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The Specific Consumer Expectations Test for Product Defects

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The consumer expectations test in products liability law holds firms liable for producing goods that are more dangerous than the reasonable consumer would anticipate. But judicial experience in the majority of states that have utilized the consumer expectations test demonstrates that it is ambiguous and impossible to apply predictably. The test is ill-suited for regulating complex products or markets with heterogeneous consumers; moreover, the test requires courts to expend significant resources to identify consumers' ex ante beliefs about product risks, even when consumers lacked tangible beliefs about products at the time of purchase. The other major test that courts apply to design defects, the risk-utility test, is also not well defined. The several factors of the risk-utility test are difficult for courts to apply consistently and permit courts to overrule the preferences of consumers who may be willing to tolerate higher risks for lower prices.

In this Article, we propose that courts adopt an amended version of the consumer expectations test that we call the "specific consumer expectations test." The specific consumer expectations test would apply to any product or product component for which consumers have clear, articulable ex ante expectations about the function of the product. Under the specific consumer expectations test, a defendant is liable if consumers expected such a product to reduce a particular risk, and the product in fact increased that risk. Similarly, if a product was intended to convey a particular benefit, but in fact harmed consumers along the same dimension, the test is violated. For example, if defective airbags increased the risk of injury after a motor-vehicle crash rather than decreased the risk, that product would be deemed defective under the specific consumer expectations test. By shifting the law's focus from measuring the magnitude of consumer expectations to a simpler identification of the direction that consumers expected risks to change, the specific expectations test increases the administrability of products liability law and captures most of the incentives that the traditional consumer expectations test could theoretically provide. In particular, firms are incentivized to produce products that never increase risks unexpectedly, and consumers are empowered to purchase products which reflect their willingness to pay for risks. In cases where consumers lack specific expectations, we argue that courts should apply the risk-utility test to minimize unanticipated accident costs to consumers and firms.

We bolster our analysis with a novel experiment that demonstrates that the specific expectations test is consistent with the preferences of actual consumers. Our incentive-compatible experiment asked subjects to make consumption decisions over various risky products and determine punishments for the firms that manufacture

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defective products. The results reveal that individuals demand substantially greater punishments for firms that manufacture products that violate specific expectations. But, before the defect has manifested, consumers are willing to tolerate prospective defect risks in general as well as defects that would cause a product to perform the opposite of its intended function. It is after the defect has occurred that consumers display greater outrage with respect to product defects that impose harms that are the opposite of the intended function of the product or product component. Taken together, these results indicate that the specific expectations test would deter manufacturers from making defective products in the exact circumstances where consumers suffer the greatest harms from product defects, and the test would permit consumers to choose when to consume dangerous products without producers risking ex post liability.

INTRODUCTION

Courts determining whether a defendant manufactured and sold a defective product have long struggled to coherently assign liability and punishments to defendants. Modern products liability law is torn between two tests, each of which envisions a different role for the courts in regulating markets.[1] The consumer

1. Douglas A. Kysar, *The Expectations of Consumers*, 103 COLUM. L. REV. 1700, 1708–1724 (2003) (discussing the debate between the risk-utility test and consumer expectations

expectations test, under which a defendant is liable if they manufactured a product that is "in a defective condition and dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchased it, with the ordinary knowledge common to the community as to its characteristics," holds producers strictly liable for products that pose risks beyond what consumers expected.[2] The risk-utility test, under which a defendant is liable if "the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design . . . and the omission of the alternative design renders the product not reasonably safe," employs a negligence-like framework.[3] State courts have intermittently adopted either or both of these tests, leaving manufacturers and consumers to navigate a fragmented legal landscape, particularly for nationally marketed products.[4]

As one would expect, both the traditional consumer expectations test and the risk-utility test have different merits. The consumer expectations test incentivizes manufacturers to produce products that comport with consumer beliefs, reducing the probability that consumers are exposed to risks they do not anticipate.[5] But the scope of the consumer expectations test is both potentially unlimited and not well defined.[6] Because consumers generally do not have perfect foresight that a product defect will occur, the definite occurrence of the unfavorable product outcome will be contrary to general consumer expectations in almost all product defect situations.[7] Do all such unfavorable product outcomes trigger producer liability or must the defect constitute a significant violation of consumer expectations? Perhaps the defect is not a complete surprise, as in the case of the purchase of a used car model despite the existence of well-known, highly publicized repair problems. The risk-utility alternative does not fare much better; by divorcing liability from consumer perceptions, it theoretically incentivizes firms to take efficient precautions but has proven difficult to implement or predict.[8] Moreover, it causes firms to choose how safe their products are by

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test); *see also* Izzarelli v. R.J. Reynolds Tobacco Co., 136 A.3d 1232, 1242 (Conn. 2016) ("Under the 'modified' consumer expectation test, the jury would weigh the product's risks and utility and then inquire, in light of those factors, whether a 'reasonable consumer would consider the product design unreasonably dangerous.'") (quoting Potter v. Chi. Pneumatic Tool Co., 694 A.2d 1319, 1333 (Conn. 1997)); Mikolajczyk v. Ford Motor Co., 901 N.E.2d 329, 352–53 (Ill. 2008) (holding that it may be appropriate to apply both the risk-utility test and the consumer expectation test in the same case).

2. Delaney v. Deere & Co., 999 P.2d 930, 946 (Kan. 2000); RESTATEMENT (SECOND) OF TORTS § 402A (AM. LAW INST. 1965).

3. Evans v. Lorillard Tobacco Co., 990 N.E.2d 997, 1011 (Mass. 2013) (quoting RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 2(b) (AM. LAW INST. 1998)).

4. *See* Mike McWilliams & Margaret Smith, *An Overview of the Legal Standard Regarding Product Liability Design Defect Claims and a Fifty State Survey on the Applicable Law in Each Jurisdiction*, 82 DEF. COUNS. J. 80, 83–90 (2015) (reviewing the applicable test in each U.S. jurisdiction).

5. *See infra* Section II.B.

6. *See infra* Section II.C.

7. *See* Keith N. Hylton, *The Law and Economics of Products Liability*, 88 NOTRE DAME L. REV. 2457, 2490–92 (2013) (discussing the consumer expectations test's tendency to find liability too often).

8. *See infra* Sections I.C.

anticipating what level of safety courts would expect, rather than the consumers who actually purchase and consume the product.[9]

As an alternative to the morass that the traditional consumer expectations and the risk-utility tests have created for manufacturers and consumers, this Article proposes that courts adopt an altered consumer expectations test, which we call the "specific consumer expectations test." Under the specific consumer expectations test, a defendant is liable for manufacturing a defective product if one or more attributes of the product cause harm and serve the opposite of their intended purpose. Our test would apply only to products over which consumers have specific expectations; all other products would be subject to the risk-utility test which is the only major alternative to the consumer expectations test.[10] To satisfy the specific consumer expectations test, a plaintiff must demonstrate that the product or a component of the product was intended to alleviate a particular risk of harm, and that the product was defective in a manner that caused harm of the kind that the product or component was intended to alleviate. For example, airbags that explode independent of any accident and cause harm to the passenger clearly violate specific consumer expectations, and a manufacturer of such airbags would be liable under the specific expectations test.[11] In contrast, cigarettes that cause smoking-related illnesses, such as lung cancer and heart disease, would not violate the specific expectations test since consumers do not generally believe that smoking cigarettes enhances health on these dimensions.[12]

The impetus for our specific consumer expectations test is twofold. First, our proposed test avoids many of the pitfalls of the existing consumer expectations test, which we present and discuss in Part II. The goal of products liability law should be to maximize the total economic welfare of consumers and producers of potentially risky products.[13] Such welfare is generally maximized by incentivizing firms to create products consistent with consumer expectations, so that consumers can opt in to risks that they are willing to assume and opt out of those risks they are not.[14] Courts applying the test must therefore be able to predictably identify product defects presenting risks that consumers (1) are willing to assume when they know of such risks, and (2) are averse to in the absence of specific risk information. Our test frames the consumer expectations test in terms of specific aspects of product performance that the consumer has reasons to believe the product will meet. Thus, the test does not deal with aspects of product performance that might be entirely unanticipated but instead focuses on the performance dimensions for which the product or attributes of

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9. *See* W. KIP VISCUSI, REFORMING PRODUCTS LIABILITY 73–74 (1991) (arguing that it is inappropriate for the preferences of courts to determine product safety levels when markets are capable of assigning risks on the basis of consumer preferences).

10. *See infra* Section I.C. for a discussion of the risk-utility test.

11. *E.g.*, Hiroko Tabuchi & Neal E. Boudette, *Automakers Knew of Takata Airbag Hazard for Years, Suit Says*, N.Y. TIMES (Feb. 27, 2017), https://www.nytimes.com/2017/02/27/business/takata-airbags-automakers-class-action.html?login=email&auth=login-email [https://perma.cc/M53V-Z2CC].

12. *E.g.*, Evans v. Lorillard Tobacco Co., 990 N.E.2d 997, 1011 (Mass. 2013).

13. *See* STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 2–3 (2004) (discussing the use of social welfare in law and economics).

14. *See infra* Part II.

the product were primarily intended.[15] Reserving the specific consumer expectations test for product dimensions that consumers have particular expectations over, while reserving the risk-utility test for other aspects of product performance, makes products liability law more predictable and contributes to its goals of enhancing economic welfare.

Second, as we demonstrate using a novel experiment in Part III, reformulating the test in the manner that we propose is consistent with strongly held consumer beliefs. These original experimental results demonstrate that specific consumer expectations are predictable, and that punishing firms that violate them is consistent with consumer preferences. Consumers view defects that violate specific consumer expectations as being much more blameworthy than comparable generic product defects. Our experiment asked respondents two sets of questions. In the first, subjects expressed preferences over products that presented a risk of defect, some of which undermined the product's primary purpose and others which did not. In the second set of questions, subjects considered whether to punish a manufacturer that made products that were defective in the same manner as the product that consumers had just considered purchasing. The results indicate that consumers will shift their expectations in response to direct information about a risk that a product will not serve its intended purpose. But when subjects learn ex post that a harm has occurred to other consumers without such knowledge, subjects exhibited moral outrage and a desire to punish firms, consistent with an actionable violation of expectations.

The remainder of this Article proceeds as follows. Part I traces the development of modern products liability law from its foundations to the current fragmented legal landscape. The Sections explore the operation of the consumer expectation test and risk-utility test, demonstrating the significant room for ambiguity in application. Part II presents our analytic framework for evaluating the traditional consumer expectations test, the specific expectations test, and the risk-utility test. We demonstrate that the specific expectations test preserves producer incentives to provide products that are consistent with consumer expectations and overcomes the substantial weaknesses in the conventional consumer expectations test. Part III presents our novel experiment, which demonstrates that consumers possess detectable and predictable specific expectations, the violation of which consumers see as meriting more severe punishment than product defects more generally. The results demonstrate that our test captures social preferences for the operation of products liability law.

I. CONTEMPORARY APPROACHES TO PRODUCTS LIABILITY

Modern courts hearing a plaintiff's claim that a defendant manufactured a defective product generally apply one of two tests, or a combination thereof: the consumer expectations test and the risk-utility test.[16] This Part explores the evolution

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15. *See infra* Section II.C., which argues that the unanticipated aspects of product performance are a primary explanation for the failures of the traditional consumer expectations test.

16. *E.g.*, General Motors Corp. v. Fansworth, 965 P.2d 1209, 1220 (Alaska 1998) (recognizing both tests); Ostendorf v. Clark Equip. Co., 122 S.W.3d 530, 535 (Ky. 2003)

of products liability law over time and presents both of these common tests as courts apply them today. Section A recounts the development of the law, tracing its path from common law privity doctrines to the fractured jurisprudence of today. The failure to reach a national consensus regarding the most pertinent test for product defects is reflective of the current disarray in these products liability criteria. Section B explores the consumer expectations test, which fifteen states apply exclusively.[17] The test, which resembles strict liability, focuses on whether a product presented risks that an ordinary consumer would not expect. Section C explores the risk-utility test, which eighteen states apply exclusively.[18] The risk-utility test, which loosely resembles ordinary negligence doctrine, focuses on whether a manufacturer could have made the product safer without decreasing its usefulness. Nine states allow a plaintiff to allege that a defendant is liable under either test.[19] Finally, a small

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(applying the risk-utility test); Woods v. Fruehauf Trailer Corp., 765 P.2d 770, 774–76 (Okla. 1988) (applying the consumer expectations test).

17. Arkansas, Indiana, Kansas, Maryland, Nebraska, New Hampshire, North Dakota, Oklahoma, Oregon, Rhode Island, Tennessee, Utah, Vermont, Wisconsin, and Wyoming exclusively apply the consumer expectations test. ARK. CODE ANN. § 16-116-102(7)(A) (2016); IND. CODE ANN. § 34-20-4-1 (West 2011); North Dakota, N.D. CENT. CODE § 28-01.3-01(4) (2016); Tennessee, TENN. CODE ANN. § 29-28-102(8) (2012); Brown v. Sears, Roebuck & Co., 328 F.3d 1274, 1278–79 (10th Cir. 2003) (discussing Utah's consumer expectation's test); Austin v. Lincoln Equip. Assocs., 888 F.2d 934, 936 (1st Cir. 1989); Delaney v. Deere & Co., 999 P.2d 930, 945–47 (Kan. 2000); Halliday v. Sturm, Ruger & Co., 792 A.2d 1145, 1152 (Md. 2002); Freeman v. Hoffman-La Roche, Inc., 618 N.W.2d 827, 834 (Neb. 2000); Vautour v. Body Masters Sports Indus., Inc., 784 A.2d 1178, 1181 (N.H. 2001); Oklahoma, Woods v. Fruehauf Trailer Corp., 765 P.2d 770, 774–76 (Okla. 1988); McCathern v. Toyota Motor Corp., 23 P.3d 320, 331 n.15 (Or. 2001); Zaleskie v. Joyce, 333 A.2d 110, 113–14 (Vt. 1975); Green v. Smith & Nephew AHP, Inc., 629 N.W.2d 727, 739–41 (Wis. 2001); Sims v. General Motors Corp., 751 P.2d 357, 364–65 (Wyo. 1988); *see also* McWilliams & Smith, *supra* note 4, at 83–85 (collecting references).

18. Alabama Colorado, Georgia, Idaho, Kentucky, Louisiana, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Texas, and West Virginia exclusively apply the risk-utility test.); Louisiana, LA. STAT. ANN. § 9:2800.54 (2018); North Carolina, N.C. GEN. STAT. ANN. §§ 99B-6(A), (B), 99B-11 (West 2011); Ohio, OHIO REV. CODE ANN. § 2307.75 (LexisNexis 2017); Pennsylvania, Surace v. Caterpillar, Inc., 111 F.3d 1039, 1042 (3rd Cir. 1997) (discussing Pennsylvania's risk-utility test); Minnesota, Ehlers v. Siemens Medical Solutions, USA, Inc., 251 F.R.D. 378, 383–384 (D. Minn. 2008); Flemister v. GMC, 723 So.2d 25, 27–28 (Ala. 1998); Camacho v. Honda Motor Co., 741 P.2d 1240, 1246–47 (Colo. 1987); Jones v. NordicTrack, Inc., 550 S.E.2d 101, 103–104 (Ga. 2001); Toner v. Lederle Labs., 732 P.2d 297, 306 (Idaho 1987); Kentucky, Ostendorf v. Clark Equip. Co., 122 S.W.3d 530, 535 (Ky. 2003); Evans v. Lorillard Tobacco Co., 990 N.E.2d 997, 1013–1014 (Mass. 2013); Gregory v. Cincinnati Inc., 538 N.W.2d 325, 333 (Mich. 1995); Jurado v. W. Gear Works, 619 A.2d 1312, 1317–18 (N.J. 1993); Brooks v. Beech Aircraft Corp., 902 P.2d 54, 62 (N.M. 1995); Scarangella v. Thomas Built Buses, Inc., 717 N.E.2d 679, 681–682 (N.Y. 1999); Branham v. Ford Motor Co., 701 S.E.2d 5, 14 (S.C. 2010); Uniroyal Goodrich Tire Co. v. Martinez, 977 S.W.2d 328, 335 (Tex. 1998); Beatty v. Ford Motor Co., 574 S.E.2d 803 (W. Va. 2002); *see also* McWilliams & Smith, *supra* note 4, at 85–87 (collecting references).

