SPEED BUMPS ON THE ROAD TO PROGRESS: HOW PRODUCT LIABILITY SLOWS THE INTRODUCTION OF BENEFICIAL TECHNOLOGY—AN AIRBAG EXAMPLE

INTRODUCTION

> Technological innovation has driven the American economy, over the past century, to the exclusion of virtually all other growth factors.[1]

From its inception in 1790 through 2003, the United States Patent and Trademark Office granted 7,160,561[2] patents based on over twelve million[3] applications. The United States alone spends over $271 billion, or 2.7 percent of its gross domestic product, on research and development each year.[4]

Given the massive investment in technology and the great potential it has to improve our quality of life, it would seem natural, even essential, that the law would develop in a way that encourages the rapid adoption of technological advances. Our legal system, however, acts to retard the introduction of new and beneficial technology.[5] Specifically, product liability creates significant disincentives for the adoption of new technology.[6]

Airbags provide an example of how product liability can prompt manufacturers to delay the introduction of new technology. In the early days of airbag technology, experts had grand visions of the wonderful effect that airbags would have.[7] In 1977, the National Highway Transporta-

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1 Hilton Davis Chem. Co. v. Warner-Jenkinson Co., 62 F.3d 1512, 1529 (Fed. Cir. 1995) (Newman, J., concurring) (footnote omitted).

2 U.S. PATENT AND TRADEMARK OFFICE, PATENT TECH. MONITORING DIV., U.S. PATENT ACTIVITY CALENDAR YEARS 1790 TO THE PRESENT (2004), *available at* http://www.uspto.gov/web/offices/ac/ido/oeip/taf/h_counts.pdf. Patents granted equal the sum of all utility, design, and plant patents.

3 *Id*. Total applications include applications for utility, design, and plant patents. Application count includes as applications utility patents granted prior to July 4, 1836 and design patents granted prior to 1880 when patents were granted upon filing with no examination. *Id*.

4 U.N. DEV. PROGRAM, HUMAN DEVELOPMENT REPORT 2003: MILLENNIUM DEVELOPMENT GOALS—A COMPACT AMONG NATIONS TO END HUMAN POVERTY at 274, U.N. Sales No. 03.III.B.1 (2003), *available at* http://hdr.undp.org/reports/global/2003/pdf/hdr03_complete.pdf. Other industrialized nations spend similar portions of their gross domestic product: Japan 3.0%, Germany 2.5%, France 2.2%, UK 1.9%. *Id*.

5 *See* Mark F. Grady, *Why Are People Negligent? Technology, Nondurable Precautions, and the Medical Malpractice Explosion*, 82 NW. U. L. REV. 293 (1988) [hereinafter Grady, *Why Negligent?*].

6 *See id*. at 294-95. Grady describes an example of how technology can increase legal bills. *Id.*

7 As early as 1972, Allstate Insurance began equipping its company cars with airbags and offering discounts to customers who owned cars with airbags. Fred Mannering & Clifford Winston, *Automobile Air Bags in the 1990s: Market Failure or Market Efficiency?*, 38 J. L. & ECON. 265, 265 (1995).

tion and Safety Agency predicted that airbags could save 12,000 lives annually and prevent an additional 100,000 injuries.[8] Despite these predictions, the automotive industry almost continuously opposed airbags until at least the early Nineties[9] in the face of sharp and pervasive criticism.[10] The Supreme Court of the United States went so far as to accuse the automobile industry of waging war on airbags.[11]

This Comment contends that automobile manufacturers were neither stubborn nor irrational, but rather that they were simply rationally responding to the disincentives created by the doctrine of strict product liability. These same disincentives have the potential to inhibit the introduction of many other new technologies.[12] Part I provides a brief history of the airbag. Part II discusses the costs and benefits of technology. Part III examines the relationships between risk transfer, product liability, and the adverse incentives manufacturers face when introducing new technology. This Comment concludes that automakers were concerned about the unmanageable liability they might face and justifiably reluctant to assume that liability.

I. A BRIEF HISTORY OF AIRBAGS

In 1953, the United States Patent and Trademark Office issued the first airbag patent to John W. Hetrick, an engineering technician from Pennsylvania.[13] Hetrick conceived of the device following an accident on a Sunday afternoon drive with his family,[14] but the inspiration came from an incident

8 Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co., 463 U.S. 29, 35 (1983) (citing 42 Fed. Reg. 34,298 (July 5, 1977)).

9 As of 1983, only Mercedes Benz offered driver-side airbags in the United States. Mannering & Winston, *supra* note 7, at 265. As late as 1988, only two percent of new cars had airbags. *Id*. In 1984, Chrysler CEO, Lee Iacocca cited air bags as example of a "solution being worse than the problem." Motorvista, *History of Airbags*, *at* http://www.motorvista.com/airhist.htm (last visited Mar. 7, 2006). It was only in 1988 that Chrysler had a change of heart and became the first American automaker to install drivers-side airbags on all its domestic-made cars. *Id*.

10 *See, e.g.,* Frank Waters, Comment, *Air Bag Litigation: Plaintiffs, Start Your Engines*, 13 PEPP. L. REV. 1063, 1063 (1985) ("[A]uto makers have failed to provide consumers with the 'air bag system,' a proven safety device, when the technological means to do so have been available for over a decade." (footnote omitted)).

11 *See Motor Vehicle Mfrs.*, 463 U.S. at 49 ("For nearly a decade, the automobile industry waged the regulatory equivalent of war against the airbag and lost . . . .").

12 *See* Grady, *Why Negligent?*, *supra* note 5, at 294-95.

13 Don Sherman, *The Rough Road to Air Bags*, INVENTION & TECH., Summer 1995, at 48, *available at* http://www.americanheritage.com/articles/magazine/it/1995/1/1995_1_48.shtml. Hetrick's patent is U.S. Patent No. 2,649,311 (Aug. 18, 1953), entitled "Safety Cushion Device for Automotive Vehicles."

14 *Id.*

that occurred years earlier when compressed air in a torpedo Hetrick was repairing suddenly released, inflating the torpedo's canvas cover.[15] However, Hetrick's device was unusable at the time.[16] No triggering device existed that could react fast enough for the airbag to function properly.[17] The airbag idea languished until 1966, when the United States Army developed a capable trigger in response to NASA's need to protect astronauts.[18]

In the first automotive application, Ford decided to use airbags in its full-size Ford and Mercury cars starting with the 1971 model year.[19] However, technical obstacles and liability concerns prevented Ford from commercializing the airbag.[20] In 1973, General Motors Company became the first automaker to install airbags in production vehicles when it installed airbags in one thousand Chevrolet Impalas.[21] General Motors followed-up in 1974 to 1976, offering customers an airbag option and selling 10,321 Oldsmobile, Buick, and Cadillac cars equipped with airbags.[22] However, this number fell far below General Motor's expectations, and the company withdrew the option.[23]

Despite the technical and market hurdles, the potential of airbags seemed vast, and Secretary of Transportation Brock Adams issued a new mandatory passive restraint regulation, known as Modified Standard 208.[24] "The Modified Standard mandated the introduction of passive restraints beginning with large cars in model year 1982 and extending to all cars by

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15 *Id.*

16 *Id*.

17 Sherman, *supra* note 12. In the late fifties, Ford Motor Company looked briefly at airbags. *Id.* Ford discovered that the triggering device would have to react within forty milliseconds. *Id.* Since no existent triggering device could react that rapidly, Ford pushed the airbag down its list of priorities. *Id.*

18 *Id*.

19 *Id*.

20 Sherman, *supra* note 12 (noting Ford's concern "that child-size dummies received what could be fatal blows from air bags during crash tests.").

21 *Id*.

22 *Id*.

23 *Id*. General Motors had hoped to sell 100,000 airbag equipped automobiles per year. Motorvista, *supra* note 9.

24 42 Fed. Reg. 34,289, (July 5, 1977); 49 C.F.R. § 571.208 (1978). In *Pacific Legal Foundation v. Department of Transportation*, 593 F.2d 1338 (D.C. Cir. 1979), *cert. denied*, 444 U.S. 830 (1979), the Court of Appeals upheld Modified Standard 208 as a rational, non-arbitrary regulation consistent with the agency's mandate under the Act. The Standard also survived scrutiny by Congress, which did not exercise its authority under the legislative veto provision of the 1974 Amendments. No action was taken by the full House of Representatives. The Senate Committee with jurisdiction over NHTSA affirmatively endorsed the Standard, S. Rep. No. 95-481 (1977), and a resolution of disapproval was tabled by the Senate. 123 Cong. Rec. 33332 (1977).

model year 1984."[25] The automakers were left with the choice to install either airbags or automatic seat belts.[26]

The airbag seemed to be on its way to universal acceptance. However, in 1981, after a change in administration, Secretary of Transportation Andrew Lewis reopened the rulemaking.[27] Two months later, NHTSA ordered a one-year delay extending the large car deadline to the 1983 model year.[28] At the same time, the agency also proposed a possible rescission of the entire Standard.[29] After receiving written comments and holding public hearings, NHTSA issued a final rule that revoked the passive restraint requirement contained in Modified Standard 208.[30]

However, NHTSA's rescission of the rule was not based a change in opinion regarding the effectiveness of the passive restraint technology.[31] Rather, NHTSA promoted the rule change based on changed predictions about the auto industry's plans.[32] When it propagated the rule in 1977, NHTSA assumed that automakers would install airbags in 60% of new cars and install automatic seatbelts in 40%.[33] However, by 1981, the automotive industry planned to install automatic seatbelts in 99% of cars and airbags in fewer than 1%.[34]

Though the United States Supreme Court later ruled, in *Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Insurance Co.*,[35] that the rescission of Modified Standard 208 was "arbitrary and capricious,"[36] the automotive industry still did not embrace the airbag.[37] Even

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25 *Motor Vehicle Mfrs.*, 463 U.S. at 37.

26 *Id*.

27 *Id*. at 38 (citing 46 Fed. Reg. 12,033 (Feb. 12, 1981)).

28 *Id*. (citing 46 Fed. Reg. 21,172 (Apr. 9, 1981)). In the mean time, Ronald Reagan had become president and appointed Elizabeth Dole as the new Transportation Secretary. General Motors Corporation, *Air Bag History*, GMability, *at* http://www.gm.com/company/gmability/safety/protect_occupants/air_bags (follow "View timeline of GM's air bag history" hyperlink) (last visited Mar. 7, 2006).

