account for stylized facts observed in insurance markets. The first models developed were one period or static. Partial insurance, such as deductible and coinsurance contracts, can be justified by asymmetric information (Holmström, 1979; Rothschild & Stiglitz, 1976; Shavell, 1979). However, a deductible can be optimal for moral

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[1] Symmetric learning creates a full information result only when the rate of learning (or updating perceived probabilities) is sufficiently high.

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hazard, adverse selection, or proportional administrative costs.[2] Risk classification based on observable characteristics and multi-period relationships between principal and agent are other mechanisms associated with the presence of asymmetric information.

Road safety policies and automobile insurance contracts often use incentive mechanisms based on traffic violations and accidents to promote safe driving. These mechanisms are monetary (fines, insurance premiums) and non-monetary (point-record driver's licenses). They are justified by the presence of asymmetric information in insurance contracting and in road safety regulation. Drivers have more information on their driving environment and safety behavior than insurers and regulators do. Short-term and long-term relationships between principal (insurer or regulator) and agent (driver) are part of the incentive mechanisms that can reduce the potential private and social costs associated with asymmetric information. These costs take various forms. In general, more asymmetric information is associated with fewer incentives to drive safely and more accidents. Given that asymmetric information implies less insurance coverage, this means that victims receive less compensation. More asymmetric information also implies stronger road safety regulation with associated monitoring costs (more police officers on the roads, more traffic radar use, etc.) to achieve social objectives. Finally, accidents may cause damage to other parties. Negotiations between many parties are costly; these externalities can be resolved through regulation or through traffic and accident laws (Priest, 1987; Shavell, 2004).

Can these incentive mechanisms improve road safety efficiently? Do they reduce asymmetric information between drivers, insurers and regulators? In other words, is there residual asymmetric information in observed distributions of accidents and infractions once these mechanisms are in place? In this chapter, we answer these questions by reviewing recent theoretical and empirical results based on various methodologies and types of data. The purpose of the review is to present recent tests related to the identification of residual asymmetric information in road safety management and in automobile insurance contracting in the presence of incentive mechanisms. We also propose a theoretical analysis of the foundations of point-record driver's licenses observed around the world.

The remainder of the chapter is organized as follows. Section 2 provides recent statistics on road safety around the world. We then review the literature on the economics of incentives in road safety management. Section 4 presents the theoretical models of point-record driver's licenses corresponding to those observed in North America and in Europe. Section 5 proposes a review of recent models that test for the presence of residual asymmetric information in insurance markets. Section 6 reviews two tests for the presence of residual moral hazard in automobile insurance data in detail, and Section 7 concludes the chapter.

2. Road safety around the world

Since the 1970s, fatality rates (with respect to population) due to road-traffic accidents have decreased steadily in developed countries despite increased risk exposure (OECD International Transport Forum, 2010). In addition, road accidents have declined steeply during the first decade of this century. This situation stands in sharp contrast with that of less developed regions, especially in low and middle income countries, where 90% of global road deaths occur. For example, the road fatality rate decreased by 48% in France during the 2000–2009 period, whereas it increased by 12% in Malaysia during the same period. The corresponding variations are −19% in the United States and +12% in Argentina. In 2009, the average number of fatalities per 100,000 people was 18 in Argentina and 6.3 in Canada (11.1 in the United States and 3.8 in the United Kingdom). These numbers are consistently lower for OECD countries and higher for emerging countries for which we have official data. Many factors can explain these differences. Risk exposure is an important one, but even when we control for this factor, differences between developed and less developed regions remain. The evidence suggests that risk exposure in less developed regions has increased significantly in recent years. If we concentrate on road fatalities per billion kilometers driven in 2008, the risk of dying in a road accident is lowest in Sweden (5.1) and the UK (5.2) while it is 8 in the United States, 17.7 in Malaysia, and 20 in Korea.

3. The economics of incentives in road safety management

One major reason for the improvement of the situation in the OECD has been the development of incentives for safe driving. Insurers and regulators have introduced several contract mechanisms and legal rules to reduce asymmetric information and improve road safety. Experience-rating schemes (either no-claims discount or bonus–malus) used by the insurance industry have incentive properties (Abbring, Chiappori, & Pinquet, 2003; Boyer & Dionne, 1989; Dionne & Vanasse, 1989, 1992). By adjusting the premium individuals pay to their driving history (past accidents and past demerit points), insurers set the price of road safety. These schemes are supplemented by point-record driver's licenses based on traffic violations. In many countries, each convicted traffic offense is filed with a specific number of demerit points. When the accumulated number of points exceeds a given threshold, the driver's license is suspended. Redemption clauses were added so that this penalty can be avoided in the long run. Bourgeon and Picard (2007) investigate the most important properties of point-record licenses in terms of road safety incentives and discuss how they can be combined with fines to design an optimal system that internalizes the social cost of road accidents. They do not take into account insurance pricing based on traffic violations and accidents. Dionne, Pinquet, Maurice, and Vanasse (2011) extend their model by considering insurance pricing based on demerit points, and compare the relative incentive efficiency of insurance pricing, fines and the point-record driver's license.

The North-American continent preceded Europe in the design of point-record systems. Point-record driver's licenses were introduced in the USA in 1947. By comparison, they were introduced in Germany, Québec, France, and Spain in 1974, 1978, 1992 and 2005, respectively. Incentive mechanisms for road safety have been investigated in the economic literature for many years (Blomquist, 1988; Boyer & Dionne, 1987; Cummins, Phillips, & Weiss, 2001; Cummins & Weiss 1992; Devlin, 1992; Dionne & Laberge-Nadeau, 1999; Graham & Garber, 1984; Landes, 1982; Peltzman, 1975). Of the many mechanisms proposed, we consider fines, point-record driver's licenses, partial insurance (deductible) and insurance experience rating. In the latter case, the individual driving history is usually summarized by past accidents or by point-records based on traffic offenses. We will not examine the incentive effects of the fault system closely.[3] Shavell (2004) discusses in detail how legal rules of liability influence parties' incentives to reduce accident risks. Negligence and strict liability rules are analyzed. In a fault system, the accident law introduces rules that govern the rights of

[2] Proportional administrative costs are generally measured by a constant multiplicative loading factor greater than one on the actuarial insurance premium.

[3] See Fagart and Fluet (2009) for a recent theoretical contribution, and Cohen and Dehejia (2004) for a recent empirical analysis.

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