19. Alaska, Arizona, California, Connecticut, Florida, Hawaii, Illinois, Mississippi, and Washington recognize both tests. GMC v. Farnsworth, 965 P.2d 1209, 1220 (Alaska 1998);

minority of eight states apply tests that adopt elements of both tests, but do not perfectly align with either the consumer expectations test or the risk-utility test.[20]

A. A Brief History of Products Liability Law

At the beginning of the twentieth century, tort law generally provided no remedy when a product harmed the consumer who purchased it.[21] Early courts reasoned that a manufacturer did not generally owe a duty of care to third parties that it did not transact with,[22] and no claim for negligence could arise if a defendant did not owe the plaintiff a duty of care.[23] The requirement that a plaintiff consumer had privity of contract with the defendant manufacturer precluded tort law remedies for harms that defective products caused. In some cases, courts were willing to infer that a defendant owed a duty to the public at large to prevent particularly dangerous products from harming the public, but such cases were rare.[24] In a particularly famous instance, the court in *Thomas v. Winchester* found an apothecary liable after he mislabeled poison he sold to distributors as medicine and buyers who consumed the poison were injured.[25] Other courts reasoned that a caterer who served "unwholesome" food endangered the lives of event guests, just as if the caterer had administered poisonous medicine.[26] But outside of such dangerous product cases, tort law did little to accommodate plaintiffs who sought a remedy against a manufacturer.

As a result, a suit for defective products could only arise under contract law.[27] Sometimes a contract for goods included an explicit warranty of merchantability, but courts also proved generally willing to infer an implied warranty of merchantability,

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Arizona, Golonka v. GMC, 65 P.3d 956, 962–63 (Ariz. Ct. App. 2003); Soule v. GMC, 882 P.2d 298, 308–09 (Cal. 1994); Potter v. Chi. Pneumatic Tool Co., 694 A.2d 1319, 1330 (Conn. 1997); Force v. Ford Motor Co., 879 So. 2d 103, 106 (Fla. Dist. Ct. App. 2004); Acoba v. General Tire, Inc., 986 P.2d 288, 304 (Haw. 1999); Calles v. Scripto-Tokai Corp., 864 N.E.2d 249, 255 (Ill. 2007); Glenn v. Overhead Door Corp., 935 So. 2d 1074, 1081 (Miss. Ct. App. 2006); Soproni v. Polygon Apartment Partners, 971 P.2d 500, 504–05 (Wash. 1999); *see also* McWilliams & Smith, *supra* note 4, at 87–88 (collecting references).

20. Delaware, Iowa, Maine, Missouri, Montana, Nevada, South Dakota, and Virginia each apply tests that differ from the traditional consumer expectations or risk-utility formulations. Robinson v. Brandtjen & Kluge, Inc., 500 F.3d 691, 698 n.2 (8th Cir. 2007) (discussing the uncertainty over South Dakota's law); Redman v. John D. Brush & Co., 111 F.3d 1174, 1177 (4th Cir. 1997) (discussing Virginia's test); Allen v. IBM, No. 94-264-LON, 1997 U.S. Dist. LEXIS 8016, at *139 (D. Del. May 19, 1997); Wright v. Brooke Grp. Ltd., 652 N.W. 2d 159, 169–70 (Iowa 2002); Guiggey v. Bombardier, 615 A.2d 1169, 1172 (Me. 1992); Moore v. Ford Motor Co., 332 S.W.3d 749, 760 (Mo. 2011); Krueger v. GMC, 783 P.2d 1340, 1345 (Mont. 1989); Fyssakis v. Knight Equip. Corp., 826 P.2d 570, 572 (Nev. 1992); *see also* McWilliams & Smith, *supra* note 4, at 88–90 (collecting references).

21. George L. Priest, *The Invention of Enterprise Liability: A Critical History of the Intellectual Foundations of Modern Tort Law*, 14 J. LEGAL STUD. 461, 461 (1985).

22. *E.g.*, Goodlander Mill Co. v. Standard Oil Co., 63 F. 400, 403–05 (7th Cir. 1894).

23. *E.g.*, Singleton v. Felton, 101 F. 526, 528 (6th Cir. 1900).

24. *See id.*

25. 6 N.Y. 397, 397–98 (1852).

26. Bishop v. Weber, 1. N.E. 154, 154–55 (Mass. 1885).

27. *See, e.g.*, Loxtercamp v. Lininger Implement Co., 125 N.W. 830, 831–32 (Iowa 1910).

which worthless or dangerous products would violate as a matter of law.[28] A consumer could then bring a claim for breach against the seller if a product was defective. But, plaintiffs could levy this claim against only their contractual counterparty—the seller.[29] In the many cases where the manufacturer and the final seller were not the same entity, contract law enabled a cause of action only against the seller. If the seller was judgment proof, then a plaintiff was without recourse; strategic dealing by manufacturers could therefore render them generally immune to liability for defective goods.[30]

But in 1916, the New York Court of Appeals in *MacPherson v. Buick Motor Co.* held that privity was not required to bring a claim in negligence against a manufacturer of a dangerous product that was defective.[31] Instead, *MacPherson* extended the rule of *Thomas v. Winchester* to products "which, in their normal operation, are implements of destruction."[32] Under *MacPherson*, a manufacturer of any good that is "reasonably certain to place life and limb in peril when negligently made" owed a duty of care to the public at large to not make the product negligently.[33] The class of products no longer subject to the privity rule grew substantially. No longer limited to poisons and adulterated foods, plaintiffs brought claims against the manufacturers of electric cranes,[34] roads,[35] stoves,[36] and many other goods that routinely posed a risk to consumers. *MacPherson* was a watershed moment in the law of products liability; courts across the country and the Restatement (First) of Torts subsequently adopted the no-privity rule in the decades that followed.[37]

In the Restatement (Second) of Torts, the American Law Institute expanded upon the notion of dangerous products from *MacPherson* and the Restatement (First).[38] Comment i to section 402A provided the first articulation of the modern consumer expectations test.[39] Section 402A of the Second Restatement stated that a defendant should be liable for selling "any product in a defective condition *unreasonably dangerous* to the user or consumer."[40] Comment i clarified what kinds of risks were

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28. *E.g.*, Weed v. Dyer, 13 S.W. 592, 594 (Ark. 1890); Snowden v. Waterman, 28 S.E. 121, 121 (Ga. 1897); Nixa Canning Co. v. Lehmann-Higginson Grocer Co., 79 P. 141, 141 (Kan. 1905).

29. *See, e.g.*, *Weed*, 13 S.W. at 594; Snowden v. Waterman, 28 S.E. 121, 121 (Ga. 1897); Nixa Canning Co. v. Lehmann-Higginson Grocer Co., 79 P. 141, 141 (Kan. 1905).

30. *Cf.* Lynn M. LoPucki, *The Death of Liability*, 106 YALE. L.J. 1, 14–37 (1996) (discussing actions that defendants can take to become judgment proof and arguing that judgment-proof defendants interfere with the operations of the tort system).

31. MacPherson v. Buick Motor Co., 111 N.E. 1050, 1051 (N.Y. 1916).

32. *Id.* at 1050.

33. *Id.* at 1053.

34. Payton's Adm'r v. Childers Electric Co., 14 S.W.2d 208, 208–10 (Ky. 1929).

35. Harriman v. N.Y., Chi. & St. Louis R.R., 171 N.E. 686, 686 (N.Y. 1930).

36. Coakley v. Prentiss-Wabers Stove Co., 195 N.W. 388, 389–91 (Wis. 1923).

37. *E.g.*, Kalash v. L.A. Ladder Co., 34 P.2d 481, 482 (Cal. 1934); Carter v. Yardley & Co., 64 N.E.2d 693, 699–700 (Mass. 1946); RESTATEMENT (FIRST) OF TORTS: NEGLIGENCE §§ 394–402 (AM. LAW INST. 1934).

38. RESTATEMENT (SECOND) OF TORTS § 402A, comment i (AM. LAW INST. 1965).

39. *Id.*

40. *Id*. § 402A(1) (emphasis added).

"unreasonably dangerous" to consumers; a product is "unreasonably dangerous" only if it is "dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics."[41] Thus, under the Restatement's test, any manufacturer that sold a defective product which violated ordinary consumer expectations about its safety was strictly liable for any harm the product caused.[42] And while it is unclear whether the Restatement precipitated state court adoption of the consumer expectations test or merely predicted it, [43] it is undeniable that states widely adopted the consumer expectations test in the years that followed.[44]

Over time, some courts became dissatisfied with how the consumer expectations test was practically applied.[45] In particular, some courts questioned whether strict liability remained an appropriate approach to products liability when courts could balance the benefits and costs of alternative products, similar to the traditional negligence analysis that courts had long engaged in.[46] As a result, some courts adopted what has become known as the "risk-utility" test for products liability.[47] As discussed in Section C, the risk-utility test shifts the focus of products liability law from the expectations of an ordinary consumer to whether an alternative product which presents a better risk-benefit tradeoff existed. The pace of change remained slow, however. Today, roughly even numbers of state courts apply the consumer expectations test and the risk-utility test, though many states permit plaintiffs to make their case under either test.[48]

B. The Consumer Expectations Test

In most states today, plaintiffs can successfully bring a products liability claim if they demonstrate that the product violated consumer expectations.[49] In particular, plaintiffs will prevail if they show that a product failed to perform as safely as an ordinary and reasonable consumer would expect when the product is used in a reasonably foreseeable manner.[50] Courts apply the test in all manner of products

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41. *Id.* at comment i.

42. *Id.* § 402A.

43. *See* Hylton, *supra* note 7, at 2467 (discussing the controversy over whether the ALI adopted the strict liability theory prescriptively or descriptively).

44. *E.g.*, Zaleskie v. Joyce, 333 A.2d 110, 113 (Vt. 1975); Vincer v. Esther Williams All-Aluminum Swimming Pool Co., 230 N.W.2d 794, 797–98 (Wis. 1975). Courts that apply both tests split on how to determine whether liability attaches when the tests differ in result. Some courts favor one test or the other, Gutterman v. Target Corp., 242 F. Supp. 3d 695, 706 (N.D. Ill. 2017), while others will find a defendant liable if either test demonstrates a defendant was liable, *Zaleskie*, 333 A.3d at 113.

45. *See infra* Part II, for an analysis of critiques of the ordinary consumer expectations test.

46. David G. Owen, *The Evolution of Products Liability Law,* 26 REV. LITIG. 955, 980 (2007).

47. *E.g.*, *Banks v. ICI Americas, Inc.*, 450 S.E.2d 671, 673–74 (Ga. 1994).

48. McWilliams & Smith, *supra* note 4, at 83–85, 87–88.

49. *See supra* notes 17–18 and accompanying text.

50. Douse v. Bos. Sci. Corp., 314 F. Supp. 3d 1251, 1251 (M.D. Fla. 2018); Show v. Ford Motor Co., 697 F. Supp. 2d 975, 980–81 (N.D. Ill. 2010).

liability cases, including manufacturing defects and design defects.[51] *MacPherson*'s influence is still observable, though, as courts have applied the test to a variety of products that could cause danger even though those products are not inherently dangerous, including household goods,[52] food and drink,[53] and health care products.[54]

Whether a particular product violated the expectations of an ordinary and reasonable consumer is a question of fact for the jury to decide.[55] A plaintiff may offer specific evidence of ordinary consumer expectations, but the jury can also rely upon their own experience to determine what an ordinary consumer would expect.[56] Letting jurors draw on their own experiences is reasonable particularly because the pool of jurors, made up of ordinary consumers, is better situated to define what an ordinary consumer may expect than expert witnesses. But, when the plaintiff's claim involves technical information beyond the common knowledge and experience of jurors, courts generally require a plaintiff to present expert testimony that demonstrates the defect.[57] For example, in *Show v. Ford Motor Company*, the court considered whether a plaintiff's claim that a vehicle rolled over too easily, rendering it defective, could survive summary judgment.[58] The plaintiff had declined to proffer any expert witness testimony about the car's design.[59] Because consumers generally lack articulable expectations about something as technical as a car frame, the court reasoned that a jury was not well suited to draw on its own experiences and granted summary judgment for the defendant.[60]

Because juries decide whether particular products are unreasonably defective, court opinions rarely engage in a prolonged analysis about whether a particular product violated consumer expectations.[61] For example, in *Brand v. Holmes Air Taiwan, Inc.*, a court considered a motion to dismiss a plaintiff's claim that a

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51. *E.g.*, Boy v. I.T.T. Grinnell Corp., 724 P.2d 612, 620 (Ariz. Ct. App. 1986) (applying the consumer expectations test to a manufacturing defect); Barker v. Lull Engineering Co., 573 P.2d 443, 446 (Cal. 1978) (applying the test to a design defect).

52. *E.g.*, Alevromagiros v. Hechinger Co., 993 F.2d 417, 418 (4th Cir. 1993) (step ladder collapsed).

53. *E.g.*, Gates v. Standard Brands Inc., 719 P.2d 130, 131 (Wash. Ct. App. 1986) (candy bar contained snake vertebrae).

54. *E.g.*, Haddix v. Playtex Family Prods. Corp., 138 F.3d 681 (7th Cir. 1998) (fiber in tampons caused Toxic Shock Syndrome).

55. Gutterman v. Target Corp., 242 F. Supp. 3d 695, 706 (N.D. Ill. 2017) ("Typically, application of the consumer-expectation test is a task for the jury, but it can be decided as a matter of law where no reasonable jury could find that a product performed other than how an ordinary consumer would expect.") (citation omitted).

56. Show v. Ford Motor Co., 697 F. Supp. 2d 975, 981 (N.D. Ill. 2010).

57. *E.g.*, *id.* at 985.

58. *Id.*

59. *Id.* at 982.

60. *Id.* at 985–87.