29 *Motor Vehicle Mfrs.*, 463 U.S. at 37 (citing 46 Fed. Reg. 21,205 (Apr. 9, 1981)).

30 Notice 25, 46 Fed. Reg. 53,419 (Oct. 29, 1981).

31 *Motor Vehicle Mfrs.*, 463 U.S. at 38.

32 *Id*.

33 *Id*.

34 *See id.*

35 *Id*.

36 *See Motor Vehicle Mfrs.*, 463 U.S. at 39. The Court of Appeals for the District of Columbia had ruled that the rescission was "arbitrary." State Farm Mut. Auto. Ins. Co. v. Dep't of Transp., 680 F.2d 206, 242 (D.C. Cir. 1982). The Supreme Court upheld the Court of Appeals decision and remanded the issue to the NHTSA for further consideration. *Motor Vehicle Mfrs.*, 463 U.S. at 57.

37 In response to the courts ruling in *Motor Vehicle Manufacturers*, transportation secretary, Elizabeth Dole, issued a rule in 1984 requiring automatic belts or air bags in all cars by 1990, but she included an escape route: If states representing two-thirds of the U.S. population enacted mandatory-use seat belt laws before April 1989, the passive-restraint regulation wouldn't take effect. James R. Healey & Jayne O'Donnell, *Deadly Air Bags: How a Government Prescription for Safety became a Threat to*

after the Supreme Court ruling, the automotive industry continued to oppose the adoption of airbags and NHTSA delayed the airbag requirement several times.[38] Mercedes Benz was the first automaker to finally reintroduce airbags as an option on its 1984 models and as standard equipment on its 1986 models.[39] Since then airbags have gained the upper hand. They have been required on all passenger cars since September 1997 and light trucks since September 1998.[40]

While initial estimates about the life-saving efficacy of airbags have proven to be overstated,[41] it seems clear that airbags do save a significant number of lives.[42] Given that airbags effectively save lives, it seems odd that the automotive industry was so resistant. The auto industry obviously does not benefit by having its customers die. Why, then, would the automakers object to installing a life-saving device in their cars? This Comment argues that the answer to this question can be found in the interaction between technology, risk and the law.

II. TECHNOLOGY: BENEFITS AND COSTS

Consumers come to the market with a limited income and must choose between competing uses of that income.[43] Accordingly, a product will succeed only if it provides a benefit which consumers are willing to trade for

Children, USA TODAY, July 8, 1996, at B1. Automakers strongly supported the state laws, hoping to defeat the airbag requirement of the rule. *Id*.

38 In 1986, NHTSA allowed automakers to meet passive-restraint requirements through the 1990 model year with only driver-side air bags. Motorvista, *supra* note 9. In 1987, NHTSA allowed automakers to meet passive-restraint requirements with driver-side air bags until the 1994 model year. *Id*.

39 Sherman, *supra* note 13.

40 Intermodal Surface Transportation Efficiency Act of 1991, Pub. L. No. 102-240, §§ 2508(a)(1), (b)(1), (b)(2), 105 Stat. 1914, 2084-86, *available at* http://www.house.gov/transportation/highway/compilations/istea91_.pdf.

41 NHTSA estimated life savings of 12,000 per year. *Motor Vehicle Mfrs*., 463 U.S. at 34 (citing 42 Fed. Reg. 34,298 (July 5, 1977)). However, current estimates of lives saved are about one fifth this estimate at 2,488 lives saved in 2003. NHTSA, NAT'L CTR. FOR STATISTICS & ANALYSIS, DOT HS 809 765, TRAFFIC SAFETY FACTS 2003: OCCUPANT PROTECTION 5 (2004), [hereinafter SAFETY FACTS 2003], *available at* http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF2003/809765.pdf.

42 An estimated 14,227 lives were saved by airbags between 1987 and 2003. SAFETY FACTS 2003, *supra* note 41, at 5. Additionally, airbags reduce the likelihood of moderate or greater injuries by 73% when used with a seat belt. NHTSA, NAT'L CTR. FOR STATISTICS & ANALYSIS, DOT HS 809 442, FIFTH/SIXTH REPORT TO CONGRESS: EFFECTIVENESS OF OCCUPANT PROTECTION SYSTEMS AND THEIR USE 12 (2001) [hereinafter FIFTH/SIXTH REPORT], *available at* http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/Rpts/2002/809-442.pdf. The debate about the true value of airbags rages to this day, but it seems clear that at least driver's side airbags constitute a worthwhile safety investment. *See* J.D. Graham et al., *The Cost-Effectiveness of Air Bags by Seating Position*, 278 JAMA 1418 (1997).

43 RICHARD IPPOLITO, ECONOMICS FOR LAWYERS 3 (2005).

some other potential use of their income. Unfortunately, some counterbalancing cost often accompanies a product's benefit as an inherent byproduct of the technology itself.[44] Society gains by adopting a product when the product's benefits outweigh its costs.[45] Therefore, society's first reaction to any new product should be to evaluate the benefit versus cost.[46] If the benefits outweigh the costs, the product will succeed. If the costs outweigh the benefits, the product will fail. However, problems arise because this balancing analysis is very often complicated, subjective, and uncertain.[47] With each new technological advance, society faces the difficult task of collectively making an efficient decision about the new technology's costs and benefits.[48] A number of factors and systems influence how we make these decisions, including: our personal preferences, the market system, and the law.[49] In order to understand the law's effect, it helps to first understand some of the costs and benefits a new product might present. This Comment uses airbags as a case study for analyzing these costs and benefits.

The benefits of any new technology can be categorized under three main types: (1) new utility, (2) increased efficiency, and (3) reduced risk. A new-utility technology provides an entirely new benefit. People can now do something that they could not do before the technology was developed. Examples of a new utility technology include space flight and bungee jumping. Before the required technology was developed, people could not travel into space at any price or jump off a bridge and live to tell about it.[50] Increased-efficiency technology allows people to do things they currently

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44 These effects are what economists typically refer to as externalities. *Id*. at 229. For example, modern air travel allows us to commute easily across great distances; however, it also carries with it costs such as noise pollution which the surrounding communities must bear. *Id*. at 230. The cost also includes "opportunity costs." *Id*. at 120-21. Opportunity costs are those benefits which could have been realized had the resources been used to acquire some other technology or, in other words, the value of the next best use of the resources consumed by chosen technology. *Id*.

45 The main objective of a cost-benefit analysis is that it allows individual consumers and society at large to weigh varying options and most efficiently allocate limited resources. *See* Raymond J. Kopp et al., *Cost-Benefit Analysis and Regulatory Reform: An Assessment of the Science and the Art* 2 (Resources for the Future, Discussion Paper 97-19, 1997).

46 *Id*. at ES-1 ("Individual welfare is assumed to depend on the satisfaction of individual preferences, and monetary measures of welfare change are derived by observing how much individuals are willing to pay, i.e., willing to give up in terms of other consumption opportunities.").

47 *See* Kopp, *supra* note 45, at 7-8. Some of the significant problems include: economic valuation of non-financial benefits, aggregation of individual preferences, and equity concerns. *Id*. at 8-12.

48 *Id*.

49 *Id*. at 15. Table 3A-1 shows a brief listing of some of the complexity that results for the various competing factors and the different ways those factors can be evaluated. *Id.*

50 *But see* BUNGEE.LT, *The History of Bungee Jumping*, http://www.bungee.lt/en/history.html (contradicting the assertion that you need advanced technology to bungee jump) (last visited Mar. 7, 2006).

do in a different, more efficient way. An example of this type of benefit is the commercial airliner. Commercial air travel is generally not a utility in and of itself, but a more efficient means to an existing end. Prior to air travel, people traveled from city to city—now they can do so more efficiently.

Finally, risk-reducing technologies allow people to do things they currently do, in the way they currently do them, but with a reduced risk.[51] Products aimed primarily at risk reduction are often referred to as "safety devices," and that term is used synonymously with risk-reducing technology.[52] Safety devices' primary purpose is to reduce the risk of existing activities.[53] Safety devices do not create a new utility, nor do they improve the efficiency of an existing activity in the typical sense.[54] Airbags are an example of a risk reducing technology. Airbags do not make automobile travel possible, nor do they improve fuel efficiency or reduce transit times.[55] However, airbags do reduce the risk of automobile travel.[56]

Risk is a composite of two separate elements and is calculated by multiplying the probability that an undesirable event will take place by the cost

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51 There is, of course, significant overlap. Risk reducing technology may reduce the risk of a known but impracticable activity to an acceptable level and thus make a new utility possible. (Think about bungee jumping again). Risk reducing technology also increases the efficiency of existing activities. By reducing the risk, the Risk reducing technology reduces the cost and therefore improves the efficiency. However, risk reducing technologies differ from efficiency increasing technologies in that efficiency increasing technologies may actually increase the overall risk in exchange for efficiency gains elsewhere.

52 A safety device is defined as "a device designed to prevent injury." WORDNET: A LEXICAL DATABASE FOR THE ENGLISH LANGUAGE (2d ed. 2004), http://wordnet.princeton.edu.

53 For example, in the context of firearms, 18 U.S.C. § 921(a)(34) defines a "safety device" as:

> (A) a device that, when installed on a firearm, is designed to prevent the firearm from being operated without first deactivating the device; (B) a device incorporated into the design of the firearm that is designed to prevent the operation of the firearm by anyone not having access to the device; or (C) a safe, gun safe, gun case, lock box, or other device that is designed to be or can be used to store a firearm and that is designed to be unlocked only by means of a key, a combination, or other similar means.

This definition is clearly not aimed at new firearms nor at devices that increase the efficiency or effectiveness of existing firearms. The defined devices are solely intended to reduce the risk of existing firearms.

54 A list of "safety devices" compiled by the International Healthcare Worker Safety Center at the University of Virginia details over one hundred medical related safety devices, none of which is used to perform a new procedure. International Healthcare Worker Safety Center, University of Virginia, *List of Safety-Engineered Sharp Devices* (2003), http://www.healthsystem.virginia.edu/internet/epinet/safetydevice.cfm.

55 NHTSA, Air Bag Basics, http://www.safercar.gov/airbags/pages/ABBasicsFront.htm [hereinafter Air Bag Basics] ("Air bags reduce the chance that an occupant's upper body or head will strike the vehicle's interior during a crash.") (last visited Mar. 7, 2005).

