Safety in Transport

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Even though the safety risks have fallen by at least half in all modes of transport in the past fifty years, the absolute level of harm is still very high. In the United States, one in 6,000 of the population dies each year in a transport crash (note that safety professionals prefer the word "crash" to "accident" because the latter suggests that occurrence is due to pure fate and cannot be influenced by human decisions). The annual death toll represents half of all accidental fatal injuries when one includes workplace injuries but excludes homicides and suicides. Studies have found that just the direct costs of highway crashes are equivalent to 2.6% of Gross National Product.

The vast majority of the fatalities, 85%, occur when private highway users, pilots and mariners are involved in single vehicle/aircraft/vessel crashes or collide with other private users. A further 13% of fatalities occur in situations where these private users are in collision with commercial operators, such as when trucks collide with cars, or trains collide with cars at grade crossings. Only about 2% of fatalities exclusively involve commercial transport, and nearly all of the casualties are employees. Therefore, despite receiving a considerable amount of press attention, the number of aviation, bus and train passenger fatalities is, in the global scheme of things, quite small.

When fatality counts are expressed relative to passenger miles, bus and commercial aviation have the best passenger safety records. In the United States the risk is about one fatality for every five billion passenger miles. Riding the train is four times as risk, and driving is twelve times more risky than taking the train. Employment in transport is also relatively risky. Employees in the maritime and trucking industries face twice as much risk than they would if they were working in construction. In contrast, railroad and aviation employees face much less risk, but these risks are still higher than in manufacturing industries. It is not surprising that much of the public concern for safety has originated from organized labor.

While the level of harm is substantial, one cannot tell from risk data whether transport safety is "a problem." To the economist, if a person knows of, and can evaluate, both the benefits and the risks, and still decides to travel then there is no inherent problem. Consequently society only minimally intervenes in the decisions made by private aviators and recreational boaters. The case for intervention is much stronger when one or more of the following six market failures are present.

The first failure occurs when people are not knowledgeable about the risks. This is more likely in commercial passenger transport where crashes are rare, and passengers do not have the

knowledge and access to understand crash data. In contrast, freight shippers are repeat purchasers who deal with carriers on a daily basis to settle claims for minor loss and damage to their products.

The second possible failure is that even fully informed people may make poor choices due to cognitive processes. People have a tendency to overestimate the possibility of low probability events and events that kill multiple people at any one time. Working in the opposite direction is the possibility that some people underestimate risk because the consequences are too horrendous to contemplate, and have a feeling of invincibility that bad outcomes "will not happen to me." It is not an understatement to suggest that much of society's intervention is to protect people from themselves rather than from avaricious carriers and third parties.

The third failure is myopic behavior by some carriers. Avaricious carriers can take advantage of imperfectly informed consumers by reducing expenditures on safety but masquerading as offering high safety and charging a premium price. As crashes occur rarely, even for careless carriers, it may take some time before consumers become aware and either shun the carrier or demand a lower price. In the meantime a myopic carrier can earn short-term profits.

The fourth possible failure occurs when crashes cause oil spills or result in the release of explosive or toxic materials that impose externality costs on bystanders. Work by psychologists suggests that bystanders are much more intolerant of the risks that they face than are people who derive some benefit from the risky activity either as users or employees.

The fifth possible failure is associated with collisions between private users, and when private users have crashes with commercial carriers. These collisions are called "bilateral crashes" because the actions of both parties influence the probability of occurrence. There is a complicated literature in law and economics that discusses the socially-optimal actions of both parties, and the role of legal mechanisms to compensate victims, penalize perpetrators and generally give both parties the correct incentives to take appropriate "care."

The sixth and final possible failure is concerned with the amount of competition. Individual drivers, passengers and shippers may have varying tastes for the amount of safety that they desire. In some markets, such as trucking, there are thousands of carriers of every ilk, and shippers can find a service that matches their taste. However, in other markets there is less competition and such a matching of tastes is unlikely.

The applicability and magnitude of the six market failures vary significantly by mode. Consequently, public policy prescription in each mode needs to be tailored to the market failures that are present.

Public policy on private automobile travel is often characterized using a 3x3 matrix. The categories on one axis are the driver, the vehicle, and the highway. The other axis is composed of actions before a crash ("crash avoidance"), the crash phase, and the post-crash phase. Traditionally, policy has been directed to the top left-hand cell of this matrix, and the minority of drivers who do not appreciate the risks and do not conduct themselves in a prudent manner (Evans, 1991). These problem drivers can be divided into four categories. The first are young drivers, especially males,

who are both inexperienced and prone to risky behaviors. The second group is the growing ranks of older motorists, whose driving performance deteriorates markedly after the age of 65. The third group comprises people who drive while under the influence of alcohol. The final group consists of drivers who fit into none of the above categories yet seem to be more risk loving and/or accident prone than other drivers.

Starting in the 1960s there was a conscious move to attack traffic safety via other cells in the matrix. For example, a significant reduction in fatality risk has come from improved medical response in the post-crash phase. Highway design is clearly important in both promoting crash avoidance and mitigating the harm when a crash occurs (Lamm *et al.*, 1999). Regulations were promulgated that imposed automotive solutions that promote crash avoidance and increased survivability in the event of a crash.

In analyzing commercial transport safety, one needs to consider the economic incentives for carriers. Safety is just one attribute of the transport product, and one that is valued by consumers but costly to provide. A monopolist, such as an infrastructure provider, would decide on the optimal safety to provide by equating the marginal revenue from providing a higher quality service with the marginal cost of doing so. In a competitive market it is possible that vertical differentiation may emerge whereby some carriers offer high quality at a premium price, and others offer lesser quality at lower prices. There is a growing literature on how safety is produced. In particular, there is a concept of "organizational accidents," whereby firms make conscious choices on the inherent safety of their production processes and the layers of "defenses" that they build into their systems to protect against naturally occurring human and environmental errors (Maurino *et al.*, 1995).

As described earlier, imperfect consumer information allows the opportunity for some carriers to act in a myopic fashion. Not all carriers will act in this way, as they would not wish to lose future custom if their reputation is sullied, and they fear legal suits and increased insurance premiums in the event of a crash. However, in most modes, there is a need for governmental intervention to supplement market discipline. One, traditionally underutilized, option is to attack the root cause of the problem by providing safety ratings and crash information directly to consumers. More common is direct regulation. There is a plethora of regulations in every mode that define acceptable safety standards, and provide for inspections to certify compliance. Traditionally, the designated standards have been expressed in terms of the quality and quantity of staff and equipment. There is a discussion as to whether switching to "performance standards," which designates minimum acceptable crash rates, would lead to a more efficient delivery of safety without sacrificing effective enforcement.

References

Evans, L. (1991). *Traffic Safety and the Driver*. Van Nostrand Reinhold, New York.

Lamm, R., B. Psarianos and T. Mailaender (1999). *Highway Design and Traffic Safety Handbook*. McGraw-Hill, New York.

Maurino, D.E., J. Reason, N. Johnson and R.B. Lee (1995). *Beyond Aviation Human Factors: Safety in High Technology Systems*. Ashgate, Aldershot, U.K.