61. *See, e.g.*, Douse v. Bos. Sci. Corp., 314 F. Supp. 3d 1251, 1260 (M.D. Fla. 2018) ("[The Complaint] alleges the entire Greenfield Filter was 'subject to breakage, collapse, migration, perforation, [and] causing thrombus.' Taken as true, these allegations plausibly support the contention that the Greenfield Filter was unreasonably dangerous because it was more hazardous than the ordinary consumer would expect.") (alteration in original) (citation omitted).

humidifier which burned the plaintiff's child was defective under the consumer expectations test.[62] In one short paragraph, the court concluded that the ordinary consumer would expect a humidifier to present a burn risk because "boiling water produces steam" and "[h]ot water is an inherent property of a steam humidifier."[63] Likewise, in *McCathern v. Toyota Motor Corp.*, the Supreme Court of Oregon spent very little time evaluating the evidence that was presented to a jury.[64] The plaintiff demonstrated that the car at issue possessed less dynamic stability than what is reasonably safe, and it therefore violated consumer expectations that a car would not easily roll over in a collision.[65] As a final example, in *Gutterman v. Target Corp.*, the court briefly noted that "an ordinary consumer would expect that riding a skateboard in a retail store would create a risk of falling down from its use," concluding that the packaging for the skateboard was not defective because the packaging could be removed and the skateboard ridden in the store.[66]

Courts disfavor finding for a plaintiff when the risk was open and obvious[67] or when the product warned consumers about the risk.[68] Some courts hold that an open and obvious risk cannot violate consumer expectations as a matter of law because any reasonable consumer would know or should know that such a risk exists.[69] For example, in *Davis v. Komatsu*, a worker injured his hand when he placed it in an industrial metal press to clear debris.[70] The court reasoned that because the danger of putting a hand inside of a 200-ton press was plainly obvious, the product was not unreasonably dangerous and did not violate consumer expectations.[71] But other courts prefer to maintain a flexible consumer expectations test and hold that the obviousness of a danger is simply one factor for courts to consider when determining what consumers' expectations were.[72] Similarly, courts are hesitant to find that products which establish consumer expectations through adequate warnings violated consumer expectations unless the warning itself was inadequate.[73] In *Thongchoom v. Graco Children's Products*, a plaintiff brought a claim alleging that a baby walker was defectively designed when a baby placed in the walker navigated to a nearby tea kettle, grabbed the cord, and was burned when the tea kettle fell.[74] The court noted that the walker instructed users to never leave children unattended, to avoid

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62. 500 F. Supp. 2d 1043, 1044–45 (S.D. Ill. 2007).

63. *Id.* at 1047.

64. *See* 23 P.3d 320, 333 (Or. 2001).

65. *Id.* at 332–33.

66. 242 F. Supp. 3d 695, 707 (N.D. Ill. 2017).

67. *E.g.*, Delaney v. Deere & Co., 999 P.2d 930, 935–939, 946 (Kan. 2000) (rejecting "open and obvious" danger test and recounting other cases in which Kansas Supreme Court has rejected it).

68. *Id.* at 936–40 (rejecting adoption of a rule which would hold a product not defective if it bore a warning label).

69. *E.g.*, Austin v. Clark Equip. Co., 48 F.3d 833, 836 (4th Cir. 1995).

70. Davis v. Komatsu Am. Indus. Corp., 46 F. Supp. 2d 745, 748 (W.D. Tenn. 1999).

71. *Id.* at 753–54.

72. *Delaney*, 999 P.2d at 946.

73. *See* Thongchoom v. Graco Children's Prods., Inc., 71 P.3d 214, 218–19 (Wash. Ct. App. 2003).

74. *Id.* at 216–17.

appliances and hot surfaces, and that improper use could result in serious injury.[75] These warnings were sufficient to inform an ordinary consumer about the possibility of injury.[76]

Another issue which has divided courts is the identity of the ordinary consumer. In its canonical formulation, the test is an objective, rather than subjective, inquiry. As a result, a plaintiff cannot prevail by demonstrating that a product violated the plaintiff's or any other identified group's expectations; only the legally constructed ordinary consumer's expectations matter.[77] Nevertheless, some courts reason that it would be inappropriate to compensate a plaintiff who was aware of the risk that a product presented.[78] To illustrate, in *Hartman v. Miller Hydro Co*., a plaintiff brought a claim against the manufacturer of a bottle washing machine when the machine caught the plaintiff's pants and body as he leaned against the machine.[79] The plaintiff testified that he was never personally warned about the risk that the machine posed.[80] But because the court applied the objective formulation of the consumer expectation test, it did not matter whether the plaintiff himself had been adequately warned—what mattered was whether the danger itself was sufficiently obvious that a reasonable consumer would expect the risk.[81] Comparably, in *Morton v. Owens-Corning Fiberglas Corp.*, a plaintiff sued an asbestos manufacturer once the plaintiff was diagnosed with cancer attributable to asbestos exposure.[82] On appeal, the defendant argued that the scientific community's uncertainty about the propensity of asbestos to cause cancer should protect it from liability.[83] Because the knowledge and expectations of the reasonable consumer are key, not the knowledge of the scientific community, the court affirmed the jury's verdict for the plaintiff.[84] In contrast, in *Magnuson v. Rupp Manufacturing*, the court considered whether the placement of a spark plug was a design defect that was unreasonably dangerous after the plaintiff injured his knee by striking the spark plug.[85] Because the plaintiff was a mechanic who knew the location of the spark plug and had removed and replaced it several times, the court held that the product was not defective; actual knowledge of the risk was sufficient to defeat the plaintiff's claim.[86]

C. The Risk-Utility Test

The risk-utility test is the major alternative to the consumer expectations test. The canonical formulation of the risk-utility test is found in Section 2(b) of the

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75. *Id.* at 218.
76. *Id.* at 219.
77. *E.g.*, Hartman v. Miller Hydro Co., 499 F.2d. 191, 194 (10th Cir. 1974); Morton v. Owens-Corning Fiberglas Corp., 40 Cal. Rptr. 2d 22, 25–26 (Cal. Ct. App. 1995).
78. *See, e.g.*, Magnuson v. Rupp Mfg., Inc., 171 N.W.2d 201, 203–05 (Minn. 1969).
79. 499 F.2d at 191–92.
80. *Id.* at 194.
81. *See id.*
82. 40 Cal. Rptr. 2d at 22–23.
83. *Id.* at 25.
84. *Id.* at 25–26.
85. 171 N.W.2d at 203–05.
86. *Id.* at 207–08.

Restatement (Third): Products Liability, which states that a product "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," and when the "omission of the alternative design renders the product not reasonably safe."[87] Relevant factors for evaluating whether the foreseeable risks would have been reduced by a reasonable alternative design include: (1) the usefulness of the product; (2) the likelihood the product will cause injury and the seriousness of that injury; (3) the availability of a safer alternative product; (4) the manufacturer's ability to make the product safer without impairing the utility of the product; (5) the user's ability to avoid danger through reasonable care; (6) the user's awareness of the dangers inherent in the product; and (7) the ability of the manufacturer to acquire insurance or incorporate losses into the price of the good.[88] Courts have widely incorporated these factors, originally proposed by Dean Wade in his seminal article, into their risk-utility analyses.[89] Even in terms of their conceptualization, these factors involve overlapping criteria and are not tantamount to a formal economic test of whether the manufacturer was negligent.[90]

In practice, the risk-utility factors have proven difficult to interpret and implement. The seven factors provide courts with several different product attributes to consider, each of which imply a different appropriate response on the part of courts.[91] The test does not provide judges or jurors with a concrete way to compare tradeoffs among the various factors—if a product is extremely useful but very likely to cause serious injury, for example, it is not clear just how much utility is necessary to offset a substantial safety risk.[92] Fully informed consumers are capable of making such determinations themselves, but the test requires that courts somehow impose an aggregate decision on their behalf.[93] Presumably, some level of utility is sufficient to offset any level of risk, but the totality-of-the-circumstances test does not provide courts with instructions on how to balance the disparate considerations the test encompasses.[94] The test also fails to address the fact that many of the factors are interdependent and more appropriately determined by functioning markets than set out by courts—the value of the product to consumers, for example, is itself a function of the safer alternatives and how much reasonable care can reduce risks.[95]

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87. RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 2(b) (AM. LAW INST. 1998).

88. *See* John W. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 837–38 (1973) (laying out the "Wade" factors for the risk-utility test); *see also* Aaron D. Twerski & James A. Henderson, Jr., *Manufacturers' Liability for Defective Product Designs: The Triumph of Risk-Utility*, 74 BROOK. L. REV. 1061, 1080–89 (2009) (reviewing the use of these factors by each court that uses risk-utility).

89. Twerski & Henderson, *supra* note 88, at 1095; *see also* John W. Wade, *Strict Tort Liability of Manufacturers*, 19 Sw. L.J. 5, 17 (1965).

90. *See* VISCUSI, *supra* note 9, at 70–77.

91. *Id.* at 73.

92. *Id.* at 72–73.

93. *Id.* at 72.

94. Incommensurability of factors is a problem wherever the law does not provide a basis for comparing different options. *See* Matthew Adler, *Law and Incommensurability: Introduction*, 146 U. PA. L. REV. 1169, 1170 (1998).

95. VISCUSI, *supra* note 9, at 73–74.

The risk-utility test potentially resembles the general spirit of considerations that would enter an economics negligence test by requiring manufacturers to implement a safer design only to the extent that the safety benefits of the alternative design outweigh the costs, including changes to product usefulness, price, and manufacturing cost.[96] This negligence-esque test sharply contrasts with the conditional strict liability of consumer expectations.[97] Under the consumer expectations test, manufacturers are held liable for any product that exposes users to a risk that an ordinary and reasonable consumer would not expect, but the risk-utility test requires courts to assess the fault of the manufacturer by determining whether a safer design of equal or greater utility existed.[98] The Restatement eschews formally identifying the test as one of negligence, though courts have recognized the similarity between classic negligence and risk-utility.[99]And of course, as in traditional negligence and the consumer expectations test, whether the adoption of a reasonable alternative design would have rendered a product reasonably safe is a question of fact relegated to the jury to decide.[100]

Despite the formal dichotomy of the two tests, some jurisdictions blend the two approaches. In some, courts apply the consumer expectations test but require plaintiffs to demonstrate that a reasonable alternative design exists.[101] Others augment the Wade factors in the risk-utility test with an analysis of whether the average reasonable consumer would have expected a safer product.[102] In both such jurisdictions, courts claim that they are applying one test or the other, though they have melded the two into one. Finally, some courts are far more transparent and simply allow a plaintiff to show that a product was defective either because it violated consumer expectations *or* because it does not satisfy the risk-utility test.[103]

II. RESTRUCTURING THE CONSUMER EXPECTATIONS TEST

As the preceding Part highlighted, courts remain deeply divided over what test should be used to evaluate products liability claims. Courts that switched to the risk-utility test generally did so because the consumer expectations test proved unmanageable and flawed in practice, and because the risk-utility test more clearly

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96. *See* RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 2(b) cmt. a (AM. LAW INST. 1998) ("Subsections (b) and (c), which impose liability for products that are defectively designed or sold without adequate warnings or instructions and are thus not reasonably safe, achieve the same general objectives as does liability predicated on negligence. The emphasis is on creating incentives for manufacturers to achieve optimal levels of safety in designing and marketing products.").

97. *See supra* Section I.B.

98. RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 2(b) cmt. a (AM. LAW INST. 1998).

99. *See e.g.*, *Banks v. ICI Americas, Inc.*, 450 S.E.2d 671, 673–74 (1994) ("The balancing test that forms the risk-utility analysis is thus consistent with Georgia law, which has long applied negligence principles in making the determination whether a product was defectively designed.").

100. *E.g.*, Tincher v. Omega Flex, Inc., 104 A.3d 328, 335 (Pa. 2014).

101. *E.g.*, Halliday v. Sturm, Ruger & Co., 792 A.2d 1145, 1153 (Md. 2002).

102. *E.g.*, Walker v. Macy's Merch. Grp., Inc., 288 F. Supp. 3d 840, 858 (N.D. Ill. 2017).

103. *E.g.*, Barker v. Lull Eng'g Co., 573 P.2d 443, 457–58 (Cal. 1978).

resembles the negligence test with which the courts are more familiar and comfortable.[104] But these reasons fail to address which test is likely, in practice, to optimize social welfare. This Part addresses the critiques of the consumer expectations test and concludes that it remains theoretically superior to the risk-utility test. In particular, we conclude that the problems that the consumer expectations test has faced in implementation do not doom it. Rather, the test needs to be restructured to reflect both the underlying characteristics of consumer decisions and judicial experience in the years since the test first entered the jurisprudence.

Section A presents the theoretical foundations of our analysis of the specific consumer expectations test. We lay out a simple analytic framework for examining consumer expectations, purchasing decisions, product safety, and the relevant rules for products liability. Section B uses our framework to demonstrate that the consumer expectations test is generally superior to the risk-utility test in establishing incentives for manufacturers to create safe products. While the risk-utility test induces firms to choose a risk level that minimizes the social harm from accidents, it will also often cause consumers with flawed expectations to purchase goods they would not have if they were aware of the risks the products presented. Section C considers the operation of the consumer expectations test under our framework in situations where courts have historically found the test lacking. We demonstrate that our specific consumer expectations test improves the practical operation of the consumer expectations test without sacrificing the incentives demonstrated in Section B.

A. Conceptual Framework for Understanding Consumer Decisions

This Section presents the theoretical foundations of the specific consumer expectations test. The theoretical model provides an analytically tractable framework in which to compare the consumer expectations test and risk-utility test and evaluate our proposed specific consumer expectations test.

Consider a hypothetical representative consumer who may purchase a potentially risky product. Before taking any action, the consumer faces some baseline probability p_0 of a bad outcome d, such as experiencing a car accident.[105] In reality, consumers are exposed to myriad risks along multiple dimensions, but rather than clutter our analysis with many parameters, we will assume consumers face only one relevant risk. The assumption is not critical to our analysis but permits a simpler exposition. The consumer can purchase a product which costs c and provides a consumption benefit b, such as the enjoyment and utility of driving a new car. In addition to the consumption benefit, many products potentially increase or decrease risks. Let p_c represent the probability of a bad outcome that a consumer expects to face if the product is purchased. If the consumer expects the probability of a bad

104. *Cf. id.* at 456 (augmenting the consumer expectations test with an early articulation of the risk-utility factors to more adequately address product complexity and put the burden on the manufacturer to establish the safety of a product).

105. To ease the exposition of our analytic model, we will consider a product that reduces the risk of some bad outcome. The implications of our model and the specific expectation test's implementation are parallel if we consider a product that increases the likelihood of a positive outcome.

outcome is higher than the baseline probability, the utility benefit b of the product must be sufficient to warrant incurring the product cost. If the probability of the bad outcome is less than the baseline probability, then the product confers both a utility benefit as well as a safety benefit. Risk-neutral consumers[106] will purchase the product as long as the total benefits of purchasing the product, including both the consumption benefit and the product's expected tendency to reduce risks, exceed its costs—or more specifically, if $b > c + (p_c - p_0)d$.[107]

To illustrate using a concrete example, consider a consumer who possesses a car and is contemplating purchasing an aftermarket forward-collision warning system.[108] The consumer primarily uses the car to commute to work. During the commute, the consumer faces approximately a 10% chance of experiencing a car accident in a given year.[109] The forward-collision warning system costs $1000[110] and reduces the probability that the consumer experiences a car accident by three percentage points to 7% per year.[111] Assume that a collision warning system provides no consumption benefit and will not affect the severity of accidents if they occur, but it will affect the financial cost of repairs.[112] Then the consumer will purchase the forward-collision

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106. In reality, many consumers are not risk-neutral; however, assuming risk-neutrality simplifies our model and does not materially affect our analysis. In particular, the model could be expanded to account for risk-averse consumers by adding a risk-premium or penalty term to the purchasing condition which represents the consumer's distaste for a risk. The premium or penalty will generally be a function of the other parameters in the model. *See generally* HAL R. VARIAN, MICROECONOMIC ANALYSIS 177–190 (3d. 1992) (discussing various functional forms of risk aversion).

107. Without the product, the consumer's payoff is $-p_0 d$. With the product, the consumer's payoff is $b - p_c d - c$. Consumers would therefore purchase the product if and only if $b - p_c d - c > -p_0 d$, or equivalently $b > c + (p_c - p_0)d$.

108. The availability of such after-market upgrades is discussed in Dee-Ann Durbin, *Old Car, New Tricks: Adding Safety Tech to an Older Car*, USA TODAY (May 4, 2017), https://www.usatoday.com/story/money/personalfinance/2017/05/04/old-car-new-tricks-adding-safety-tech-older-car/100976250/ [https://perma.cc/JMV3-X2YW].