56 *See* J. D. Graham et al., *supra* note 41, at 1418.

of such an event were it to occur.[57] Accordingly, safety devices can reduce the overall risk of an activity in two ways. First, the safety device could reduce the likelihood that an unwanted event would occur, and second, the safety device could reduce the cost of an undesirable event once it has occurred.[58]

This is best explained by a comparison of two automotive safety devices. Anti-lock braking systems are an example of a safety device that reduces the likelihood an unwanted event will occur.[59] The primary purpose of anti-lock brakes is to prevent accidents.[60] Anti-lock brakes do nothing to mitigate the damage once a collision has occurred.[61] By contrast, airbags fulfill the opposite role. Airbags do nothing to reduce the chance of a collision.[62] Rather, they reduce the cost of a collision when it occurs.[63]

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57 *See* United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947) ("[I]f the probability be called P; the injury, L; and the burden, B; liability depends upon whether B is less than L multiplied by P: i.e., whether B less than PL."). The given definition of risk is simply equal to one side of the famous Learned Hand Formula. Risk = PL where P equals the probability of some event occurring and L equals the injury or cost if that event does occur.

58 *See id.* If risk is defined as equal to PL then there can be only two ways to reduce the risk: reduce the probability of harm occurring (P), or reduce the effect of the harm if it does occur (L). *C.f.* Grady, *Why Negligent?, supra* note 4, at 297 (suggesting that "risk-loading technologies" tend to be aimed at reducing the effect of harm, while "risk-dumping technologies" tend to be aimed at reducing the probability of harm).

59 Stephen Dirksen, Brakes, http://web.bryant.edu/~ehu/h364proj/sprg_97/dirksen/brakes.html (last visited Feb. 25, 2006).

> [Anti-lock brakes help] drivers maintain control when braking in wet or slippery conditions . . . . With normal brake systems, when the brakes are applied in slippery conditions, the wheels lock up and the car can easily lose control since it can not [sic] be steered as effectively. With an anti-lock braking system the wheels never lock up so drivers can still steer and therefore better maintain control of their cars.

Id.

60 Insurance Institute for Highway Safety, Q&A: Antilock Brakes: Cars, Trucks, Motorcycles (Dec. 2005), http://www.iihs.org/research/qanda/antilock.html ("Antilock brakes are designed to help drivers avoid crashes.").

61 *See id*.

62 There is, in fact, evidence that airbags increase the likelihood of collisions. An analysis of 1993 Virginia State Police accident reports indicated that "air-bag-equipped cars tend to be driven more aggressively and that aggressiveness appears to offset the effect of the air bag for the driver and increases the risk of death to others." Steven Peterson et al., *Are Drivers of Air-Bag-Equipped Cars More Aggressive? A Test of the Offsetting Behavior Hypothesis*, 38 J. L. & ECON. 251, 251 (1995). If this conclusion holds true then driver behavior is changing airbags from a risk reducing technology into a new utility technology. Drivers are now able to drive in an aggressive manner that would not be acceptable without airbags. *Id*.

63 This reduction in cost is measured by the reduction in injury to the airbag-equipped vehicle occupants. *See* Air Bag Basics, *supra* note 55.

A. *Airbags Reduce Risk*

Empirical evidence shows that airbags are effective at reducing the risk of driving by lowering the cost of accidents that occur. NHTSA estimates that airbags saved 2,488 lives in 2003.[64] In total, from 1975 through 2003, airbags have saved an estimated 14,227 lives.[65] Given that during 2003 a total of 33,471 vehicle occupants were killed in traffic accidents,[66] the 2,488 lives saved by airbags represents a reduction of 14.5% in the number of vehicle occupants that would otherwise have been killed without the use of airbags.[67] A NHTSA report prepared for Congress in 2001 estimated that airbags reduced the fatality risk for passenger car drivers by 14% when the airbag was used alone and by 51% when an airbag was used in conjunction with a seatbelt.[68] This risk reduction increases significantly when the analysis is limited to fully frontal crashes, with a reduction in the fatality risk of 36% for unbelted drivers and 21% over seatbelts alone for drivers using a seatbelt.[69]

In addition to reducing the risk of fatalities, airbags also significantly reduce the risk of non-fatal injuries. In the same report, NHTSA estimated that, when used alone, an airbag reduces the likelihood of a driver suffering moderate or greater injuries during an accident by 29%.[70] Using an airbag in conjunction with a seatbelt reduced the risk by 73% compared to at most 60% from seatbelts alone.[71]

Recent data clearly shows that airbags are effective at reducing the risk inherent in driving. This recent data corroborates, at least to a significant degree, historic predictions prior to the widespread use of airbags and concurrent data collected during the airbag adoption period. A study conducted by NHTSA in 1977 predicted that airbags could save approximately

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64 SAFETY FACTS 2003, *supra* note 41, at 5. This compares to an estimated 14,903 lives saved by seatbelts in 2003. Airbags thus decreased the number of lives lost by 16.7% over seatbelts alone. *See id.*

65 *Id*.

66 NHTSA, NAT'L CTR. FOR STATISTICS & ANALYSIS, DOT HS 809 775, TRAFFIC SAFETY FACTS 2003, A COMPILATION OF MOTOR VEHICLE CRASH DATA FROM THE FATALITY ANALYSIS REPORTING SYSTEM AND THE GENERAL ESTIMATES SYSTEM (2004) [hereinafter COMPILATION 2003], *available at* http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSFAnn/TSF2003F.pdf.

67 Percentage reduction in lives lost was calculated by adding the 2,488 lives saved to the 33,471 lives lost and determining the percentage of this total represented by the 2,488 lives saved (2,488/(33,471 + 2,488)). *See id*.

68 FIFTH/SIXTH REPORT, *supra* note 42, at 9. Seatbelt use alone resulted in a fatality risk reduction of 45%. *Id.*

69 *Id*. at 11.

70 *Id*. at 12.

71 *Id*.

12,000 lives per year and prevent over 100,000 serious injuries.[72] Annual reports developed by NHTSA from 1993 to the present show a steady increase in the number of lives saved by airbags.[73] Even though airbags have not necessarily produced the predicted magnitude of benefit,[74] it seems clear that at no time during the last thirty years has there been any doubt that airbags were generally effective at reducing risk.

B. *Continued Industry Resistance*

Given that airbags provide a benefit by reducing the cost of collisions, there are several possible reasons that might explain why automakers resisted the adoption of airbags. First, the automobile manufacturers could have been stubborn or irrationally resistant to airbags.[75] Modified Standard 208 gave automakers the option of installing either airbags or automatic seatbelts.[76] The automakers overwhelmingly chose to install automatic seatbelts.[77] Upon finding that automatic seatbelts did not meet the standard's safety goals, NHTSA revoked the standard.[78] The Supreme Court held that NHTSA's decision was arbitrary and capricious because NHTSA

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72 *Motor Vehicle Mfrs.*, 463 U.S. at 34 (1983) (citing 42 Fed. Reg. 34298). These estimates consider the use of passive restraints which are either airbags or automatic seatbelts. *Id.*

73 *E.g.*, NHTSA, NAT'L CTR. FOR STATISTICS & ANALYSIS, TRAFFIC SAFETY FACTS 1993: OCCUPANT PROTECTION 5 (1994) (1993 version of report produced annually), *available at* http://www-nrd.nhtsa.dot.gov/pdf/nrd-30/NCSA/TSF93/occprt93.pdf.

74 Compare 1977 estimate of 12,000 lives saved annually, *Motor Vehicle Mfrs.*, 463 U.S. at 34 (citing 42 Fed. Reg. 34,298 (July 5, 1997)), to 2003 data showing 2,488 lives saved annually, Safety Facts 2003, *supra* note 41, at 5.

75 *See Motor Vehicle Mfrs.*, 463 U.S. at 48-50 ("Given the effectiveness ascribed to airbag technology by the agency, the mandate of the Act to achieve traffic safety would suggest that *the logical response* to the faults of detachable seatbelts would be to require the installation of airbags.") (emphasis added).

76 42 Fed. Reg. 34,289 (July 5, 1977); 49 C.F.R. § 571.208 (1978).

77 *Motor Vehicle Mfrs.*, 463 U.S. at 38 ("By 1981 it became apparent that automobile manufacturers planned to install the automatic seatbelts in approximately 99% of the new cars.").

78 *Id*. In the opinion of the Court, Justice White explained:

> Moreover, it now appeared that the overwhelming majority of passive belts planned to be installed by manufacturers could be detached easily and left that way permanently. Passive belts, once detached, then required 'the same type of affirmative action that is the stumbling block to obtaining high usage levels of manual belts.' For this reason, the agency concluded that there was no longer a basis for reliably predicting that the Standard would lead to any significant increased usage of restraints at all.
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> In view of the possibly minimal safety benefits, the automatic restraint requirement no longer was reasonable or practicable in the agency's view. The requirement would require approximately $ 1 billion to implement and the agency did not believe it would be reasonable to impose such substantial costs on manufacturers and consumers without more adequate assurance that sufficient safety benefits would accrue.

Id. at 38-39 (citation omitted).

did not explain why, given that automatic seatbelts were not satisfactory, it did not simply require airbags in all vehicles.[79] The Supreme Court noted that, "For nearly a decade, the automobile industry waged the regulatory equivalent of war against the airbag and lost . . . ."[80] Justice White suggested that regulation "was necessary because the industry was not sufficiently responsive to safety concerns"[81] and concluded that "the industry has opted for an ineffective seatbelt design."[82]

The idea that the entire automobile industry acted irrationally is possible, but not very plausible. The automobile industry is fiercely competitive, with each manufacturer constantly vying for any possible advantage.[83] Logic dictates that if installing airbags could provide a competitive advantage, at least one manufacturer would have rushed to do so. Before assuming an entire industry acted irrationally, it makes sense to examine other potential reasons for the automakers' behavior.

First, automakers could logically have said, "Airbags will not save lives. They will not effectively reduce risk." If this were true, then the automakers would have been justified in objecting to airbags. Society could not have benefited if airbags were truly ineffectual. However, the evidence does not bear this out.[84] Evidence in the early days of airbags strongly supported the idea that airbags would be beneficial, and later evidence has corroborated this conclusion, at least to some degree.[85]

A second logical reason might be that the automakers were concerned about the cost airbags would impose. As with any technology, airbags have both costs and benefits.[86] The cost of manufacturing and installing the air-

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79 *Id.* at 46 ("The first and most obvious reason for finding the rescission arbitrary and capricious is that NHTSA apparently gave no consideration whatever to modifying the Standard to require that airbag technology be utilized.").