109. The National Safety Council estimates that in 2017 approximately 24,800,000 vehicles were involved in crashes in the United States. National Safety Council, *Injury Facts*, *Overview*, https://injuryfacts.nsc.org/motor-vehicle/overview/introduction/ [https://perma.cc/U963-MNAV]. There were 225,346,257 licensed drivers in the United States in 2017. U.S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION, OFFICE OF HIGHWAY POLICE INFORMATION, *Highway Statistics 2017: Licensed Drivers by Sex and Ratio to Population*, (December 2018), https://www.fhwa.dot.gov/policyinformation/statistics/2017/dl1c.cfm [https://perma.cc/N23T-858G]. The implied probability of any driver being involved in any car accident is 11%.

110. *E.g.*, *Safety Upgrades for Your Car: These Aftermarket Aids Can Help You Avoid an Accident*, CONSUMER REPORTS (Sept. 2013), https://www.consumerreports.org/cro/magazine/2013/11/safety-upgrades-for-your-car/index.htm [https://perma.cc/7P3V-KTZA] (reviewing an aftermarket forward crash detection system that costs $850 for the product and $150 to install).

111. *E.g.*, Durbin, *supra* note 108 ("Forward-collision warning systems, for example, can reduce the risk of a crash by 27 percent . . . .").

112. Of course, these assumptions could fail. If individuals experience mental comfort from having an additional safety device, b would be some positive value. Likewise, the

warning system as long as he or she values a three percentage point reduction in car accidents more than $1000. Depending on the consumer's insurance policy, it's quite plausible that the forward-collision warning system is worth the cost.

In general, consumers' expectations of risks will not perfectly correspond to the actual risks that consumers face.[113] Sometimes the information necessary to determine the actual rate at which an adverse event occurs is unavailable to consumers, such as when an airbag manufacturer does not disclose that their airbags can explode and cause harm to drivers.[114] Consumers may fail to aggregate risk information because doing so requires technical knowledge that the average consumer lacks.[115] Finally, behavioral economics research demonstrates that the average individual systematically overestimates small risks.[116] Let p denote the true probability of an adverse event occurring when the consumer purchases the product. If p is greater than p_c, consumers will tend to purchase products more often than they would have if they fully appreciated the risks associated with a product. In cases where consumers overestimate risks, they will decline to purchase products that they should have based on the consumption and risk-reduction benefits that the products actually provide.

With this analytic framework, we can identify the decision rules that the traditional consumer expectation test, our specific consumer expectations test, and the risk-utility test establish. Of course, each of these decision rules are somewhat stylized relative to their actual operation. As explored further in Section C, the way that the traditional consumer expectations test and the risk-utility test deviate from their economic formulation is a primary justification for our specific consumer expectations test. Under the traditional consumer expectations test, a producer is liable as long as their product presents a greater risk to consumers than consumers expect.[117] If the actual probability of harm p is greater than consumer's expected probability of harm p_c, the traditional consumer expectations test is violated and the manufacturer will be liable for damages. Since courts generally focus on determining liability and providing compensation to those who have suffered injuries, and courts

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device could cause average crash speeds to decrease, thereby decreasing the probable harm when an accident occurs. If these conditions persist, the consumer would be willing to pay an even higher price for the product.

113. *E.g.*, Sarah Lichtenstein, Paul Slovic, Baruch Fischhoff, Mark Layman & Barbara Combs, *Judged Frequency of Lethal Events*, 4 J. EXPERIMENTAL PSYCHOL.: HUM. LEARNING & MEMORY 551, 556–57 (1978) (showing that individuals overestimate risks due to causes that are easy to imagine).

114. *See, e.g.*, Tabuchi & Boudette, *supra* note 11 (discussing Takata's knowledge of its defective airbags).

115. *See generally* Athanasios Krystallis, Lynn Frewer, Gene Rowe, Julie Houghton, Olga Kehagia, & Toula Perrea, *A Perceptual Divide? Consumer and Expert Attitudes to Food Risk Management in Europe*, 9 HEALTH, RISK & SOC'Y 407 (2007) (discussing the differences in risk perception between consumers and individuals who measure health risks of food).

116. Lichtenstein et al., *supra* note 113, at 556–67; *see also* W. Kip Viscusi, *Jurors, Judges, and the Mistreatment of Risk by the Courts*, 30 J. LEGAL STUD. 107, 131–33 (2001) (demonstrating that jury-eligible citizens do not properly perceive risks, particularly in the context of low-probability events in negligence cases).

117. *See supra* Section I.B.

have historically been uneasy awarding probabilistic damages,[118] the measure of damages in the case of liability will be the full level of injury that a particular injured plaintiff sustained d.[119] Under our specific consumer expectations test, a firm is liable for a defective product that consumers expected would reduce a risk, but the product in fact *increased* the risk. In other words, the plaintiff prevails if they can demonstrate that the risk consumers expect to face is less than the baseline risk and the actual risk that consumers who purchased the product face is greater than the base risk. The first condition corresponds to our requirement that the product be one which consumers expect to reduce the particular risk. The second condition corresponds to our requirement that the product actually increased risk, contrary to the specific expectations identified in the first condition. Depending on the products involved, a plaintiff could demonstrate that the product increased the risk relative to the baseline with a variety of evidence, including scientific studies, analysis of the mechanical properties of the allegedly defective product, or surveys of the experiences of a large sample of consumers. Consistent with traditional tort principles, plaintiffs will generally need to demonstrate that they had suffered injury before a court will award damages. As with the traditional consumer expectations test, actually injured plaintiffs will receive d in damages.

Under economic formulations of the risk-utility test, a producer is liable if there exists some alternative product design with a different consumption benefit, risk profile, price, and manufacturing cost such that the alternative product is safer and still at least as preferable to consumers. Using the parameters defined above and an "a" to denote the characteristics of the alternative product, the risk utility test would be violated if $b^a - c^a - p^a d \geq b - c - pd$. In practice, the risk-utility test is not a formal benefit-cost analysis that perfectly tracks the formula, though the essence of the test tries to approximate one.[120] Two specific cases of alternative products

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118. *See* Jonathan Remy Nash, *Standing's Expected Value*, 111 MICH. L. REV. 1283, 1319 (2013) (discussing the hesitancy of courts to award probabilistic damages in many settings).

119. Courts that provide full damages to all plaintiffs who sustain an injury will overcompensate plaintiffs as a class and overcharge defendants when a product increases the probability of a risk rather than exposing consumers to a new risk, because $pd > (p - p_c)d$. As a result, it is appropriate for courts to probabilistically reduce damages. *See, e.g.*, Doll v. Brown, 75 F.3d 1200, 1205–06 (7th Cir. 1996) (recognizing the "inescapably probabilistic character of many injuries," and discussing the propriety of awarding 25% of full damages when a defendant increased the probability of a bad outcome by 25 percentage points); *see also*, United States v. Hatahley, 257 F.2d 920, 923 (10th Cir. 1958) ("The fundamental principle of damages is to restore the injured party, as nearly as possible, to the position he would have been in had it not been for the wrong of the other party.").

120. *See, e.g.*, Ferraro v. Hewlett-Packard Co., 721 F.3d 842, 846 (7th Cir. 2013) ("Illinois courts consider a broad range of factors in their risk-utility analysis, including the magnitude and probability of the foreseeable risks of harm; . . . the nature and strength of consumer expectations regarding the product, including expectations arising from product portrayal and marketing; the likely effects of any alternative designs on production costs; and conformity with industry standards, voluntary organization guidelines, and government regulation."). The relationship between the risk-utility test's economic formulation and the courts' articulated totality-of-the-circumstances approach is similar to the relationship between the Hand formula and the rule for negligence in torts. *Cf.* McCarty v. Pheasant Run, Inc., 826 F.2d 1554, 1557

deserve note here. If there exists an alternative design that is safer, provides the same consumption benefit, costs the same to manufacture, and would be priced the same,[121] the product fails the risk-utility test. Defined in this manner, the risk-utility test requires firms to manufacture products which are Pareto-efficient.[122] In other words, a safety-related aspect of the product cannot be improved without increasing the price or manufacturing cost or decreasing the benefit of the product. Next, there always exists at least one "alternative product," which is no product at all.[123] If the risks of the relevant product are such that consumers would be better off without consuming the product at all, then the product may inherently fail the risk-utility test. But, note that if consumers were perfectly informed about the risk of products, such a product could never exist because consumers would never buy it.[124]

This analytic framework suggests that the specific consumer expectations test depends on informational components that are quite similar to the regular consumer expectations test. Courts and juries must still acquire information about consumer risk expectations, actual risks, and baseline risks to determine whether a product is defective. But each of the three tests we discuss causes manufacturers to choose different levels of product risk as a function of consumer beliefs, which we explore in Section B.

(7th Cir. 1987) ("Illinois courts do not cite the Hand Formula but instead define negligence as failure to use reasonable care . . . . But as this is a distinction without a substantive difference, we have not hesitated to use the Hand Formula in cases governed by Illinois law."). However, the application of the risk-utility test in practice is substantially less precise than its parallel in negligence. *See generally* VISCUSI, *supra* note 9, at 70–77 (discussing the difficulty of applying the risk-utility factors).

121. Of course, consumer willingness to pay for products increases with perceived safety, and so such an improvement in the product will often yield a higher price. *E.g.*, Ana M. Angulo & José M. Gil, *Risk Perception and Consumer Willingness to Pay for Certified Beef in Spain*, 18 FOOD QUALITY & PREFERENCE 1106, 1109 (2007) (demonstrating that consumer willingness to pay for beef is increasing in the perceived safety of beef). But if consumers choose whether to purchase goods based on their expectations rather than actual safety, an increase in safety may not allow firms to charge a higher price.

122. Pareto efficiency requires resources to be allocated in a manner such that no actor can be made better off without leaving another actor worse off. *See* Gabrielle Gayer, Itzhak Gilboa, Larry Samuelson & David Schmeidler, *Pareto Efficiency with Different Beliefs*, 43 J. LEGAL STUD. S151, S157–59 (2014).

123. Some legal scholars criticize the use of the "null product" as a potential alternative design. *See* Kim D. Larsen, *Strict Products Liability and the Risk-Utility Test for Design Defect: An Economic Analysis*, 84 Colum L. Rev. 2045, 2061 (1984) (discussing the use of risk utility to determine whether a product can be marketed with any feasible design). Because consumers possess heterogeneous risk preferences, it is probably generally preferable to permit consumers to decide how much they are willing to pay for a certain risk-benefit tradeoff through functioning markets rather than having courts impose preferences on markets. *See* VISCUSI, *supra* note 9, at 73 ("In a democratic society, courts should not be engaged in deciding for the public that some products (such as recreation equipment) are not useful or essential. We can rely on effective markets, when they exist, to establish the appropriate values.").

123. *See supra* note 107 and accompanying text. The expression $b > c + (p_c - p_0)d$ implies that $-p_0 d$ is in fact *less* than $b - pd - c$.

B. Producer Incentives

The two extant liability tests and our specific consumer expectations test incentivize manufacturers to provide goods with different levels of safety under different levels of consumer expectations. This Section reviews the equilibrium behavior of manufacturers under each of the three tests, arguing that the tests based on consumer expectations provide better incentives for manufacturers.

At the outset, it will be helpful to have a specific definition of what constitutes an efficient level of product safety. The efficient level of product safety will be the safety level that maximizes the benefit that consumers get from products they consume minus the price they pay (the consumer surplus), plus the benefit that manufacturers receive from the products they produce minus the cost they pay to produce such goods (the producer surplus).[125] This total economic welfare standard ensures that courts value the consumption benefits that individuals derive from product markets, the safety of consumers, and the profits of firms that make products. The socially optimal level of product risk p^* is the one where the marginal social benefit of an additional unit of precaution is precisely equal to the marginal social cost of such care. By construction, if products were any safer, the additional cost to firms to manufacture such products would outweigh the benefits that consumers receive from the safety; identically, if products were any riskier, the harm to consumers from those risks would outweigh the saved costs of producers.[126]

The traditional consumer expectations test incentivizes producers to take care that is either consistent with consumer expectations or at the efficient level. Assume that manufacturers know consumer expectations with certainty and can perfectly price discriminate.[127] As a result, producers will always charge the highest price that consumers are willing to pay, and we can focus on what level of risk manufacturers will choose. Consider a firm subject to the consumer expectations test. If the firm produces a product that poses greater risks than consumer expectations, its expected profits are its revenues minus costs and the expected damages it will pay upon being

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125. This "total surplus" standard is the standard metric for social welfare in law and economics analysis. *See, e.g.*, SHAVELL, *supra* note 13, at 2–4 (discussing measures of welfare in economic analysis). While it is possible to construct a different measure of social welfare (such as a weighted measure of consumer and producer welfare), it may be preferable to maximize total welfare first and pursue distributive policies later. *See id.* at 3 (noting that the income tax system is generally better for pursuing redistributive goals than changing rules of liability). However, some legal doctrines (like antitrust law's rule of reason) explicitly embrace a more consumer welfare-focused standard. *See* Dennis W. Carlton, *Does Antitrust Need to Be Modernized?*, 21 J. ECON. PERSPS. 155, 156–57 (2007) (discussing the consumer welfare standard of antitrust law and its distributive consequences).

126. *Cf.* Thomas J. Miceli & Kathleen Segerson, *Defining Efficient Care: The Role of Income Distribution*, 24 J. LEGAL STUD. 189, 189–90 (1995) (arguing that the efficient level of care is independent of income levels because redistribution is achieved through other means and tort law should generally focus on minimizing net-accident costs).

127. A firm can price discriminate if it can charge different customers different prices. A "perfect" price discriminator is capable of charging all consumers exactly what they are willing to pay, so that firm profits correspond perfectly with total social welfare. *See* Hal R. Varian, *Price Discrimination and Social Welfare*, 75 AM. ECON. REV. 870, 870–71 (1985).

sued.[128] If the firm produces a product which is at least as safe as consumer expectations, its expected profits are revenues minus costs, but it no longer faces a risk of damages. Because care is costly, profit-maximizing firms will never produce a product which is even safer than consumer expectations, as doing so merely increases production costs without changing consumer demand (which is dictated by consumer expectations).[129] In cases where the efficient level of product risk is riskier than the level of risk that consumers expect, firms will produce products that are safer than the efficient level, at a level consistent with consumer expectations. If consumers expect products *safer* than the efficient level, firms will manufacture products that are as safe as consumer expectations until consumers expect products so safe that it is cheaper to produce at the efficiently safe level and pay damages to injured plaintiffs. Firms switch from producing products consistent with consumer expectations to the efficient level when consumers expect products so safe that the cost of producing efficient products, including the expected damages that will be paid, is less than the cost of producing products consistent with consumer expectations.

Our specific expectations test provides substantially similar incentives to manufacturers as the consumer expectations test. As in the situation of a firm under the traditional consumer expectations test that produces a product as safe as consumers expect, the expected profits of a firm that produces a product which is expected to increase safety and actually does so are its revenue minus the costs of producing the safety-increasing product. A firm producing a safety-increasing product under the specific expectations test will take the bare minimum level of care necessary to ensure that its products do not increase the risk of harm that consumers face.[130] But if a product actually *increases* risks relative to ex ante levels, the firms' expected profits are its revenues minus costs and the damages that it will pay to each injured plaintiff. Firms producing a good that violates specific expectations will therefore produce at the efficient level of care because they minimize the expected damages they face. If taking the level of care necessary to prevent products from increasing the level of harm facing consumers is cheaper than paying damages and taking the efficient level of care, firms will do so and meet specific consumer expectations. The primary difference between firm behavior under the specific expectations test and the traditional consumer expectations test is the level of care firms take. The specific expectations test incentivizes products that do not increase risks relative to the baseline of the particular class of risks (the level that consumers would experience in the absence of purchasing the product), while the traditional consumer expectations test incentivizes firms to produce at current levels of consumer expectations.