80 *Id.* at 49.

81 *Id.*

82 *Id.* The *Motor Vehicle Mfrs.* case is principally cited in law school casebooks as an illustration of the Court's review of agency action in accordance with the "arbitrary and capricious" standard. However, Justice White's dicta indicates that the Court clearly thought the automakers were behaving irresponsibly.

83 National Institute of Standards and Technology, NIST and the Automotive Industry, http://www.nist.gov/public_affairs/automotive.htm ("In the highly competitive automotive market, manufacturers must continually improve their products.") (last visited Apr. 12, 2006).

84 *See* Graham et al., *supra* note 41, at 1418.

85 *Compare* 42 Fed. Reg. 34,298 (July 5, 1977) (predicting passive restraints would save 12,000 lives annually) *with* Graham et al., *supra* note 41, at 1418 (concluding that driver's side airbags are cost effective safety devices).

86 For an early analysis of the costs and benefits of implementing airbags, see William H. Lawrence, *The Economic Impact of Air Bags*, 25 AM. U. L. REV. 371 (1975). Lawrence looks at the benefits of airbags but compares this only to the manufacturing and installation costs. *Id*. at 399. None of the

bag is probably the most obvious and least complex cost to calculate.[87] An automobile with an airbag costs more to design and manufacture than a car without an airbag.[88] A 1993 estimate by NHTSA put the installed cost of an airbag at $278.[89] The manufacturing cost alone would appear to be significantly below what consumers would be willing to pay for an airbag and does not adequately explain the manufacturers' reluctance.[90] There are, of course, additional costs, beyond manufacturing and installation when installing airbags.[91]

When analyzing the costs and benefits of risk reducing technology, airbags offer an especially effective example because airbags offer a kind of symmetry. The benefit of an airbag is a reduction in the risk of injury from an automobile collision.[92] By contrast, the non-manufacturing costs all relate to the risk that the airbag will not function properly.[93] Unlike some other technologies, airbags significantly effect only those parties having a direct relationship with the airbag-equipped car.[94] Airbags directly affect only the operator of the airbag-equipped car.[95] Because airbags are free of the externalities that affect many other technologies, the effect airbags have on the allocation of risk can be analyzed more directly. Therefore, airbags

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cost estimates used by Lawrence appear to include any other costs which may accrue to the manufacturer or society. *Id.*

87 Despite being the least complex cost involved, there is still a lack of consensus regarding the cost of manufacturing and installing airbags. Some estimates, converted to 2003 dollars for comparison, include: $1606 ($370, 1972 RECAT report, Lawrence, *supra* note 86, at 390); $871 ($220, 1974 NHTSA analysis, *id.* at 392); $890 ($225, 1974 General Motors installation option, *id.* at 392-93); and $347 ($278, 1993 NHTSA analysis, Graham et al, *supra* note 42, at 1420 (citation omitted)).

88 *See, e.g.,* Lawrence, *supra* note 86, at 387.

89 Graham et al, *supra* note 42, at 1420 (citing NHTSA, FMVSS NO. 208: MANDATORY AIRBAG INSTALLATION, FEDERAL REGULATORY IMPACT ANALYSIS. III-5 (1993)). This equates to $347 in 2003 dollars. *See supra* note 87.

90 *See* Mannering & Winston, *supra* note 7, at 274 (indicating that in 1993 drivers would be willing to pay an average of $512 for an airbag, equating to $640 in 2003 dollars).

91 *See, e.g.,* John D. Graham & Maria Segui-Gomez, *Airbags: Benefits and Risks*, RISK IN PERSPECTIVE, July 1997, at 2.

92 *See* Air Bag Basics, *supra* note 55.

93 This point is illustrated by comparison with other technological advances. For example, the costs inherent in an internal combustion engine include the risk that the engine may not function correctly, but the costs also include the risk from the pollution produced by the engine.

94 *But see* Peterson et al., *supra* note 62, at 262 (concluding that drivers of airbag equipped cars drive more recklessly and thus create externalities).

95 This means that the cost/benefit analysis of airbags is generally free from sweeping concerns about costs imposed on the environment or society as a whole. This is not true for many other technologies. *See supra* note 93. The externalities imposed by some technologies severely complicate the cost/benefit analysis in many cases. *See* Kopp et al., *supra* note 45, at 7-8; IPPOLITO, *supra* note 43, at 228-30; *see supra* note 44.

serve as a good model for a broader evaluation of how technology affects the allocation of costs and benefits.[96]

C. *Risk Transformation*

Risk reducing technologies typically reduce one type of risk in exchange for creating or increasing another type of risk.[97] Airbags are a good example. Installing an airbag in an automobile reduces the risk of injury from a collision.[98] In exchange, a new risk is created—the risk that the airbag will malfunction.[99] This exchange of one type and magnitude of risk for another may be referred to as *risk transformation*. Each time a new product is introduced, consumers must determine whether the benefit of reduced risk outweighs the newly created risk.[100] This balancing is done not only in light of the magnitude of the contrasting risks, but also considering ways to mitigate each type of risk.[101]

When evaluating the costs and benefits of adopting a new technology, consumers first, at least implicitly, compare the risk associated with each

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[96] Because airbags do not create broader externalities, it is possible to focus on the cost/benefit of a single airbag and still get a good picture of what the analysis would be on a society wide scale. This is mainly because the effects of airbags are proportionally the same on an individual or societal level. This is in contrast to the internal combustion engine example, *see supra* note 93, where a single engine might not have much effect on the environment, but a large number of engines certainly will.

[97] *See* Grady, *Why Negligent?*, *supra* note 5, at 295.

[98] *See* Air Bag Basics, *supra* note 55.

[99] *See, e.g.,* Smith v. Chrysler Corp., 1996 Del. Super. LEXIS 489, at 1-2 (Del. Super. Ct. 1996) (not released for publication) (driver's side airbag in 1991 Dodge Shadow deployed during a single-car collision with a deer); Morton Int'l v. Gillespie, 39 S.W.3d 651 (Tex. App. 2001) ("airbag did not deploy within the 50 milliseconds for which it was designed and . . . a delay in deployment of between 60 to 70 additional milliseconds constituted a manufacturing defect").

[100] *See* Lester B. Lave, *Health and Safety Risk Analyses: Information for Better Decisions*, SCIENCE Apr. 17, 1987, at 291 ("'Risk-risk' situations occur in designing safety equipment. . . . One 'how safe' situation is the controversy over whether air bags should be mandated in cars."); NATIONAL RESEARCH COUNCIL, NATIONAL SCIENCE EDUCATION STANDARDS 166 (1995) ("[T]echnological solutions have side effects; and technologies cost, carry risks, and provide benefits."); *see also* Douglas Birsch, *Product Safety, Cost-Benefit Analysis, and the Ford Pinto Case*, *in* THE FORD PINTO CASE: A STUDY IN APPLIED ETHICS, BUSINESS, AND TECHNOLOGY 147, 148 (Douglas Birsch & John H. Fielder eds., 1994).

[101] *See, e.g.*, Birsch, *supra* note 100, at 154-55.

> In the Pinto case, the alternatives were either upgrading or not upgrading the integrity of the fuel system. All the costs and benefits associated with each alternative needed to be identified and translated into monetary units; for example, upgrading the fuel system for a particular model year would be a cost to Ford of approximately $2,880,000.

Id. at 154.

available option.[102] The cost equation must consider the effectiveness of any precautions that could mitigate each of the risks.[103] In the airbag example, a consumer would look at the two options: a car with airbags, and a car without airbags. The consumer would evaluate each option and determine the type, probability and magnitude of risk associated with that option. For example, a car without airbags entails a bundle of risk, comprising costs and benefits of varying probabilities and magnitudes; a car with airbags entails a different bundle of risk, comprising different costs and benefits. In comparing risks, the consumer would look not only to the type and magnitude of the different risks but would also ask, "What actions can be taken to mitigate the two types of existing risk?" Two fundamentally different types of precaution can be taken in order to mitigate risks—durable and non-durable.[104] Durable precautions are long lasting and require a low rate of activity.[105] By contrast, non-durable precautions are not long lasting and require a high rate of activity.[106]

In order to explain risk transformation and analyze the effect of the two types of precaution on the risk equation, it is useful to hypothesize a world in which automakers do not manufacture or install airbags.[107] Instead,

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102 *See generally Introduction: Cost-Benefit Analysis*, *in* THE FORD PINTO CASE: A STUDY IN APPLIED ETHICS, BUSINESS, AND TECHNOLOGY 119 (Douglas Birsch & John H. Fielder eds., 1994) (discussing the cost/benefit analysis as applied in making business decisions). "The basic idea is that a manager can identify the alternatives, distinguish the costs and benefits associated with each, translate the costs and benefits into monetary units, calculate the sums and differences, and justify the alternative which provides the largest net monetary benefit." *Id*. at 119-20. Consumers may not explicitly apply this analysis, but they must do so implicitly in order to make a decision regarding new technology.

103 *See, e.g., id*. at 120; Birsch, *supra* note 100.

104 Mark F. Grady, *Efficient Negligence*, 87 GEO. L.J. 397, 400 (1998) ("Low-rate precautions are durable and have long service lives; they need not be used repetitively. High-rate precautions have opposite characteristics.").

105 *Id*. Durable precautions typically only need to be done once or, at most, on infrequent intervals. *Id*. Examples of durable precautions include such things as installing a fire escape, hiring a bargee, or installing seatbelts. *Id*.; *see, e.g.*, United States v. Carroll Towing Co., 159 F.2d 169 (2d Cir. 1947); Radley v. Knepfly, 135 S.W. 111 (Tex. 1911)

106 Grady, *supra* note 104, at 400. Non-durable precautions must be taken repetitively and frequently. *Id*. Examples of non-durable precautions include remembering to lock doors, looking for pedestrians, and fastening seatbelts. *Id.* at 400-01; *see, e.g.,* Mackey v. Allen, 396 S.W.2d 55 (Ky. 1965); Barker v. City of Philadelphia, 134 F. Supp. 231 (E.D. Pa. 1955). Failure to take a non-durable precaution is referred to as a "compliance error." WARD FARNSWORTH & MARK F. GRADY, TORTS: CASES AND QUESTIONS 157 (2004).

107 For simplicity, this hypothesis also assumes that no party will face liability for anything not related to driving the vehicle or manufacturing the airbag. For example, the hypothesis assume that the vehicle is otherwise correctly manufactured and that the automaker will not be liable for any negligence with regard to other aspects of the vehicle. The hypothesis also assumes that any collision would be the result of the driver's negligence alone and not another driver, a negligently constructed road or any

consumers have the technological know-how to make and install airbags themselves. Suppose a driver wishes to ensure that the risk of driving his car never exceeds a certain level. In this hypothetical world, he can do so by taking one of two actions. First, he could drive with sufficient care. Driving carefully is a non-durable precaution because it is not long lasting.[108] The driver must be ever attentive, and a single lapse in concentration could negate all the effort he has put into risk reduction.[109]

But suppose the driver manufactures and installs his own airbag. The airbag is a durable precaution.[110] The driver need only install the airbag once, and the airbag will continue to provide a reduced exposure to risk regardless of any momentary lapses in the driver's concentration.[111] The non-durable precaution of attentive driving has been transformed into the durable precaution provided by the airbag.[112] In terms of risk, the driver's inattention has been transformed into a risk associated with the airbag.

So what risks are associated with the airbag? There are two types.[113] First there is a risk that the airbag was not properly designed and will not provide the expected risk reduction because of a faulty design.[114] The predicted risk reduction does not occur because a design flaw renders the airbag incapable of performing as expected.[115] Precaution against design risk is principally a durable precaution.[116] Once the airbag is correctly designed, the driver need allocate no more resources to overcoming this risk.[117]

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other factors. The model created by this hypothesis solely concerns the risks associated with driving the vehicle and installing the airbag.

108 FARNSWORTH & GRADY, *supra* note 106, at 157; Grady, *supra* note 104, at 400-01.

109 FARNSWORTH & GRADY, *supra* note 106, at 157; Grady, *supra* note 104, at 400-01.

110 FARNSWORTH & GRADY, *supra* note 106, at 157 ("A durable precaution generally is some safety measure that can be implemented with a single decision . . . .").

111 *Id.*

112 *See* Grady, *Why Negligent?*, *supra* note 5, at 297 (example of how the non-durable precaution of removing the door from old refrigerators was transformed into the durable precaution of using a magnetic lock).

113 *See, e.g.,* Perry v. Mercedes Benz of N. Am., Inc., 957 F.2d 1257, 1259 (5th Cir. 1992); Hisrich v. Volvo Cars of N. Am., Inc., 226 F.3d 445 (6th Cir. 2000); Collazo-Santiago v. Toyota Motor Corp., 149 F.3d 23 (1st Cir. 1998).

114 *E.g., Perry*, 957 F.2d at 1259; *Hisrich*, 226 F.3d at 448; Drattel v. Toyota Motor Corp., 699 N.E.2d 376, 377 (N.Y. 1998).

115 *E.g., Collazo-Santiago*, 149 F.3d at 24; Bresnahan v. Chrysler Corp., 32 Cal. App. 4th 1559, 1563 (2d Dist. 1995).

116 *See* Grady, *supra* note 104, at 400.

117 FARNSWORTH & GRADY, *supra* note 106, at 157 ("A durable precaution generally is some safety measure that can be implemented with a single decision.").

The second type of risk is a manufacturing defect.[118] The airbag was designed correctly but failed to function as designed because of some defect in the manufacture or installation.[119] Manufacturing risk is principally subject to non-durable precaution.[120] Did the driver perform each step correctly; did he leave out any parts; or did he gloss over any steps? These are precautions that must be taken every time the driver installs an individual airbag, not just once when he designs it.[121]

In the end, the risk of the driver failing the non-durable precaution of attentive driving has been transformed into the risk of failing (1) the durable precaution of effectively designing the airbag and (2) the non-durable precaution of attentively manufacturing and installing the airbag. In our hypothetical world, if the costs and risks associated with driving attentively are higher than the costs and risks associated with installing an airbag, the driver will of course install the airbag. Because we assumed that the driver manufactured and installed his own airbag, the driver is able to internalize all the costs and benefits of the airbag.[122] The driver's decision will be based solely on the airbag technology's ability to transform risk from the prior risk allocation to a more desirable risk allocation.[123] Given what the evidence shows regarding the effectiveness of airbags, the driver will likely decide to install the airbag.[124]

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118 *E.g.,* McPhail v. Mitsubishi Motor Mfg. of Am., Inc., 80 F. Supp. 2d 1309 (S.D. Ala. 1997); Silvestri v. General Motors Corp., 210 F.3d 240 (4th Cir. 2000); Walters *ex rel*. Walters v. General Motors Corp., 209 F. Supp. 2d 481 (W.D. Pa. 2002).

119 *E.g.*, Smith v. Chrysler Corp., 1996 Del. Super. LEXIS 489, at 1-2 (Del. Super. Ct. 1996) (not released for publication) (driver's side airbag in 1991 Dodge Shadow deployed during a single-car collision with a deer); Morton Int'l v. Gillespie, 39 S.W.3d 651 (Tex. App. 2001) (airbag did not deploy within the 50 milliseconds for which it was designed, and a delay in deployment of between 60 to 70 additional milliseconds constituted a manufacturing defect).

120 *See* Grady, *supra* note 104, at 400. Here the owner installed hypothetical breaks down a little. If it were in fact a driver installing his own airbag, then the precautions against a manufacturing defect would be more akin to a durable precaution. The driver would only have to manufacture the airbag correctly one time. However, in the real world, airbags are manufactured in large volume and much of the precaution is most similar to non-durable precaution. In order for the hypothetical to have a meaningful comparison to the later examination of the real world situation, the hypothetical proceeds under the construct that even with an owner-installed airbag, manufacturing defects are generally avoided through non-durable precaution.

121 *Supra* note 120.

122 This is because airbags have no, or at least very limited, externalities. *Supra* note 95. *But cf.* Peterson et al., *supra* note 62, at 262 (concluding that drivers of airbag equipped cars drive more recklessly and thus create externalities).

123 The prior risk of driving dangerously is transformed into the more desirable risk allocation embodied in the design and manufacture of the airbag.

124 Graham & Segui-Gomez, *supra* note 91, at 1 ("qualitative predictions were correct: airbags are saving lives").

The evidence strongly suggests that when a driver is able to completely internalize the costs and benefits of installing an airbag, the driver will install the airbag.[125] This indicates that the cost of an airbag—including manufacturing, installation and increased risk—is less than the benefits derived from having an airbag. Therefore, the risk transformation associated with airbags would not explain the automakers' decision to wage war on airbags[126] rather than embrace them.[127]

D. *Risk Transfer*

In the real world, the driver would not install his own airbag. Rather, automobile manufacturers or their suppliers design, manufacture and install airbags for consumers' benefit.[128] The involvement of the automaker results in a *risk transfer* in addition to the risk transformation discussed *supra*. In the above hypothetical, the only effect of airbag technology was to transform the risk associated with attentive driving into the risk associated with airbag manufacture and installation. The same party bore both types of risk and simply weighed their relative value.[129] In reality, however, the same party does not bear both risks.[130] The risk of driving inattentively is transformed into the risk of incorrectly designing and manufacturing airbags, and the airbag related risk is transferred from the driver to the automaker.[131] The added step of risk transfer results in complications that are not present in the previous hypothetical. A single person is no longer able to internalize

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125 *See* J. D. Graham et al., *supra* note 41, at 1422 (indicating a cost of $24,000 per quality-adjusted life-year saved by driver-side airbags).

126 *Motor Vehicle Mfrs.*, 463 U.S. at 49.

127 *See* Birsch, *supra* note 100, at 155 (concluding that in the Pinto case, it would have been difficult for Ford to accurately asses the risks associated with not redesigning the Pinto fuel tank). In contrast to the Pinto fuel tank case, the evidence in favor of airbags seems much clearer. *E.g.*, SAFETY FACTS 2003, *supra* note 41, at 5; J. D. Graham et al., *supra* note 41, at 1422.

128 SAFETY FACTS 2003, *supra* note 41, at 5 ("as of 2003, more than 146 million air-bag-equipped passenger vehicles were on the road").

129 *See* VICTORIA TRANSPORT POLICY INSTITUTE, *Evaluating Pricing Strategies: Factors To Consider When Evaluating TDM Strategies That Change Transportation Prices*, *in* TDM ENCYCLOPEDIA, http://www.vtpi.org/tdm/tdm70.htm ("Some costs are internal (borne directly by the user of a good, such as transit fares and vehicle operating costs), while others are external (borne by others, or by users indirectly and not related to their consumption, such as pollution emissions and general taxes used to fund transportation services).").

130 *Id*.

131 *See* Grady, *Why Negligent?*, *supra* note 5, at 297 (analogous example of how the non-durable precaution of removing the door from old refrigerators was transformed into the durable precaution of using a magnetic lock, and the risk was transferred from the consumer to the appliance manufacturer).

all the costs and benefits of the airbag.[132] Negligence law and, in particular, product liability address the complications that risk transfer introduces into the hypothetical.[133] The way that product liability deals with risk transfer offers an explanation for the automobile industry's reluctance to install airbags.

III. PRODUCT LIABILITY AND RISK TRANSFER

With new technologies, assessing the effects of the transformation of risk from one type and magnitude to another is often difficult.[134] The benefits and costs of new technologies are often not fully understood.[135] Adding complication, in our modern market economy, the consumer of a new product rarely designs or manufactures the product, so in addition to risk being transformed, risk is also transferred from one party to another.[136] This Part first discusses the issues created by risk transfer then follows with a discussion of how our legal system has applied the product liability doctrine in an effort to resolve these issues, all in the context of the airbag example.

A. *The Problems of Risk Transfer*

To understand the problems created by risk transfer, we look back to the risk transformation that took place with the hypothetical driver-installed airbag. Before installing the airbag, the driver faced the risk of being injured in a collision.[137] He could only mitigate this risk by taking the non-durable precaution of driving carefully.[138] More importantly, no one else

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132 *See* VICTORIA TRANSPORT POLICY INSTITUTE, *supra* note 129 ("Paying costs directly (what economists call 'internalizing costs') is generally most fair and efficient. It means that consumers 'get what they pay for and pay for what they get.' It allows individual consumers to make their own decisions and trade offs between different goods and services.").

133 Committee on Environment and Public Works, Reliable Fuels Act, S. Rep. No. 108-57, at 46 (2003) ("Product liability makes the product manufacturer strictly liable for placing an unreasonably dangerous product into the market. The purpose of product liability is to deter unwanted behavior . . . .").