The risk-utility test causes manufacturers to produce goods which have the efficient level of risk, regardless of consumer expectations. Under the economic formulation of the risk-utility test presented in Section A, firms will be liable if there

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128. The firm will also face legal fees, but we assume these away for expositional reasons. Our analysis accommodates legal expenses by subtracting expected expenses from profits.

129. *Cf.* VARIAN, *supra* note 106, at 63, A13 (proving that profit maximization requires minimizing costs).

130. As in the consumer expectation test, this follows from the profit-maximizing nature of the firm.

existed an alternative product with a superior risk-cost tradeoff. The risk-utility rule therefore requires firms to take care until the marginal benefit of additional care is exceeded by its cost—by definition, the efficient level of risk. Firm profits are therefore increasing in care until the efficient level, at which point the firm only loses money by taking more care.

In sum, the consumer expectations test incentivizes firms to produce products that are consistent with consumer expectations, unless consumers expect extremely safe products, at which point firms produce efficiently safe products. The specific consumer expectations test incentivizes firms to produce goods that are no riskier than the baseline risk, except in the peculiar but possible case when the efficient level of risk is actually sufficiently greater than the baseline level. The risk-utility test incentivizes firms to produce products that are efficiently safe, always.

However, if the applicable products liability rule incentivizes firms to take the socially efficient level of care, it does not follow that the rule has optimized behavior. The divergence arises because consumers choose whether to purchase goods based on their *expectations*, not the actual level of risk to which a product exposes them.[131] As a result, if firms produce a product with an actual risk that exceeds the expected risk, consumers will purchase a product believing it to be safe enough to be worth purchasing, when in fact the product exposes them to risks so large they would not have purchased the product if they knew about the risks. The consumer expectations test minimizes the quantity of consumers who purchase goods that they would not want by providing goods that are consistent with consumer expectations except when expectations are extremely low. The specific consumer expectations test narrows the framing of this assessment and is based on whether the product increases a risk that it was supposed to decrease. The risk-utility test, on the other hand, maximizes the quantity of consumers who purchase goods that they would not have purchased if they were perfectly informed by making the firm's production decision completely independent of consumer expectations.

Deciding between the traditional consumer expectations tests and the risk-utility test therefore requires weighing the harm to consumers from increased accidents versus the harm to consumers from mistaken purchases. Determining whether inappropriate purchases or increased accidents harm consumers more will depend on a variety of product-specific factors, particularly the baseline risk that consumers face, the risk that a firm actually chooses, and the efficient level of risk. Balancing these competing interests ex ante will depend upon consumers' preferences for the products liability system. Ex ante, we hypothesize that consumers are willing to surrender marginal gains in safety in favor of not purchasing products that actually increase the risks that they face contrary to their expectations.[132] Our experiment in

131. *See supra* notes 115–116 and accompanying text for a discussion of why expectations and observed risks may differ.

132. *Cf.* Christine Jolls, Cass R. Sunstein & Richard Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1484, 1536 (1998) (discussing loss aversion and its legal relevance).

Part III explicitly tests for social preferences of consumers in an analogous situation.[133]

The consumer expectations and specific consumer expectations tests will therefore be preferable to the risk-utility test in situations where consumers prefer to limit the losses from mistakenly purchasing goods. If consumer expectations for all product ramifications were well identified, the consumer expectations test would have a potential advantage over the specific expectations test, as it often eliminates the divergence between expectations and actual risk, while specific expectations merely limits it. But the traditional consumer expectations test is not well defined and has proven unworkable in courts in a way that prevents the generation of the market benefits the test ought to provide. As we explore in the next Section, focusing on specific expectations addresses the inherent shortcomings of the consumer expectations test.

C. Overcoming the Weaknesses of Consumer Expectations

Almost since the Restatement (Second) of Torts introduced the consumer expectations test, commentators have criticized it.[134] The conceptual model from Sections II.A and II.B provides a suitable framework to analyze the weaknesses in the consumer expectations test that judicial experience has revealed. In this Section, we identify three major problems with the test as it exists today. First, in the case of complex products, consumers rarely have clearly articulable expectations over every product dimension. Second, when different groups of consumers possess very different safety expectations, courts may struggle to coherently assign liability. Third, the traditional consumer expectations test is administratively burdensome upon courts. This Section considers each of these weaknesses in turn, demonstrating how the specific expectations test overcomes the problems that consumer expectations has in each case.

1. Complex Products and Unknown Risks

The consumer expectations test has proven poorly situated to address the risks that complex products present. By "complex products," we mean any product that is sufficiently complicated—by virtue of the product's large number of parts or the technical nature of the product's manufacture—such that consumers lack clearly articulable expectations about the performance of every dimension of the product. For example, a car has approximately 30,000 different parts.[135] An ideal consumer considering buying a new car would possess risk beliefs $p_{C1}, p_{C2}, \ldots p_{C30,000}$ for these 30,000 parts, which they balance against the benefit of the car, the risks they face without the new car (a vector with a potentially arbitrarily large number of risks attributable to the alternative to purchasing a car), and the harm that the consumer

133. We find that our experimental subjects do in fact prefer to punish firms which produce products that violated specific expectations, while avoiding purchasing products with risks they are unwilling to tolerate. *See infra* Section III.B.

134. Kysar, *supra* note 1, at 1702–03.

135. *How Many Parts is Each Car Made of?*, TOYOTA: CHILD. QUESTION ROOM https://www.toyota.co.jp/en/kids/faq/d/01/04/ [https://perma.cc/8ZQN-2UUL].

would experience if such risks manifest. It is impossible that consumers have clearly articulable risk beliefs and preferences regarding the potential harm caused by failure of each of those parts; it is more likely that consumers have a general expectation that specified constellations of parts will accomplish their intended purpose. Consumers collapse the 30,000 different risk beliefs into a single parameter p_C (or a smaller collection of beliefs attributable to sets of car parts) which corresponds to their aggregate belief about the risk of the product.[136]

But if a single part in a complex product fails and causes injury, the consumer expectations test requires the factfinder to convert the unitary and general expectations that consumers actually used to make their decision into risk beliefs over individual parts, particularly the part that failed, even though consumers never actually held such beliefs. In practice, this process nearly universally finds a defendant liable for the unobservable risks of a complex product.[137] Judicial practice, as a result, forces jurors to reverse engineer expectations for complex products and to decide that consumers expect products to be completely safe from unknown risks, even in cases where the general type of risk is completely foreseeable. The normal consumer expectations test therefore incentivizes manufacturers to make extreme investments in safety for each individual part of complex products that is particularly likely to be the subject of litigation. But more likely is that firms will not be able to predict which of many parts will be subject to litigation; as a result, the ambiguity over parts will dampen incentives to make specific improvements in product quality.[138]

Our proposed specific consumer expectations test avoids reverse engineering consumer expectations. Because the first step of the test is to identify whether consumers had a specific expectation that the product or component would reduce a particular risk, jurors would not be required to determine what consumers expected of particular products that few consumers devote any actual thought to during their decision process. Rather, jurors must determine whether the nature of the product itself creates a specific expectation that a risk would be reduced. If so, then jurors need only determine whether the product increased a risk that consumers expected would be decreased. In cases where consumers lack specific expectations, courts should employ risk-utility analysis to determine whether a more efficient alternative product existed. This approach incentivizes firms to produce products at the level of safety that consumers expect in cases where consumers have clear expectations over complex products, and to produce efficiently safe products under the risk-utility test in cases where expectations are not clear. Thus, consumer misinformation is less

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136. Consumers may adopt a variety of different processes to collapse overwhelming information into manageable chunks, including focusing on well-known or understood parameters or fixating on the most salient characteristic. *Cf.* Troy A. Paredes, *Blinded by the Light: Information Overload and Its Consequences for Securities Regulation*, 81 WASH. U.L.Q. 417, 437–43 (2003) (reviewing the consequences of information overload and the heuristics that individuals employ to avoid it).

137. Hylton, *supra* note 7, at 2491–92.

138. *See supra* Section II.B. If firms do not know whether particular safety investments are likely to reduce the risk of liability, they will be substantially less likely to take such safety investments and will instead accept that they are likely to be found liable for damages.

likely to result in consumer harm, and when it does the consumer harm is minimized because the firms have been incentivized to do so by the residual risk-utility test.

2. The Amorphous Nature of the Test

The traditional consumer expectations test is amorphous.[139] The test requires factfinders to identify reasonable consumer expectations about the performance of the product, but what constitutes "reasonable consumer expectations" is vague. Without more content, the standard does little to guide any decisionmaker.[140] The ambiguity of the consumer expectations test makes it difficult for manufacturers to predict liability ex ante. If a manufacturer does not know what risk consumers expect or what courts will conclude that the consumer expected, their ability to tailor the risk of their product to consumer expectations is lessened. Even in the simplest case, where there are two possible levels of consumer expectations p_{c1} and p_{c2}, the consumer expectations test yields poor results. Firms will choose to produce goods consistent with the level of consumer expectations that maximizes expected profits, including the expected risk of liability. Producing at the safer of the two levels of consumer expectations will be safer but will yield higher manufacturing costs. Producing at the riskier of the two levels will expose the manufacturer to a risk of liability, which will only manifest if consumers actually expect products at the safer level. Firms will likely choose to produce products at the riskier potential level of consumer expectations, as doing so maximizes expected profits except when there is a sufficiently large likelihood that consumers expect the safer risk level. But ex post, if consumers actually expect products that are safer than the high level of risk selected by the firm, such consumers will suffer harm from having purchased goods that are riskier than expected. Thus, ambiguity in the test prevents the products-liability system from accomplishing its goals of compensating consumers who are harmed by defective products and incentivizing manufacturers to create efficiently safe products. Under such a system, different manufacturers' idiosyncratic beliefs about the expectations of their consumers will determine the level of precaution each firm takes, rather than court-calibrated incentives that encourage efficient levels of safety.

A related issue is the consumer expectations test's inability to predictably manage heterogeneous consumer beliefs. The test's ambiguity is compounded in situations where consumers may have sharply divergent expectations for the safety of a given product.[141] Other than the amorphous "reasonable person," a jury has no guidance as to *whose* expectations matter for determining liability.[142] If a particular group of consumers expects products that are perfectly safe ($p = 0$), and another group expects products that are efficiently safe ($p = p^*$, the level which minimizes the total

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139. *See supra* Section I.B.

140. *See* Hylton, *supra* note 7, at 2491 ("The consumer expectations test depends on a determination—specifically, the expectation of the consumer—that the producer may not be able to predict with any reasonable degree of accuracy at the time of production.").

141. Hylton, *supra* note 7, at 2490.

142. *Cf.* Stephen G. Gilles, *On Determining Negligence: Hand Formula Balancing, the Reasonable Person Standard, and the Jury*, 54 VAND. L. REV. 813, 816–21 (2001) (discussing the contours of the reasonable person standard in torts).

social cost of product accidents), liability will be a function of which jurors happen to get selected, rather than any aggregate measure of consumer preferences. Heterogeneous consumer beliefs and uncertain consumer beliefs are very similar problems for the firm and the products liability system. In both cases, there is some ex ante probability that a jury hearing a lawsuit against the defendant manufacturer would determine that consumers expected products at a given level of safety, and some residual probability that consumers expected another level of safety. As a result, rational firms will behave in this situation much the same as in the case where consumer expectations are hard to decipher. Firms will be guided by the expected chance of liability for each potential level of consumer expectations, and they will choose to produce at the level that maximizes their expected profits. Because care is costly, firms will favor less safe levels until the probability of damages is sufficiently high to justify increasing the level of safety. But such a situation results in liability being determined not necessarily by clear legal standards that firms should follow, but by the lottery of which jurors get selected. Clarity of legal outcomes increases the likelihood that the incentives of products liability are not dampened.

In the case of our specific consumer expectations test, the failure of product performance is with respect to a dimension that is known to consumers and indeed the product fails to perform in the opposite of the intended manner. When the product fails to perform on some dimension in the opposite of the intended manner, there is no ambiguity with respect to whether reasonable consumer expectations are being met. In a broad variety of cases, manufacturers may have a difficult time identifying ex ante whether consumers have some risk expectation p_{c1} or p_{c2}, but it will be simple to identify whether p_{c1} and p_{c2} are greater than, less than, or equal to the baseline risk p_0. As a result, manufacturers can identify the level of risk that is consistent with consumers' specific risk expectations. In the case of products that are meant to increase the probability of a good outcome happening, the result is analogous. Firms can more easily identify whether consumers expect a benefit and produce products that will not cause a harm on that dimension.

3. Legal Administrability

The most straightforward benefit of the specific consumer expectations test is saved judicial resources. Whereas under the traditional consumer expectations test, a decisionmaker needs to determine three factors to decide liability—the precise level of risk consumers face without the product, the precise level of risk consumers face with the product, and consumers' expectations of the level of risk they would face with the product—our test enables a liability determination if the decisionmaker knows whether a product should have reduced a particular kind of risk and whether the product actually increased the risk. Such binary conditions are significantly easier to identify. Testimony from plaintiffs or similarly situated consumers will be sufficient to establish whether they expected the product to increase or decrease a particular risk. Often the marketing of the product and the product's attributes make the direction of the purported effect clear as, for example, safety devices should decrease rather than increase risks. The direction of the risk change will also often be easy to detect; certainly, it will require less testimony than establishing the precise magnitude of the risk change.

Simpler legal tests will be better whenever the increased error costs from less effective behavioral incentives are smaller than the saved administrative costs.[143] While many of these benefits and costs are difficult to quantify and compare in the abstract, the saved administrative costs will be substantial. Jurors will likely be able to determine the major factual elements of the test—whether the product was expected to reduce a risk and whether it actually did so—without extended expert testimony.[144] Reducing the expected costs attributable to expert testimony and other legal costs will also result in classes of harmed plaintiffs keeping larger portions of their damages awards, contributing to the goal of products liability law of making injured plaintiffs whole. Finally, if the fundamental elements determining liability are easier, thereby increasing or decreasing the ex ante probability of plaintiffs prevailing, it is more likely that cases will be disposed of earlier, either by motions to dismiss, summary judgment, or settlement.[145]

In sum, the specific expectations test provides several analytic advantages over the more familiar consumer expectations test. It provides firms incentives to produce products that serve their intended purposes. It is substantially easier to apply than the consumer expectations test; in particular, it coherently determines liability for defective complex products and is easier to articulate and apply. To assess whether the specific consumer expectations test does align with consumer preferences regarding the structure of the liability regime, we fielded a novel experiment which we present and discuss in Part III.

III. AN EXPERIMENTAL TEST OF SPECIFIC CONSUMER EXPECTATIONS

In addition to the analytic superiority of the specific consumer expectations test that we demonstrated in Part II, our specific expectations test reflects the way that consumers actually value product risks and consider purchasing products. This Part presents our experimental evidence that individuals prefer to punish firms that produce products that violate specific expectations. Section III.A lays out the methodology of our experiment that we used to test whether the specific consumer expectations test aligns with consumer preferences. We designed an incentive-compatible[146] experiment to test whether individuals' attribute-specific expectations

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143. *Cf.* Ronald J. Allen & Alan E. Guy, Conley *as a Special Case of* Twombly *and* Iqbal*: Exploring the Intersection of Evidence and Procedure and the Nature of Rules*, 115 PENN ST. L. REV. 1, 6 (2010) (discussing the role of error costs in evaluating legal rules); Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 596–99 (1992) (comparing the utility of rules and standards based on how easy they are to apply and potential error costs).

144. While expert testimony is not formally required in consumer expectation or risk-utility based products liability claims, such testimony is practically required when ordinary knowledge is insufficient to detect a defect. *E.g.*, *In re* Mirena IUD Prods. Liab. Litig., 202 F. Supp. 3d 304, 310–11 (S.D.N.Y. 2016).

145. *Cf.* Jeffrey M. Perloff, Daniel L. Rubinfeld & Paul Ruud, *Antitrust Settlements and Trial Outcomes*, 78 REV. ECON. & STATS. 401, 405–07 (1996) (finding that the lawsuits that plaintiffs are more likely to win are more likely to result in settlement).

146. A survey is incentive-compatible if it provides subjects with financial incentives to reveal their true preferences. *E.g.*, Ronald G. Cummings, Glenn W. Harrison & E. Elisabet Rutström, *Homegrown Values and Hypothetical Surveys: Is the Dichotomous Choice*

(1) react rationally to known risks and (2) accurately predict whether individuals believe punishment is appropriate. In Section III.B, we present our results. We find that our experimental subjects appropriately incorporated known risks into their attribute-specific expectations. But, when facing hypothetical scenarios where consumers did *not* know about product risks, our subjects sought to punish only those products that violated specific expectations.

A. Experiment Design and Hypotheses

To investigate how individuals respond to defective products with attribute-specific and other risks, we constructed an incentive-compatible survey that asked respondents to express preferences between alternative risky products. Our sample consisted of 128 undergraduate students recruited on campus at Vanderbilt University. Student samples are common in experimental research in law and economics.[147] Random assignment of treatment and control groups ensure that our results are internally valid even if the preferences of students are systematically different from those of the population at large with respect to their preferences over defective products.[148] Appendix Table 1 provides summary statistics for our experiment sample.[149] Each of our scenarios revolved around car parts and accessories. We chose car parts because virtually all subjects would be familiar with these common (and commonly faulty) products.[150] Additionally, car parts—subject to regulation and fines from the National Highway Traffic Safety Administration (NHTSA)—provide a well-defined legal framework to use in testing subjects' preferences.[151]

Approach Incentive-Compatible?, 85 AM. ECON. REV. 260, 260–61 (1995). Our instrument is incentive compatible because we endow our subjects with a budget and ask them to make consumption decisions which have a real impact on that budget. If a subject purchases a car part in our experiment for $2.00, their payout at the end of the experiment will be $2.00 lower. If they choose to purchase a riskier car part for a lower price, the transactional setup ensures that their willingness to accept a risk-price trade off reflects their authentic preferences.

147. *E.g.*, Michele Belot, Raymond Duch & Luis Miller, *A Comprehensive Comparison of Students and Non-Students in Classic Experimental Games*, 113 J. ECON. BEHAV. & ORG. 26, 26–27 (2015); David A. Hoffman & Tess Wilkinson-Ryan, *The Psychology of Contract Precautions*, 80 U. CHI. L. REV. 395, 416 (2013).

148. *See generally* Arthur Schram, *Artificiality: The Tension Between Internal and External Validity in Economic Experiments*, 12 J. ECON. METHODOLOGY 225, 226–27 (2005) (discussing the tradeoff between internal and external validity in economic experiments).

149. Regressions that explicitly control for our subjects' characteristics do not materially differ from the results that we present here.

150. As of 2017, there were approximately eight registered cars in the United States for every ten individuals (272,480,899 cars for 325 million people). *See* U.S. DEP'T OF TRANSP., *Number of U.S. Aircraft, Vehicles, Vessels, and Other Conveyances*, https://www.bts.gov/content/number-us-aircraft-vehicles-vessels-and-other-conveyances [https://perma.cc/64CR-M9X9].

151. *See generally* Jerry L. Mashaw & David L. Harfst, *From Command and Control to Collaboration and Deference: The Transformation of Auto Safety Regulation*, 34 YALE J. ON REG. 167, 172–73 (2017) (describing the evolution of traffic safety regulation since 1966).

Our study presented subjects with two types of scenarios: (1) product choices and (2) manufacturer evaluations and punishments. Subjects answered questions concerning five car parts and accessories: airbags, seatbelts, an autopilot system, air conditioning, and gas caps. We chose these five car parts because most individuals are familiar with each of them and because they have salient potential defects that we could utilize.[152] The order of products was randomized among subjects.[153] Within product type, subjects always answered a product choice question immediately followed by a manufacturer evaluation and punishment question. The product choice questions occurred first because these questions were individually incentive-compatible and previous research demonstrates that incentive-compatible questions have spillover effects on other questions, causing subjects to take more care on all questions in an experiment.[154]

1. Product Choice Scenario Design

Subjects received a starting balance of $15.00 and were told they would receive their remaining balance at the end of the survey. We informed them that the survey would ask them to make multiple purchasing decisions between two car parts and that we would deduct the price of the product they purchased from their balance.[155] Additionally, we informed subjects that some of the products had a risk of defect and that, if the product they purchased was actually defective, the cost of the defect would also be deducted from their balance. The scenarios specified the risk of a product defect and the cost of the defect. The prices and other features of each question were calibrated so that the average subject earned approximately $12.00 over the course of the experiment, which took subjects approximately twenty-five minutes to complete.

The product choice scenarios asked subjects to choose between one of two possible car parts. The first product always had some risk of defect while the second part did not. To illustrate, an exemplary scenario describing a choice between airbag models is provided in Figure 1.

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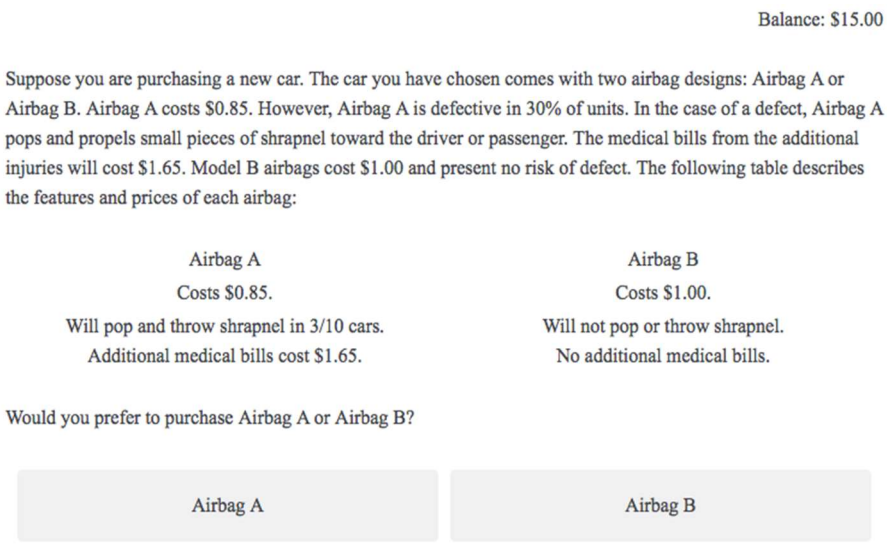
152. Some of those defects have been the subject of recent recalls or media attention. *E.g.*, Nathan Bomey, *Uber Self-Driving Car Crash: Vehicle Detected Arizona Pedestrian 6 Seconds Before Accident*, USA TODAY, (May 24, 2018), https://www.usatoday.com/story/money/cars/2018/05/24/uber-self-driving-car-crash-ntsb-investigation/640123002/ [https://perma.cc/NH8Q-5SL9]; *Takata Recall Spotlight*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., https://www.nhtsa.gov/equipment/takata-recall-spotlight [https://perma.cc/NE2G-3JBH].

153. If questions are always answered in the same order, then it is impossible to distinguish between "order effects," such as subject learning or changing their preferences during participation and the actual effect of interest. *See* Charles A. Holt & Susan K. Laury, *Risk Aversion and Incentive Effects: New Data Without Order Effects*, 95 AM. ECON. REV. 902, 902–03 (2005) (discussing how order effects may influence previous estimates of individual risk aversion).

154. *E.g.*, Todd L. Cherry, Thomas D. Crocker & Jason F. Shogren, *Rationality Spillovers*, 45 J. ENVTL. ECON. & MGMT. 63, 70–76 (2003).

155. Deducting the price of a product from subjects' balance is a common method for creating incentive compatibility. *E.g.*, Julie R. Irwin, Gary H. McClelland, Michael McKee, William D. Schulze & N. Elizabeth Norden, *Payoff Dominance vs. Cognitive Transparency in Decision Making*, 36 ECON. INQUIRY 272, 273–74 (1998).

Figure 1: Product Choice Example Scenario



The primary experimental treatment for each product-choice question was whether the defect present in the risky product caused a risk of harm the product was intended to prevent or whether the harm was unrelated to the function of the product. Such a product would violate our specific consumer expectations test as long as consumers did not expect such a risk to exist. We isolated the effect of such defects on consumer decisions by endowing all products with a risk of defect and comparing consumer responses across defect types.

Table 1 presents each version of each product that subjects faced. Each subject was randomly assigned to see either a defect that caused a product to perform opposite its intended function or a defect unrelated to the intended purpose of the product. We randomly determined which version of the product the subject saw separately for each of the five products. Independent assignment across products allowed us to test for the effect of defect type both between and within subjects.[156]

156. For a discussion of the merits of "between-" versus "within-" subject designs in experiments, see Gary Charness, Uri Gneezy & Michael A. Kuhn, *Experimental Methods: Between-Subject and Within-Subject Design*, 81 J. ECON. BEHAV. & ORG. 1, 3–5 (2012). Our experiment presents little risk of confounding results by treating and not treating the same individual across different questions because all of the questions are of a similar form and we randomize question order among participants. As a result, our within-subject design permits a more precise estimate of the effect of our treatment versus control. *See id.* at 6.

Table 1: Summary of Product Defect Scenarios

Product	Defects related to product purpose	Defects unrelated to product purpose
Airbag	"In the case of a defect, Airbag A pops and propels small pieces of shrapnel toward the driver or passenger. The medical bills from the additional injures will cost [x]."	"In the case of a defect, Airbag A has faulty wiring which causes the car's check engine light to remain on. Repairing the faulty wiring costs [x]."
Autopilot	"In the case of a defect, Model A's sensors cannot detect other cars and will get into a low-speed rear-end collision at the first opportunity for such an accident. The damage from such a collision will cost [x]."	"In the case of a defect, Model A will burn more fuel. The additional fuel costs are [x]."
Seatbelt	"In the case of a defect, the seatbelt will not unlock following a car accident, trapping the individual wearing the seatbelt in the car until the seatbelt is cut. Suppose that individuals in a typical car accident who are wearing a seatbelt that prevents an individual from leaving the car will spend [x] in additional medical bills."	"In the case of a defect, the seatbelt will not adjust properly and is uncomfortable to use. Users must pay [x] in repair costs to adjust the tension."
Air conditioning refrigerant	"In the case of a defect, Refrigerant A will cause your car to constantly blow hot air. The discomfort from the hot air is equivalent to losing [x]."	"In the case of a defect, Refrigerant A will cause an unpleasant odor. The discomfort from the odor is equivalent to losing [x]."
Gas cap	"In the case of a defect, Gas Cap A will not seal properly, causing your car to lose a small amount of gasoline. Such gasoline loss presents no risk of personal injury or property damage, but will cause you to spend [x] more on gasoline."	"In the case of a defect, Gas Cap A does not tighten properly and causes the car's check engine light to turn on. A defective gas cap will cause you to spend [x] to diagnose and repair the issue."

Note: Each entry in the table is the actual language from the experiment describing the product defect.

In addition to randomly assigning the defect type, we randomly assigned the price, defect probability, and cost of defect for the risky product in each question. The price was between $0.50 and $0.90, which we varied at five-cent increments. The price of the nonrisky second car part was fixed at $1.00. The risk of a defect was randomly set at 10%, 20%, or 30%. The amount of money that the subject would lose if the risky car part was defective was set between $1.25 and $1.75 at five-cent increments. We chose these values so that the ex ante expected cost of both products would equal $1.00. Upon random assignment of the various parameters, subjects faced risky products with expected costs that ranged from $0.625 to $1.425. As a result, we observe subject choices when the risky products have an expected cost above, below, and equal to the risk-free product. After subjects made their choice, a random number generator determined whether the purchased product was defective. The price of the selected product and any applicable defect cost were deducted from the subject's balance.

In summary, the subjects engaged in an incentivized experiment in which they had a choice between purchasing a higher priced safe product or incurring a lower price for a potentially risky product that could generate a financial penalty. In addition to the incentivized experimental structure, embedded in the experimental design are three types of consistency tests for which it is feasible to do across-subject comparisons. Subjects should be less likely to buy a given product if either the price of the product is increased, the probability of harm is increased, or the magnitude of the harm is increased.[157] Using ordinary least squares regression, we find that each of the expected relationships hold, indicating that our subjects demonstrated consistent preferences and reacted rationally to financial incentives in our study.[158] But our initial analyses also reveal that subjects did not view the five products as interchangeable financial lotteries. Subjects were much more likely to choose a risky gas cap than a risky seatbelt, for example.[159] Consistent with aversion, subjects chose a safe product in 59.2% of their choices.

2. Manufacturer Evaluation and Punishment

After the product choice scenarios, the survey asked subjects to evaluate a company that produced defective car parts with identical qualities to the risky

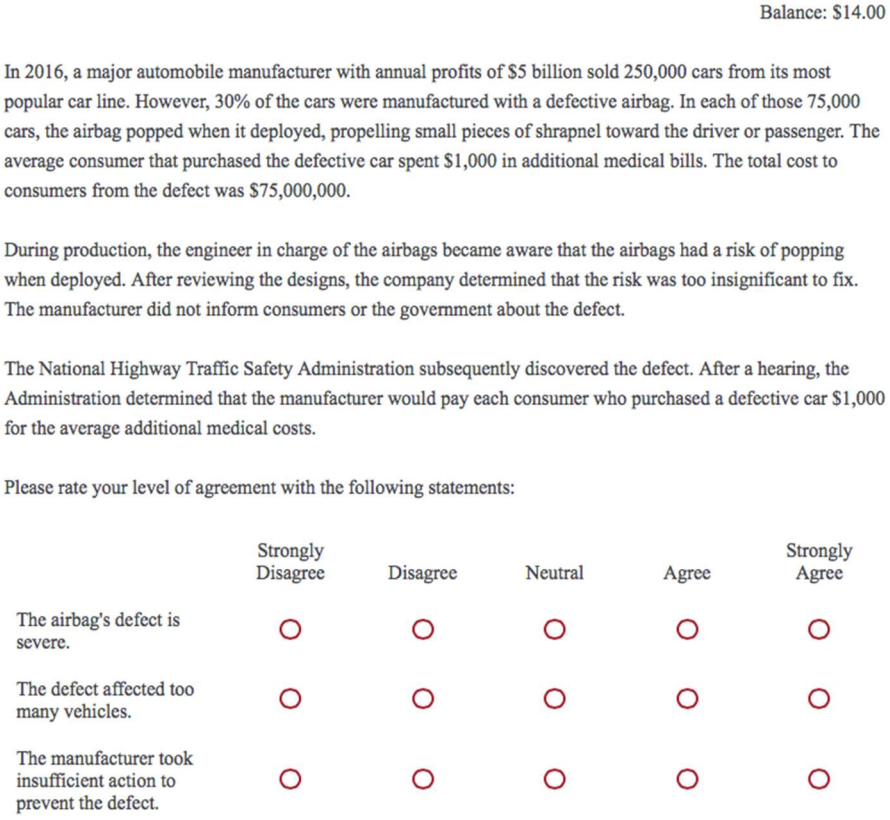
157. Similar tests are widely used in the experimental economics literature to demonstrate that the subjects of an experiment exhibited rational preferences. *See, e.g.*, Vivien Foster & Susana Mourato, *Testing for Consistency in Contingent Ranking Experiments*, 44 J. ENVTL. ECON. & MGMT. 309 (2002) (developing a set of tests for determining whether survey responses are logical).