134 *E.g.*, Birsch, *supra* note 100, at 155 ("[T]here are difficulties connected to predicting the consequences of the action and the costs and benefits that will accrue.") (referring to the Pinto fuel tank redesign).

135 NATIONAL RESEARCH COUNCIL, *supra* note 100, at 166 (1995) ("Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.").

136 Grady, *Why Negligent?*, *supra* note 5, at 297 (refrigerator example).

137 Of course, he still faces this risk after an airbag is installed, but the risk is reduced.

138 *See* Grady, *supra* note 104, at 400.

was responsible for his safety.[139] If the driver were injured in a collision, the automaker would not be responsible. Now, assume that the driver has installed an airbag. The driver benefits from the reduction in risk that the airbag provides.[140] The driver can either enjoy the benefit of decreased risk, or the driver can relax his level of care while driving and still maintain the same overall level of risk.[141] With either choice of action, the driver is still completely liable for any risk of injury.[142] The driver has benefited from the new technology, but no one else is responsible for the driver's risk of injury.[143]

The driver who installs an airbag internalizes all the costs and benefits and, therefore, the driver-installed airbag has the benefit of providing the correct incentives for precaution in all aspects.[144] For example, the driver may find that if he spends more time designing the airbag or builds the airbag from more expensive materials, he can increase the effectiveness of the airbag.[145] If the cost of more design time, more expensive materials, or more accurate manufacturing is less than the benefit of a better design, then the driver will spend more time.[146] The converse of these examples is also true. The driver may find that the cost of driving more carefully is less than the cost of more expensive airbag materials or more design time.[147] He may decide to build an inferior airbag and make up for it with more attentive driving. It is not important what balance the driver finally strikes. Whatever final balance the driver determines, that balance is necessarily the most

139 *Supra* note 107 (the hypothetical assumes that the driver alone is responsible for any accident resulting from negligent driving).

140 *See* FIFTH/SIXTH REPORT, *supra* note 42, at ii.

141 For a study that suggest that drivers do, in fact, decrease their level of care commensurately with the reduced risk, see Peterson et al., *supra* note 62, at 262.

142 *Supra* note 107.

143 *See id*.

144 *See* United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947) (defining how the correct level of care is determined); VICTORIA TRANSPORT POLICY INSTITUTE, *supra* note 129 ("Paying costs directly (what economists call 'internalizing costs') is generally most fair and efficient. It means that consumers 'get what they pay for and pay for what they get.' It allows individual consumers to make their own decisions and trade offs between different goods and services.").

145 *E.g.*, Birsch, *supra* note 100, at 154 ("All the costs and benefits associated with each alternative need to be identified and translated into monetary units; for example, upgrading the fuel system for a particular model year would be a cost to Ford of approximately $2,880,000.").

146 *E.g.*, *id.*

147 *Compare id.* ("[I]t has been charged that Ford's decision not to upgrade the integrity of the fuel system was based on a cost-benefit analysis that placed a monetary value on human life.") *with* IPPOLITO, *supra* note 43, at 14, ("A consumer's problem is to allocate her income among available products and services to attain the highest level of utility.").

efficient balance.[148] The driver captures all the benefits and must pay all the costs, and he will use his resources in the most efficient way.[149]

Now compare the driver-installed airbag scenario with real life. Because the automobile company manufactures the airbag and the consumer drives the car, a single party does not capture all the benefits nor pay all the costs involved.[150] In real life, the driver pays the automaker to design and manufacture an airbag. This bifurcation of the cost/benefit analysis results in risk transfer and creates some competing incentives that are not present in the driver-installed hypothetical.

In reviewing the examples from the driver-installed risk analysis, we see some differences. The driver may have decided that additional time spent on airbag design was warranted because of the increase in airbag effectiveness.[151] However, when the auto manufacturer designs the airbag, the automaker would have to pay the additional design cost, but would not gain the additional benefit of a better designed airbag.[152] The automaker incurs a cost that it will not be able to recoup.[153] Similarly, the automaker could use superior materials in the airbag, but again, the driver benefits from this, not the automaker.[154] It is the same case if the automaker paid more to hire more conscientious employees, thereby reducing the risk of a manufacturing defect.[155] This results in a situation where one party, the driver, derives all the benefits from the cost incurred by the other party, the automaker.[156]

On its face, there seems to be a solution to this problem. The driver could simply tell the automaker that he is willing to pay an additional cost to have a better designed, higher quality airbag.[157] In the market, this would be accomplished by drivers being willing to pay a premium for airbags

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148 *See* IPPOLITO, *supra* note 43, at 18. The balance is optimal at least within the information available to the driver.

149 *See* IPPOLITO, *supra* note 43, at 18; VICTORIA TRANSPORT POLICY INSTITUTE, *supra* note 129.

150 *See* VICTORIA TRANSPORT POLICY INSTITUTE, *supra* note 129 ("others are external (borne by others, or by users indirectly and not related to their consumption, such as pollution emissions and general taxes used to fund transportation services)").

151 *See* IPPOLITO, *supra* note 43, at 16.

152 Except to the extent that the manufacturer could incorporate the increased cost of the airbag into the price charged to the consumer. However, assuming competitive automobile market, an individual manufacturer has little influence on the price of the airbag. *See* IPPOLITO, *supra* note 43, at 153 ("[T]he market is competitive in the sense that there are a sufficient number of firms so that no one firm can influence price."). Additionally, the consumer may not be willing to pay more for the airbag. Mannering & Winston, *supra* note 7, at 274.

153 *See* IPPOLITO, *supra* note 43, at 95-98 (evaluating sustainability of a market price).

154 *See id.*

155 *See id.*

156 *See id.*

157 *See* Mannering & Winston, *supra* note 7, at 274.

which were designed and manufactured to a higher standard.[158] If the driver could have perfect information about the way in which an airbag was designed and manufactured then this solution would work.[159] However, in reality it is not possible for a driver to have this information.[160] Two impediments prevent the driver from gaining this information. First, it is simply too costly for the driver to monitor the design and manufacturing process or obtain information about it.[161] Even if the driver could go to the manufacturing plant and watch the airbag being made, or pay someone else to do the same, the cost of doing so outweighs the benefit gained from the airbag.[162] The second impediment is specifically related to new or complex technology. Even if it were cost effective to monitor the design and manufacturing process, almost no driver would have the technical expertise to know if the airbag were being designed or manufactured in the most efficient manner.[163]

Automobile manufactures are faced with the following situation. They sell products in a very competitive market.[164] Any additional investment in the design or manufacture of an airbag results in additional costs being paid by the manufacturer and additional benefits going to the driver.[165] The driver is not in a position to monitor or understand the airbag design and manufacturing process.[166] The automaker, therefore, has an incentive to take any available shortcut as long as that shortcut is undetectable by consumers[167]—if the shortcut is observable, manufacturers will, of course, have an incentive to produce better airbags.[168]

The automakers' incentive to take shortcuts results in a significant problem. The cost/benefit balance is no longer at the most efficient point because the optimal amount of effort is not being put into the design and

158 *See* IPPOLITO, *supra* note 43, at 290-93 (discussing the concept of a quality assurance premium) ("Quality assuring premium refers to an increment in price that a company is entitled to charge above its marginal cost to compensate its investment in establishing its reputation for high quality.").

159 *See id*. at 282-88 (discussing problems that occur when buyers do not have perfect information).

160 *See id*.

161 *See id*. at 283.

162 *See id*. This issue also relates to the concept of transaction costs. *Id.* at 122-23.

163 Mark Abraham, *Comparing Consumer to Industrial Marketing*, STICKY-MARKETING.NET, at 3 (Mark Abraham ed. 2001), *at* http://www.sticky-marketing.net/articles/consumer_vs_b2b_marketing_p3.htm ("It is rare in consumer markets that individual consumers have as much technical knowledge about the products or services they are buying as those selling these products.").

164 National Institute of Standards and Technology, *supra* note 83.

165 *See supra* note 152.

166 Abraham, *supra* note 163, at 3.

167 *See* IPPOLITO, *supra* note 43, at 290-93.

168 *Id.*

manufacture of airbags.[169] The system cannot easily correct itself because of the hurdles that drivers face in monitoring airbag design and production. The specialty knowledge required to design and manufacture an airbag, together with an otherwise efficient division of labor, creates an information asymmetry,[170] and the market may not supply an optimal solution.[171]

B. *Solutions to the Problem of Risk Transfer*

There are two possible remedies to prevent potential short-cuts by the automakers, one solution ex ante and one ex post. First, standards may be established and the automaker may be monitored during design and production of the airbag. While, as has been indicated, it would be unreasonably inefficient for the driver to monitor the automaker, it may be possible to develop standards and engage a third party to act as an agent of the driver in monitoring the automaker. Building codes and building inspectors provide an example of this type of solution. Before a house is built, building codes governing minimum house quality are established, and building inspectors monitor the construction to ensure that the builder meets the standards. However, this solution faces a number of constraints.[172] First, while the third party inspector may be a better agent for the driver than the automaker, the inspector's incentives still might not completely align the inspector's interests with the driver's interests.[173] Second, such a system requires a high degree of knowledge ex ante. A standard must be developed for every important aspect of the product, and the standards are only useful to the extent that they address the attributes that are likely to affect the potential problem (e.g., a building code relating to foundation materials will

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169 *See* VICTORIA TRANSPORT POLICY INSTITUTE, *supra* note 129.

170 Jean-François Hennart, *Transaction Costs Theory and the Multinational Enterprise*, *in* THE NATURE OF THE TRANSNATIONAL FIRM 72, 83 (Christos N. Pitelis & Roger Sugden eds., 1991) ("Information asymmetry will be lower the older the technology and the smaller the differences between the technological capabilities of the transactors.").

171 JOHN E. SCHWARZ, FREEDOM RECLAIMED: REDISCOVERING THE AMERICAN VISION 112 (2005).

> Situations of great information asymmetry in a private market, especially regarding areas of essential need, thus becomes a crucial problem. A private market cannot operate property—or as theoretically intended—if one side to an exchange (say, the producer) is well informed and the other side (say, the consumer) is uninformed and misled concerning a good or service, when the consumer has no practical way of becoming well informed except through the producer.

Id.

172 IPPOLITO, *supra* note 43, at 369.

173 *Id.* ("When a principal hires an agent, owing to imperfect and asymmetric information, combined with a mispricing of some resources, the agent may be encouraged to pursue actions that are not in the best interests of the principal.").

not keep the roof from leaking). It may be especially difficult to determine the important factors and how to adequately monitor them when dealing with new or highly specialized technology. Finally, the standards are often set by legislative bodies that have no particular expertise and may be subject to the influence of special interests. For these and other reasons, it may be impossible to efficiently set standards and monitor compliance ex ante.

The legal system provides a potential solution by way of an ex post tort analysis. This solution, generally referred to as product liability, is a legal mechanism that holds the product manufacturer liable ex post for any product defect.[174] In the airbag example, product liability provides the automaker with an ex ante incentive not to cut corners or reduce precaution, because the automaker knows that it will face an ex post liability for any errors.[175]

The product liability solution has a number of advantages over the standards/monitoring solution. Principally, any analysis occurs only after a failure has happened. Therefore, the scope of analysis is much more limited than trying to define standards for every possible failure. Additionally, the decision about which precautions to take is left to the manufacturer who presumably has the best information about the product, the effect of any precautions that can be taken, and how to implement and monitor those precautions.[176]

1. The "Strict" Product Liability Solution

In 1964, the American Law Institute adopted section 402A of the Restatement (Second) of the Law of Torts.[177] Section 402A states, "One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property . . . ."[178] Section 402A proclaims a strict liability for any "unreasonably dangerous"

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174 RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 1 cmt. A (1998). ("Strict liability in tort for defectively manufactured products merges the concept of implied warranty, in which negligence is not required, with the tort concept of negligence, in which contractual privity is not required.").

175 *See* S. REP. NO. 108-57, at 46 (2003) ("The purpose of product liability is to deter unwanted behavior . . . .").

176 In the real world, products are often governed by a combination of ex ante standards and ex post product liability. For example, automakers face an impressive list of federally mandated safety standards in addition to the possibility of product liability litigation. *See, e.g.*, Federal Motor Vehicle Safety Standards, 49 U.S.C. § 571.

177 David G. Owen, *Defectiveness Restated: Exploding the "Strict" Products Liability Myth*, 1996 U. ILL. L. REV. 743, 744 (1996).

178 RESTATEMENT (SECOND) OF TORTS § 402A (1965).

defective product.[179] Courts and academics alike embraced section 402A with unprecedented speed.[180] As of 1996, only five states had not adopted section 402A or some other version of strict liability.[181] However, courts have struggled to apply section 402A in many instances.[182] Coming to a realization that a risk balancing test may better address design defects, many courts have applied a combination of negligence and strict liability to design defects.[183] In response to these difficulties, the American Law Institute has revised the product liability doctrine in the Restatement (Third) of Torts: Product Liability.[184] The Restatement (Third) states that, "One engaged in the business of selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect."[185] This revised Restatement goes on to define three categories of product defect: manufacturing defect, design defect, and failure to warn.[186]

> A product is defective when, at the time of sale or distribution, it contains a manufacturing defect, is defective in design, or is defective because of inadequate instructions or warnings. A product:
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> (a) contains a manufacturing defect when the product departs from its intended design even though all possible care was exercised in the preparation and marketing of the product;
>
> (b) is defective in design when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the alternative design renders the product not reasonably safe;
>
> (c) is defective because of inadequate instructions or warnings when the foreseeable risks of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the instructions or warnings renders the product not reasonably safe.[187]

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179 *Id.*

180 Owen, *supra* note 177, at 744; William L. Prosser, *The Fall of the Citadel (Strict Liability to the Consumer)*, 50 MINN. L. REV. 791, 793-794 (1966) (stating that the adoption of strict product liability was "the most rapid and altogether spectacular overturn of an established rule in the entire history of the law of torts").

181 Delaware, Massachusetts, Michigan, North Carolina, and Virginia. Owen, *supra* note 177, at 745 n.7.

182 J. Denny Shupe & Todd R. Steggerda, *Toward a More Uniform and "Reasonable" Approach to Products Liability Litigation: Current Trends in the Adoption of the Restatement (Third) and Its Potential Impact on Aviation Litigation*, 66 J. AIR L. & COM. 129, 131 (2000).

183 Susan M. Mudgett, Comment, *Exploding Liability: Creating a Cause of Action for Defectively Designed Airbags under the Restatement (Third) of Torts*, 78 OR. L. REV. 827, 828 (1999).

184 Shupe & Steggerda, *supra* note 182, at 132 (noting that the changes made to the Restatement (Third) have been criticized by members of the bar).

185 RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 1 (1998).

186 *Id.* § 2.

187 *Id.*

The courts have adopted two primary tests when applying either the Restatement (Second) or Restatement (Third) to design defects in airbags.[188] Courts continue to treat manufacturing defects under a strict liability standard.[189]

a. *The Consumer Expectation/Consumer Contemplation Test*

A number of courts have held that design defects may be evaluated based on a test of consumer expectations.[190] Under this test a product is deemed defective if it is "dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it."[191] However, this test has not been widely used and has come under considerable criticism. In *Pruitt v. General Motors Corp.*, a California court of appeals found that the consumer expectations test was inconsistent with the complex issues involved in an airbag case.[192] The appellate court found that use of the consumer expectations test in airbag cases was inconsistent with a California Supreme Court decision regarding application of the test.[193] Additionally, the United States District Court for the District of Puerto Rico found it "highly unlikely that an ordinary consumer would know what technical considerations influenced the design of the airbag system."[194]

b. *The Risk-Utility Test*

The risk-utility test has enjoyed much more success in the courts. The risk-utility test applies a balancing of factors that is much more reminiscent of typical negligence law,[195] in contrast to strict liability that implies that

188 Mudgett, *supra* note 183, at 836 ("[D]ebate continues to rage over whether the courts should apply the consumer expectations test or some risk-balancing formula to design defect cases.")

189 *Id*. at 832.

190 *E.g.*, Bresnahan v. Chrysler Corp., 38 Cal. Rptr. 2d 446 (Cal. App. 2d 1995).

191 Wheeler v. Chrysler Corp., No. 98 C 3875, 2000 U.S. Dist. LEXIS 2725, at *7 (N.D. Ill. Feb. 29, 2000) (quoting Lamkin v. Towner, 563 N.E.2d 449, 457 (Ill. 1990)).

192 Pruitt v. General Motors Corp., 86 Cal. Rptr. 2d 4, (Cal. Ct. App. 1999).

193 *Id*. at 6 (stating that the consumer expectation test is limited to cases in which "the *everyday experience* of the product's users permits a conclusion") (quoting Soule v. General Motors Corp., 882 P.2d 298, 309 (Cal. 1994)).

194 Collazo-Santiago v. Toyota Motor Corp., 937 F. Supp. 134, 140 (D.P.R 1996), *aff'd*, 149 F.3d 23 (1st Cir. 1998).

195 Mudgett, *supra* note 183, at 836; s*ee also* Owen, *supra* note 177, at 754 ("[S]ince the degree of risk or safety in every product design is counterbalanced by considerations such as cost, utility, and aesthetics, the basis of responsibility for design choices logically should be based on the principle of *optimality* inherent in philosophical notion of utility and in the economic concept of efficiency.").

any degree of risk is unacceptable.[196] Because it is impossible to design an airbag that involves no tradeoff of risk whatsoever, strict liability does not provide a very useful standard for evaluating design defects.[197] The Restatement (Third) adopted a reasonableness test that reflects a balancing standard.[198] According to the Restatement (Third), a design is defective if the "harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design."[199] The courts have adopted this standard fairly consistently,[200] though some states use a combination of the two tests.[201]

Independent of which test is applied, the pendulum swings in the opposite direction from the initial review of the automakers' incentives. Where no legal solution existed, the automaker had an incentive to use too little precaution when designing and manufacturing an airbag.[202] Under the current state of the law regarding airbag product liability, the automaker may have too much incentive to use precaution. This additional incentive means that the most efficient solution is, once again, not reached.

The incentive for excess caution comes about because it may be prohibitively expensive to reduce the number of defects below a certain level, or there may be some optimal level of defects.[203] In the case of the driver self-manufactured airbag, this is not a problem. The driver balances the cost of reducing defects with the chance that a defect will occur and comes to an optimal balance. However, with the automaker-manufactured airbag governed by strict liability, the balance cannot be achieved because the cost and benefit of the airbag are bifurcated and the automaker faces full liability for any defect.

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196 Owen, *supra* note 177, at, 754 ("'[S]trict' liability implies that any degree of risk is simply wrong . . . .").

197 *Id.*

198 RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2(b) (1998).

199 *Id.*

200 *See, e.g., Wheeler*, 2000 U.S. Dist. LEXIS 2725, at *7.

201 For example, in Ohio the "two theories of proving product-liability in Ohio Rev. Code Ann. § 2307.75(A) are not mutually exclusive, but instead constitute a single, two-pronged test for determining whether a product is defectively designed." Hisrich v. Volvo Cars of N. Am., Inc., 226 F.3d 445, 454 (6th Cir. 2000) (citing Perkins v. Wilkinson Sword, Inc., 700 N.E.2d 1247, 1248 (Ohio 1998)).

202 *See* SCHWARZ, *supra* note 171, at 112.

203 WALTER J. WESSELS, MICROECONOMICS THE EASY WAY 22 (1997).

> The customers' interest is only being served if the benefits of reduced defects are higher than the cost of reducing defects. The best level of defects, from the customers' point of view, is where the marginal benefit of reducing defects equals the marginal cost of reducing defects. Going any further (where the marginal cost exceeds the marginal benefit) makes them worse off.

Id.

C. *The Insurance Effect*

When faced with strict liability in a world of costly defect reduction, the automaker faces two choices. First, as discussed, the automaker could engage in inefficiently high levels of precaution. Alternatively, the automaker could practice a type of self-insurance in which the automaker insures itself ex ante against the cost of liability that it will incur ex post.[204] The automakers will determine their expected ex post losses due to liability claims and transfer that cost to consumers as an ex ante "insurance" premium.[205] This insurance premium will be passed to the consumer as an increased price the automaker charges for the airbag. This insurance scheme would seem to completely solve the problem of risk transfer and product liability. The automakers accurately assess their future liability and charge an appropriate premium. The driver wants the automaker to engage in the optimal level of defect precaution and willingly pays more for a car to include the appropriate "insurance" premium. However, three impediments keep the system from balancing. In each case, the consumer will be unwilling to pay the full product liability insurance premium, and the automakers will be faced with selling fewer cars.[206]

1. Consumers Must Assess Benefits

With every purchase, consumers must assess the benefits they will derive from the product, so they can decide what price they are willing to pay to gain the benefit. This assessment may be particularly difficult with a new technology that consumers may not completely understand. This problem is further exacerbated by two additional factors surrounding the adoption of airbags. First, airbags reduce the risk of injury after an accident has oc-

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204 Mark F. Grady, Dean, George Mason Univ. Sch. of Law, Address to the Mercatus Center: The Law and Economics of Tort Reform (Apr. 5, 2004) (presentation slides at 22), http://www.mercatus.org/pdf/materials/623.pdf.