158. In a regression controlling for defect type, product type, product price, defect cost, defect probability, and subject fixed effects, the estimated effects of product price, defect cost, and defect probability are in the expected direction and highly statistically significant ($p < 0.01$). A price increase of five cents made a subject five percentage points less likely to select the risky product. A similar increase in the defect cost is associated with a 1.5 percentage point decrease in the probability of choosing the risky product. A 10 percentage point increase in the risk of defect decreased the probability of selecting the risky product by 14 percentage points.

159. *See infra* Section III.B.3.

product in the scenario they just completed. The first portion presented subjects with a description of a company and asked them to indicate their agreement with several statements about the company on a five-point Likert scale. Figure 2 presents an exemplary scenario describing a company producing defective airbags.

Figure 2: Manufacturer Evaluation Example Scenario



The proportion of cars affected was set to match the probability of a defect in the first scenario. Otherwise, all quantities were constant across scenarios.

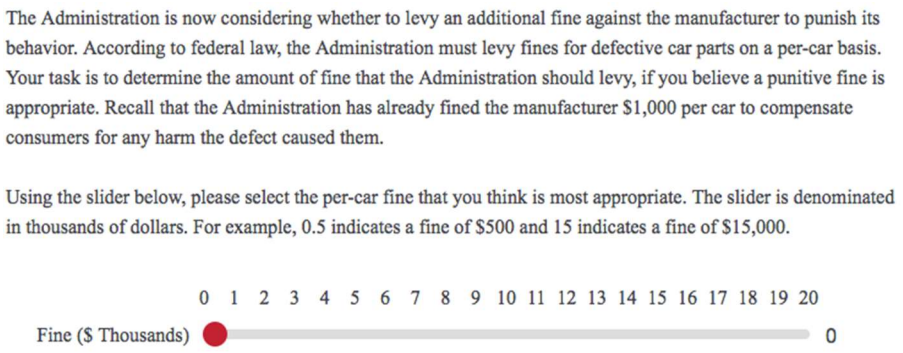
The three judgmental statements in Figure 2 drew on several of the factors that NHTSA is required to consider when determining the size of a penalty to levy against a manufacturer of defective car parts. Federal law requires that NHTSA consider: (1) "the nature of the defect;" (2) the manufacturer's knowledge of its legal obligations under federal law; (3) "the severity of the risk of injury;" (4) "the occurrence or absence of injury;" (5) the number of vehicles affected; (6) actions taken to mitigate the defect; (7) the size of the firm; (8) whether penalties had been levied against the company within the last 5 years; and (9) "other appropriate factors."[160] Some of these factors were difficult to evaluate in the context of our survey, while others we

160. 49 U.S.C. § 30165(c)(1)–(9) (2012).

modified to avoid needlessly complicating the vignette we presented to subjects. Consequently, we chose to evaluate the factors addressing severity, quantity of affected cars, and the sufficiency of the manufacturer's preventative actions.

Immediately after the question soliciting agreement with the statements (and on the same screen) we asked subjects to assign a regulatory penalty to punish the company. The mechanism for eliciting a penalty was a slider with responses ranging from 0 to 20 in thousands of dollars.[161] This scale is reflective of the statutory NHTSA penalty schedule, which after recent inflation adjustments, ranges from $0 to $21,000 per safety violation. The slider started at the 0 position, and subjects could provide no fine at all. The survey reminded subjects that NHTSA had already fined the manufacturer to provide compensation for the harms so these penalties were exclusively punitive.[162] Figure 3 presents an exemplary regulatory fine question. The slider started at the 0 position, and subjects could provide no fine at all.

Figure 3: Manufacturer Fine Example



The second stage of our experiment, in which we asked subjects their preferences over punishments, did not provide subjects with incentives to choose particular punishments. We did not incentivize the second stage of each product's question because we wanted to capture as closely as possible the real world setting in which individuals choose punishments for others; judges, juries, and agency decisionmakers cannot generally be incentivized to levy higher or lower punishments.[163] Likewise, other changes between the first and second stages of our

161. Sliders have been used in a variety of contexts to elicit subject preferences over an interval. For example, David G. Rand, George E. Newman & Owen M. Wurzbacher, *Social Context and the Dynamics of Cooperative Choice*, 28 J. BEHAV. DECISION MAKING 159 (2015), used a slider to elicit contributions in a public goods experiment, and Cade McCall, Nikolaus Steinbeis, Matthieu Ricard & Tania Singer, *Compassion Mediators Show Less Anger, Less Punishment, and More Compensation of Victims in Response to Fairness Violations*, 8 FRONTIERS BEHAV. NEUROSCIENCE 1 (2014), used a slider to elicit levels of costly punishment.

162. Subjects assigned a penalty of $0 thirty-two times. They assigned the maximum penalty of $20,000 seventeen times. The modal penalty (108 responses) was $1000, demonstrating that the quantity of harm to consumers remained a salient anchor even after subjects knew consumers had been compensated.

163. Financially interested judges and juries violate due process. Tumey v. Ohio, 273 U.S. 510, 523 (1927) ("But it certainly violates the Fourteenth Amendment, and deprives a

experiment (such as evaluating risks ahead of a decision or knowing that people were already harmed) were designed to reflect authentic punishment decisions.

After subjects answered the product choice and manufacturer punishment questions for each of the five products, the survey asked respondents to complete a lottery choice game that measures a survey respondent's individual level of risk aversion.[164] The survey concluded with a few questions about subjects' personal characteristics.[165] The survey administrators paid the subjects in cash immediately upon finishing the experiment.

3. Hypothesis

Ultimately, the experiment seeks to determine whether the specific consumer expectations test (1) channels consumer attitudes about manufacturers that make risky products in a fashion that incentivizes manufacturers to create products consistent with consumer expectations, (2) is applied predictably in courts, and (3) is not excessively costly to apply. The experiment was designed to test three central hypotheses critical to the validity of our specific expectations test along these dimensions.

Our first hypothesis, which was tested using subject responses to the questions regarding punishment levels, is as follows:

> Hypothesis 1: Subjects will assign higher penalties to firms that manufactured defects which violate specific expectations, even after consumers have been compensated for direct harms.

Hypothesis 1 must hold true in order for our specific expectations test to be an adequate substitute for the traditional consumer expectations test. As discussed in Section II.C, jurors directing their outrage that a component of a complex product which consumers implicitly expected absolute safety from is a primary cause of the failure of the traditional test. Thus, the specific expectations test will only be an adequate alternative if subjects want to punish violations of specific expectations more than generic defects. If Hypothesis 1 holds true, it demonstrates that defects that cause a product to work contrary to their specific purpose violate consumer expectations in a different fashion than ordinary defects and that our test is adequate to identify such defects.

Our second hypothesis addresses the questions measuring subjects' evaluations of companies manufacturing defective products. These questions test whether differences in punishments are accompanied by negative views towards company behavior. Our second hypothesis is as follows:

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defendant in a criminal case of due process of law, to subject his liberty or property to the judgment of a court the judge of which has a direct, personal, substantial, pecuniary interest in reaching a conclusion against him in his case.").

164. Our questions measuring risk aversion were the same as used in Charles A. Holt & Susan K. Laury, *Risk Aversion and Incentive Effects*, 92 AM. ECON. REV. 1644, 1645 (2002).

165. These questions provided the information presented in Appendix Table 1.

> Hypothesis 2: Subjects will have more negative views toward companies that manufacture products that violate specific expectations.

Previous research demonstrates that outrage is a key component of punishment decisions.[166] If betraying specific expectations causes significantly more outrage than other defective products, it confirms that consumers view these types of defects as different. If the costs to consumers from these defects exceed their pecuniary values, it justifies some separate treatment which our specific expectations test provides. As an ancillary benefit, because the legal factors used to determine punitive fines for defective products include nonobjective "evaluative" statements, the questions we use to evaluate Hypothesis 2 also allow us to evaluate the prevailing regulatory regime's ability to address violations of specific consumer expectations.

Our final hypothesis tests whether consumers' decisions to consume risky goods is responsive to information about the magnitude and type of risk they face.

> Hypothesis 3: Subjects will not distinguish between defects that cause products to serve the opposite of their intended purpose when subjects have been informed of the risks that goods pose ex ante.

In particular, we test whether consumers are less likely to purchase goods that have a potential defect that is contrary to the primary purpose of the product when the risk is fully expected. If consumers do not shy away from such defects more than others, it indicates that consumers rationally incorporate information into their specific expectations, even though they expect products to serve their intended purpose in the absence of such information. A corollary of Hypothesis 3 is that subject attitudes are independent of the type of product at issue—that consumers are averse to a product causing harm that the product is intended to prevent regardless of the type of product that is involved.

B. Experiment Results

1. Manufacturer Penalties

The experiment results provide strong support for our first hypothesis, demonstrating that consumers care much more about defects that violate specific expectations rather than general defects. Figure 4 presents the average fine that subjects assigned to manufacturers in all products as well as each of the five product categories separately. The lighter bars indicate the average penalty assigned to manufacturers of products that violated specific expectations, while the darker bars indicate the average penalty assigned to manufacturers of products that did not violate specific expectations.

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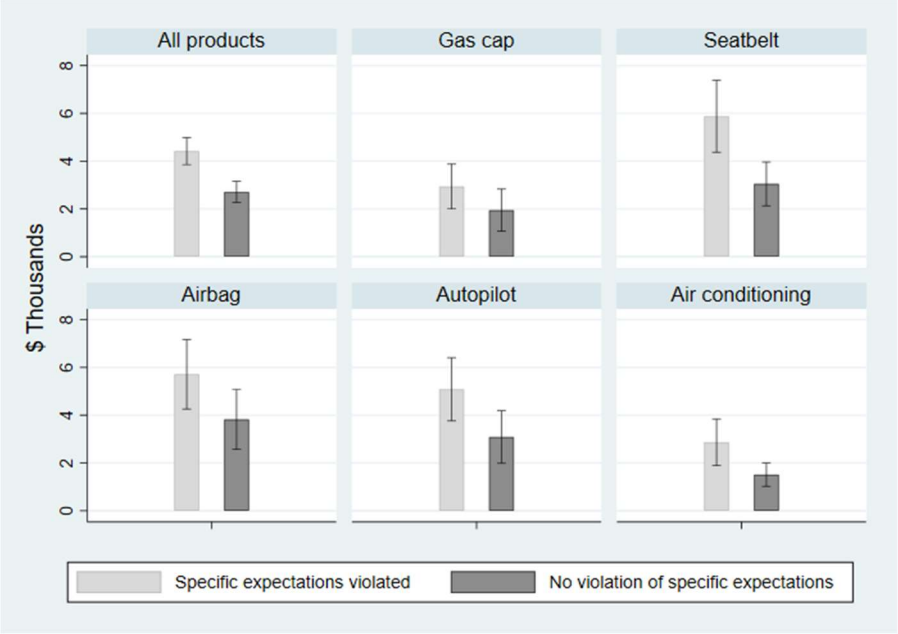
166. Daniel Kahneman, David Schkade & Cass R. Sunstein, *Shared Outrage and Erratic Awards: The Psychology of Punitive Damages*, 16 J. RISK & UNCERTAINTY 49, 60 (1998) (showing a substantial correlation between the outrage a subject expresses and the level of punishment levied).

Figure 4: Mean Penalty Assigned to Manufacturers by Product



Note: N = 640 for all products, N = 128 for individual products. Brackets indicate the 95% confidence interval for the average penalty assigned.

The average subject assigned a $4420 penalty to products that violated specific consumer expectations (such as airbags that cause worse accidents and air conditioning that blows hot hair). In contrast, the average penalty for products which did not violate specific expectations (airbags with faulty wiring and air conditioning with an unpleasant smell) amounted only to $2711. The $1709 difference (relative to the mean when specific expectations were not violated) was highly statistically significant.[167] The effect was largest in the seatbelt scenario, where the penalty for violations of specific expectations was $2827 larger (a 93% increase).[168] Across all scenarios, the difference in penalties between the products where the defect violated specific expectations and those products where the defect did not varied between $991 and $2827 (gas caps were smallest). The differences were statistically significant at conventional levels for all products except gas caps.[169] Also

167. An estimate is statistically significant at a given level if the probability of observing an effect as large as the effect observed in a sample would be less than the significance level if no true effect existed. JEFFREY M. WOOLDRIDGE, INTRODUCTORY ECONOMETRICS: A MODERN APPROACH 133–35 (4th ed. 2009). The level at which a given estimate would be significant is called a "p-value." An estimate is generally considered strongly significant if $p < 0.01$, significant if $p < 0.05$, and weakly significant if $p < 0.10$.

168. $p < 0.01$ for seatbelts.

169. $p < 0.10$ for airbags, $p < 0.05$ for autopilot and air conditioning.

noteworthy, subjects were very likely to assign a nonzero penalty in all circumstances, with 95% choosing a positive penalty.[170]

These larger penalties demonstrate that consumers view violations of specific expectations as more deserving of punishment than other defects. The reason is likely twofold. First, as explored in greater depth in Part II, specific expectations are the class of consumer expectations which are most likely to be clearly defined and articulated. When a product fails and causes harm along a dimension that the product was intended to reduce risk on instead, consumers immediately experience a loss relative to their expectations.[171] But beyond that greater loss, consumers also likely experience significant negative emotions in response to product defects that are contrary to specific expectations. The next Section provides our results that examine whether consumers exhibited such emotions and whether more negative evaluations of companies drove higher penalties.

2. Manufacturer Evaluations

Our experiment examined the effect of violations of specific expectations on three different dimensions. Subjects were asked to evaluate whether they believed the defect that affected products was severe, whether the defect affected too many cars, and whether the manufacturer took insufficient action to prevent the defect. Figures 5, 6, and 7 provide average subject responses to each of these evaluations. While we asked consumers whether they strongly disagree, disagree, are neutral, agree, or strongly agree with the statements, our figures present the proportion of subjects who strongly agree with the statement. The results are presented in this binary fashion because they involve a meaningful quantitative metric and are easier to interpret.[172]

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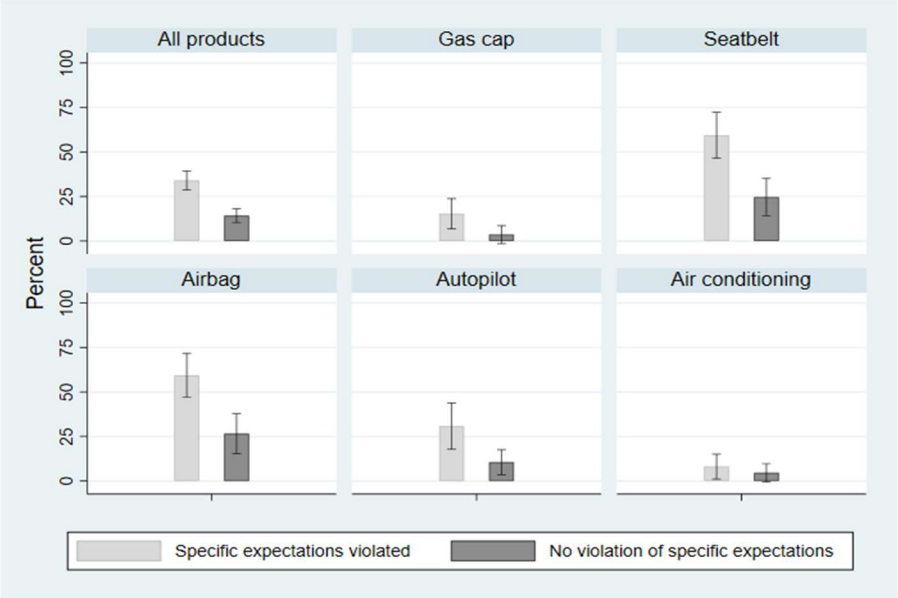
170. There are several possibilities for why our subjects almost universally chose a nonzero penalty. Subjects could have thought the $1000 compensatory measure would not actually be sufficient to compensate consumers. Alternatively, subjects could have sought a greater-than-compensatory fine to ensure that the manufacturer would be deterred in the future.