205 *Id*. at 7 ("Third-party insurance is what you buy to pay for the losses of someone else you might hurt and be liable to.").

206 In the short term the automaker may subsidize the consumer in an amount equal to the cost of the tort insurance premium. However, this subsidy is not sustainable. *See* IPPOLITO, *supra* note 43, at 111-15 (evaluating the effect of a tax on a single good—the insurance premium is functionally identical to a tax). Assuming elastic demand, which is certainly true of cars, the product liability insurance premium must reduce the number of cars sold. In a competitive market, each supplier determines its output by setting marginal cost equal to price. *Id*. at 95. If the supplier incurs an additional cost, the marginal cost increases and is no longer equal to price. The supplier will be faced with negative economic profits. *Id.* at 96. Supply will decrease and price will increase until the market reaches a new equilibrium. *Id.* at 96-98.

curred. Therefore, the driver must not only determine how effective an airbag will be at mitigating injury in an accident, the driver must also correctly determine the probability of being in an accident in the first place. Second, airbags were not considered an unmitigated benefit. Some industry insiders were not convinced that airbags could be safely employed.[207] Despite the NHTSA's positive assessment,[208] consumers may have undervalued airbags and been unwilling to pay the necessary insurance premium. If this were the case, one would expect an increased willingness to pay over time as consumers became more convinced of airbags' benefits. Mannering and Winston found exactly this trend, determining that in 1990 consumers were willing to pay an average of $331 for an airbag rising to an average of $512 in 1993.[209]

2. Automakers Must Predict Future Liability

On the other side of the equation, manufacturers must predict their future liability for defective products. This is especially difficult with a pioneering technology such as airbags because the manufacturer must predict the likelihood of a defect and the potential harm caused if that defect occurs without the benefit of direct past experience or even related experience.[210] Additionally, the manufacturer must predict how the legal system will react to the new technology.[211] If the automakers were at all risk averse, these uncertainties may have led the automakers to resist airbags even in the face of consumer willingness to pay.[212]

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207 Peter Passell, *What's Holding Back Airbags*, N.Y. TIMES, Dec. 18, 1983, at A68 ("David E. Martin, the company's director of safety research, is still not sure that perfectly safe passenger-side air bags can be engineered for small cars."). The main concern related to airbags' impact on unbelted children. *Id.*

208 *See supra* note 7 and accompanying text.

209 Mannering & Winston, *supra* note 7, at 272.

210 This is shown by the difficulty in assessing something as straight-forward as the cost of installing an airbag. See *supra* note 87.

211 Mudgett, *supra* note 183, at 833 ("While defective manufacturing cases remain straightforward under the Restatement (Third), determining the proper basis of liability for dangers inherent in design . . . continues to be 'the most vexing problem in the entire field of products liability.'") (citation omitted); *see also* Dana P. Babb, Note, *The Deployment of Car Manufacturers into a Sea of Product Liability? Recharacterizing Preemption as a Federal Regulatory Compliance Defense in Airbag Litigation*, 75 WASH. U. L.Q. 1667, 1687 (1997) ("For the last fifteen years, car manufacturers have defended against state common law claims when they installed passive restraint systems other than airbags. Now with the mandatory dual airbag requirement, manufacturers will face a new set of defective airbag claims.").

212 Passell, *supra* note 207 ("Edward N. Cole, former president of General Motors and a fan of air bags, conceded that the industry was 'worried about liability suits, even if the system works per-

3. Insurance and Product Liability Compensation

Even if consumers were able to determine the true benefit of airbags and automakers could accurately set the correct insurance premium, consumers still may have been unwilling to pay the premium.[213] Consumers are not willing to buy insurance at the levels that strict product liability compensates. Instead, consumers buy insurance to equalize their "financial" wellbeing.[214] In other words, consumers buy insurance so that their financial state will be the same whether or not the insured against event occurs.[215] For example, a consumer living in Florida would buy insurance against hurricanes.[216] That way, if a hurricane does occur, the consumer will be in the same financial situation as if the hurricane had not occurred.[217]

In contrast, consumers generally do not insure against non-financial risks.[218] Consumers do not insure against non-financial risks because, for these risks, money cannot equalize their wellbeing.[219] Insurance provides a way for consumers to equalize their financial position across various potential states of the world.[220]

> The purpose of insurance is tied to the use of money because insurers can provide us only with dollars should a loss occur. Individuals, as a consequence, do not voluntarily insure for non-pecuniary losses. Parents, for example, do not typically purchase insurance on the life of a minor child, not because the parents would not suffer severely if the child were to die, but because the child's death will not affect the flow of money into the family. . . . In contrast, if instead of a minor, the child is an adult providing financial support to the parents, the concerns are reversed.[221]

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fectly.'"); see also Grady, *Why Negligent?*, *supra* note 5, at 315 ("When … someone has above-average costs, it may pay that person to be negligent or else give up the activity entirely.") (emphasis added).

213 Grady, *supra* note 204, at 10.

214 *Id.* at 8 (examples include: "Health insurance equalizes your financial well-being between when you are sick (lots of doctors' bills) and healthy (few doctors' bills). Auto casualty equalizes your financial well-being between when you have been careful and lucky (no negligence claims) and when you have been uncareful and unlucky (huge negligence claim).").

215 *Id.*

216 *Id.* at 9.

217 *Id.*

218 George L. Priest, *The Current Insurance Crisis and Modern Tort Law*, 96 YALE L.J. 1521, 1546-1547; Grady, *supra* note 204 at 10 (examples of non-financial risk include: "Insurance against the risk we will suffer 20 years of back pain; Insurance against the risk that a non-wage-earning child will die; Insurance against the risk that we will be disfigured."). Consumers don't insure against these risks because money doesn't really compensate if the event does occur. *Id.* at 11.

219 Grady, *supra* note 204, at 11.

220 Priest, *supra* note 218 at 1546.

221 *Id.* at 1546-47 (footnotes omitted).

Additionally, consumers often fail to purchase insurance against low-probability high-loss events.[222] "Frequently they fail to obtain insurance against such losses, even when the terms are so favorable that purchasing insurance should be preferred by almost everyone."[223]Applied to the airbag example, consumers may be willing to pay the manufacturers' ex ante insurance premium for the financial loss resulting from an airbag defect such as doctor's bills or lost wages.[224] However, consumers would not be willing to pay the insurance premium for the non-financial loss such as pain, suffering, or disfigurement.[225]

But, product liability covers pain and suffering in unlimited amounts.[226] Consumers' unwillingness to insure against non-financial risk directly conflicts with the purpose of product liability, which is based on the assumption that any risk in unacceptable.[227] This conflict creates a paradox.[228] Consumers want the courts to create an incentive for manufactures to avoid defects, even those defects that cause the kind of non-financial loss that money cannot compensate.[229] However, consumers are not willing to pay for insurance against the same non-financial loss.[230] This results in a situation where, because of product liability, the automakers must insure against non-financial loss, but this cost cannot be passed on to consumers because consumers are unwilling to insure against the same non-financial loss.[231] Despite the position taken by the Supreme Court in *Motor Vehicle Manufacturers Ass'n*,[232] it is entirely logical that automakers would want to avoid this Catch-22.

New technology exaggerates the paradox.[233] First, consumers expect more of new technology. Consumers expect airbags to be more effective and less risky than seatbelts because consumers understand that there is

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222 Howard Kunreuther & Mark Pauly, *Neglecting Disaster: Why Don't People Insure Against Large Losses?*, 28 J. OF RISK & UNCERTAINTY 5, 5 (2004).

223 *Id.*

224 Grady, *supra* note 204, at 11.

225 *Id.* at 10.

226 Kenneth S. Abraham & Lance Liebman, *Private Insurance, Social Insurance, and Tort Reform: Toward a New Vision of Compensation for Illness and Injury*, 93 COLUM. L. REV. 75, 88 (1993).

227 *Compare* Grady, *supra* note 204, at 11 *with* Owen, *supra* note 177, at 754 ("'[S]trict' liability implies that any degree of risk is simply wrong.").

228 Grady, *supra* note 204, at 24.

229 *Id.*

230 *Id.* at 10.

231 *Id.* at 29.

232 *Motor Vehicle Mfrs.*, 463 U.S. at 49.

233 Grady, *supra* note 204, at 27.

only so much a low technology solution like seatbelts can do.[234] Risk that was inherent in driving, and as such assessable only against the driver, is now assessable against the automaker.[235] The baseline consumer expectation of risk has been lowered, and the automaker's baseline expectation of risk has been raised.[236] These changed expectations make the product liability paradox even more pronounced.

CONCLUSION

Both consumer advocates and the courts criticized the automobile industry for not moving more quickly to introduce airbags.[237] However, the automakers were justifiably concerned about unmanageable liability from consumer injuries caused by defective or inadequately designed airbags.[238] Rather than being irrational, automakers were simply responding to the incentives created by product liability law. Villanizing the innovators will not encourage the advancement of beneficial technology. We should instead examine the disincentives that keep new technology from being used to its greatest effect.

Robert Dan Spendlove[*]

234 See *id.* at 28 ("Before the invention of the dialysis machine, people were dying (of kidney failure), but they were not suing. After the invention of the dialysis machine, some people who would have died without the technology now die because of a medical error.").

235 *Id.*

236 *Id.*

237 *Motor Vehicle Mfrs.*, 463 U.S. at 49; *Chrysler Corp.*, 472 F.2d at 673; Leo C. Wolinsky, *Big Lobbies Clash in Fight on Seat Belts*, L.A. TIMES, Feb. 19, 1985, at A1; Don Colburn, *Seat Belts, Survival and the Law*, WASH. POST, Feb. 13, 1985, at HE7; Passell, *supra* note 207; Waters, *supra* note 10, at 1064.

238 Mudgett, *supra* note 183, at 833; Babb, *supra* note 211, at 1687.

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