171. *Cf.* Andrew D. Gershoff & Jonathan J. Koehler, *Safety First? The Role of Emotion in Safety Product Betrayal Aversion*, 38 J. CONSUMER RES. 140 (2011) (discussing the role of betrayal aversion in product safety defect preferences).

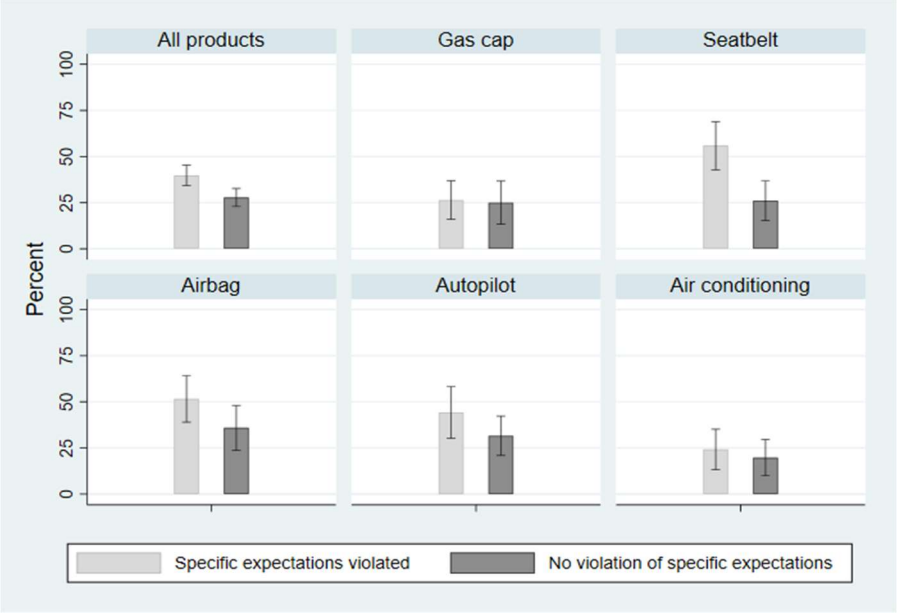
172. The results are consistent if we instead separately analyze responses to each point on the five-point scale.

Figure 5: Percent of Respondents Who Agreed Defect Was Severe



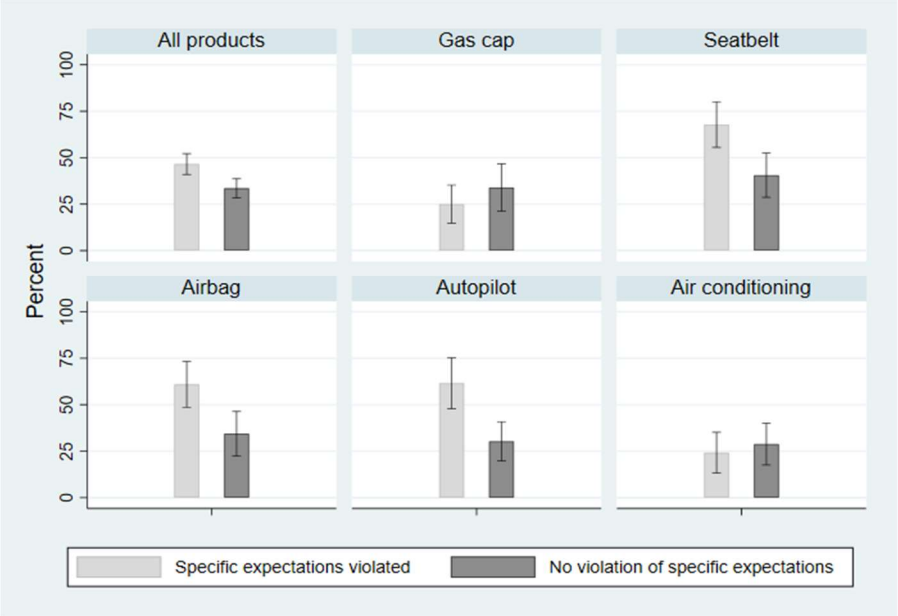
Note: N = 640 for all products, N = 128 for individual products. Brackets indicate the 95% confidence interval for the proportion of subjects strongly agreeing that the defect was severe.

Figure 6: Percent of Respondents Who Agreed Defect Affected Too Many Cars



Note: N = 640 for all products, N = 128 for individual products. Brackets indicate the 95% confidence interval for the proportion of subjects strongly agreeing that the defect affected too many cars.

Figure 7: Percent of Respondents Who Agreed Manufacturer Took Insufficient Action to Prevent Defect



Note: N = 640 for all products, N = 128 for individual products. Brackets indicate the 95% confidence interval for the proportion of subjects strongly agreeing that the manufacturer took insufficient action to prevent the defect.

The experimental results provide strong and consistent evidence that consumers are averse to violations of specific expectations. Figure 5's results for all products demonstrate that subjects considering a product which violated specific expectations were twenty percentage points more likely to agree that the defect was severe.[173] Figure 6 and Figure 7 similarly demonstrate that respondents were thirteen and twelve percentage points more likely to agree or strongly agree that the company took insufficient action to prevent the defect and that the defect affected too many vehicles, respectively.[174] These differences persisted even though the text of the experiment survey clearly articulated information that was consistent across the treatment and control groups about the level of harm that each defect caused, the action taken to prevent the defect, and the number of vehicles that each defect affected.[175]

Subject evaluations differed substantially by product type. The difference between the violation and non-violation conditions was never significant for air conditioning and was only significant in the severity question for gas caps. Subjects were more likely to strongly agree with the statements in the seatbelt, airbag, and autopilot scenarios than the air conditioning or gas cap conditions. Thus, our subjects

173. $p < 0.01$.
174. $p < 0.01$ for both differences.
175. *See supra* Section III.A.

were particularly critical of the defects on products that were intended to promote safety even when the defect did not increase risks of injury. But, the effect of specific expectations remains separately significant even though subjects display an aversion to safety product defects. These results demonstrate that the violation of specific expectations provokes moral outrage.[176]

3. Product Choice

The final results from our experiment demonstrate that the outrage and desire to punish that our subjects demonstrated are the result of violated expectations that products will perform as intended, rather than an aversion to any defect, expected or not. The distinction is critical—if consumers fail to change their consumption in the face of expected defects, either version of the consumer expectation test will not enable consumers to determine the appropriate version of risks in the market. If consumers treat risky products the same when they expect the risk, regardless of whether the defect relates to the product's intended function or some other dimension, it indicates that the asymmetry identified in the first part of the experiment results does not compromise consumers' ability to choose products in the face of full information.

Figure 8 presents our results for each of the product choice questions. Each panel demonstrates the proportion of subjects who chose the risky product in our product choice scenario. If subjects were simply averse to products that performed opposite their intended function regardless of expectations, Figure 8 would demonstrate a statistically significant difference between the rates at which subjects chose products when defects were contrary to the proper purpose of a product and when they were not. However, the results provide substantial evidence that our experiential subjects were indifferent between defects contrary to the product's purpose and defects unrelated to the product's purpose.

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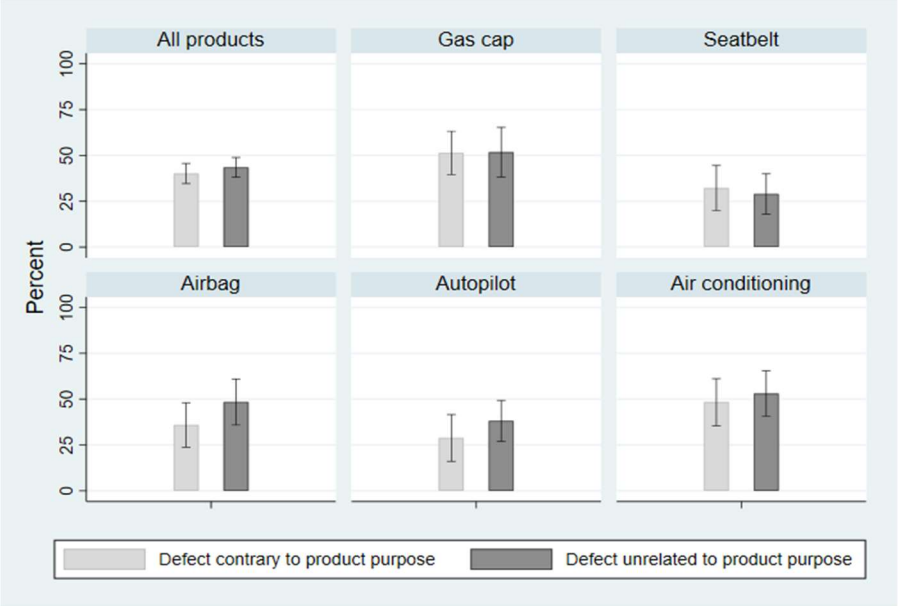
176. We also investigated whether the moral outrage that our results indicated is the mechanism through which violations of specific expectations cause an increase in the fine that subjects sought to levy upon firms. *See generally* David P. MacKinnon, Amanda J. Fairchild & Matthew S. Fritz, *Mediation Analysis*, 58 ANN. REV. PSYCHOL. 593 (2007) (discussing the goals and mechanics of mediation analysis). The results of our mediation analysis demonstrate that the evaluative responses mediate most, but not all, of the effect of violations of specific expectations. Of the approximately $1700 higher fine assigned to firms that manufacture products which violate specific expectations, 55.5% is explained by the increased negative emotions. The increase in perceived severity of the defect accounts for 75.2% of that 55.5%. These results incidentally indicate that NHTSA's framework for assessing regulatory penalties is likely consistent with consumer preferences for punishing violations of specific consumer expectations.

Figure 8: Percent of Respondents Who Chose the Risky Product



Note: N = 640 for all products, N = 128 for individual products. Brackets indicate the 95% confidence interval for the proportion of subjects who chose the risky product.

When comparing either all products together or each product separately, the results demonstrate that subjects chose the risky product at statistically indistinguishable rates across the two conditions. Subjects considering a product with a defect unrelated to the product's purpose chose the risky product 43.5% of the time, while subjects considering a product with a defect that would have caused the product to serve the opposite of its intended purpose 40.1% of the time, which was not a statistically significant difference. Subjects were most willing to choose the risky product when considering air conditioning and least willing to do so in the seatbelt condition.

In conjunction with the results for consumer attitudes toward penalties, these findings imply that on a prospective basis consumers are not as deterred by the possibility of defects as they are after the defects are manifested. Once the product fails with respect to a dimension for which the product was purported to provide a benefit, there is widespread sentiment that the product has violated one or more of the key governmental criteria for justifying regulatory penalties and that the level of the sanctions should be greater than for defects that do not violate consumer expectations. This discrepancy between consumers' ex post sentiments and their ex ante preferences provides an additional role for products liability in that even if the risk of product failures were known in advance, market forces alone would not fully reflect the harms that consumers believe they have suffered once specific expectations have been violated.

As shown in Sections III.B.1 and III.B.2 above, our subjects did exhibit a statistically significant response to the exact same defects when asked to levy punishments and evaluate manufacturers. Moreover, subjects had differential risk tolerance across products, indicating that they saw the product choices as more than

interchangeable financial lotteries. For example, subjects chose a risky gas cap 51.6% of the time, while they chose a risky seatbelt only 30.5% of the time. Further, consistent with possible risk aversion, subjects chose the safe product more often than the risky product. Across all scenarios, subjects chose the risky product only 41.8% of the time. Finally, as reviewed in the experiment design section, subjects rationally responded to financial incentives in our experiment, demonstrating that they seriously engaged with each question and the various scenarios.

CONCLUSION

Product defects can kill or permanently disable consumers and liability lawsuits can cost firms hundreds of millions of dollars,[177] yet this critical area of the law lacks clarity. The two legal tests that currently prevail, the consumer expectations test and the risk-utility test, are hard to apply and lead to outcomes that are difficult to predict. As a result, firms are more likely to avoid investing resources in making products safer and will instead accept damages as a cost of doing business. Such an outcome does not serve the consumers who expect safer products, nor does it serve the firms who would be incentivized to comply with the law if it operated in a predictable and efficient fashion.

This Article has argued that a test based on consumer expectations is not irreparably flawed but should be reframed; by adopting our specific consumer expectations test, many of the theoretical benefits of the consumer expectations test can be retained without creating the morass that persists under the current test. Our specific consumer expectations test holds firms liable if they produce a product that consumers expect would reduce a risk, but actually causes the risk to increase. The test is equally applicable in the case of a product intended to create a benefit, but which actually harms the consumer on that dimension. Because the test only requires plaintiffs to establish the direction of a change in risk rather than identify the magnitude with particularity, and the test only applies in cases where expectations are clearly salient, the test avoids the ambiguity of the traditional consumer expectations tests and is less costly to apply. As a result, its outcomes are clear and predictable, incentivizing firms to produce products that do not increase the risk that consumers face.

The specific consumer expectations test not only yields appropriate incentives, but is consistent with the way that consumers actually consider defective products and how consumers would prefer to punish firms that produce defective products. Our novel experiment demonstrated that when consumers possess information about risks ex ante, they do not distinguish between defects that are contrary to a product's primary purpose and those that are unrelated to the purpose of the product. But when individuals learn that a product defect that violated specific expectations has occurred, they punish such violations more harshly and view them as more

177. *E.g.*, Judgment on Jury Verdict at 6–7, Johnson v. Monsanto Co., No. CGC16550128, 2018 WL 4261442 (Cal. Super. Ct. Aug. 23, 2018) (awarding the plaintiff $289,253,209.32 in damages for producing an herbicide which caused cancer). *See generally* Benjamin J. McMichael & W. Kip Viscusi, *Taming Blockbuster Punitive Damages Awards*, 2019 U. ILL. L. REV. 171, 193–97(2019) (cataloguing more than one hundred punitive damage awards over $100 million dollars including several defective product cases).

condemnable. Because jurors, sitting as the finders of fact, often make the critical determination in products liability cases, fashioning the law to produce consistent and efficient outcomes conditional on such preferences is critical. Unlike either of the prevailing tests, our specific expectations test is consistent with the way that individuals actually consider defective products.

The specific consumer expectations test provides a way out for courts that recognize the problems associated with the consumer expectations test. By first considering whether consumers have clearly identifiable expectations over a particular product component, the test avoids the pitfalls of the traditional consumer expectations test. In cases where the test does not apply, the risk-utility test provides incentives for firms to minimize social losses due to accidents. This approach is a substantial advance for the jurisprudence of products liability law, contributing to its primary goals of promoting consumer welfare and minimizing costs.

APPENDIX

Appendix Table 1: Sample Summary Statistics

Variables	Full sample
Subject characteristics	
Female	0.523
	(0.500)
White	0.758
	(0.429)
Natural science major	0.219
	(0.414)
Car owner	0.461
	(0.499)
Always wears seatbelt	0.883
	(0.322)
Current smoker	0.070
	(0.256)
Observations	128