CONSUMER BEHAVIOR AND PRODUCT SAFETY: THE CASE OF RISK COMPENSATION BY DISSATISFIED CONSUMERS

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INTRODUCTION

Product safety has become a major issue for the marketing of consumer goods in Western Europe. One reason is the product liability directive of the Council of the European Communities which is to be transformed into national laws by now.[1] This transformation re-allocates consumption risks, i.e. physical and financial risks associated with the use of defective consumer goods, from consumers to producers.

Manufacturers are expected to react to the change in the legal rules by adopting marketing strategies which will decrease the firm's liability potential.[2] A very obvious strategy is to turn to products which are safer either in their basic design or by provision of additional safety features.

This, then, is the point where risk compensation becomes a highly relevant issue. According to the risk compensation hypothesis[3], the consumer will respond to more product safety by taking less care while using the product. As a result, the damage statistics will remain at their previous heights; the manufacturers' activities will not lead to the intended decrease in consumers'damages and injuries. The legal step to stricter product liability, thus, might turn out to be inefficient in this respect.

The reason why the consumers react to additional product safety by decreasing their personal care may be thought of as a special kind of dissatisfaction with the product in question. This paper analyzes the hypothesis in the light of recently collected survey data. The data result from our representative survey covering more than 1000 adults of both sexes in the Federal Republic of Germany in April and June 1988. The survey deals specifically with consumer behavior towards electric household appliances and bicycles.

The remainder of the paper goes as follows. Section B gives a comprehensive presentation of the risk compensation hypothesis as found in the empirical studies of Sam Peltzman and Kip Viscusi. Section C discusses the hypothesis with regard to the new empirical evidence. Section D gives an outlook to some marketing implications.

COMPREHENSIVE PRESENTATION OF THE RISK COMPENSATION HYPOTHESIS

As a starting point, we divide consumer behavior towards risky products into product-buying activities and product-using activities. This separation reflects two choices to care for safety in consumption: The consumer may buy immediately a product version containing strong safety features (i.e. considerable built-in-safety) and/or may select a less safe (and presumably less expensive) version, intending to compensate the lesser degree of built-in-safety by taking greater care in applying the product correctly later in the using-phase.

We think of both choices as having their proper prices. This is straightforward for built-in safety. The price of taking care is of an opportunity cost type: Taking less care saves time which may be used to earn money and vice versa.

Consider a consumer who realizes his optimum choice of product safety features and personal care in using the product. Built-in-safety and personal care may be regarded, in a household economics context[4], as factors producing jointly the benefits of consumption. The consumer-entrepreneur, thus, has to choose the appropriate proportions of both factors, i.e., arranges a combination promising maximum utility.

This consumer is now confronted by an increase in product safety; the new product offer replaces the less safe version and commands a higher price. Buying the new version and maintaining the former level of care will result in greater safety of consumption, but this combination of both factors might not be regarded as the optimum by our therefore dissatisfied consumer. Having reached maximum utility with the previous combination of built-in-safety and personal care, the consumer's utility, ceteris paribus, will decline in the new situation, if the previous level of care will be maintained. The safety level, thus, has been involuntarily increased.

Suppose the new safety level is not appreciated because it is regarded as too expensive. There is no way in cutting expenses for built-in-safety, because there is no other version of the product available. The consumer, though, may reduce the level of care thus compensating the extra-money for built-in-safety by cost saving due to less care.

Taking less care increases the consumer's utility, but keeps the risk high. The welfare goal of the product safety regulation is missed, though the manufacturer might be out of liability by now. According to the risk compensation hypothesis, entrepreneurial efforts in providing better technical safety features may, thus, be offset by a corresponding decrease in care taken by dissatisfied consumer who may be well aware of the better safety devices.

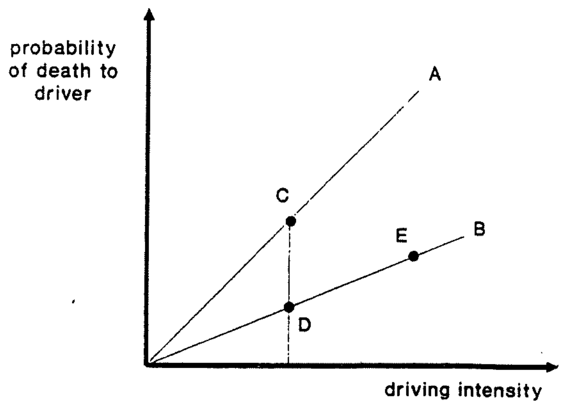
Special versions of the hypothesis have been formulated and tested by Peltzman and Viscusi.

Peltzman discusses the hypothesis with regard to automobile driving.[5]

We have "probability of death to driver" on the vertical axis and "driving intensity" (or "speed") on the horizontal. Ray A represents combinations of probability of death and speed, available with a given technology A. Suppose our consumer chooses point C and realizes some time afterwards a change in technology from A to B, which represents a safer way to use one's automobile. When our consumer holds his speed habits constant, he faces lower probability of death (point D). According to the risk compensation hypothesis, however, our consumer will increase his normal speed and will realize a greater risk, e.g., that of point E.

Sam Peltzman's data analysis is based on time series data of U.S. highway accidents before and after the introduction of safety devices as standard automobile equipment. Data were collected for death rates and injuries and concern both the occupants of the vehicles and the

Figure 1
Diagram of Risk Compensating Behavior



pedestrians involved in accidents. Peltzman finds empirical evidence which gives considerable support to the risk compensation hypothesis. His conclusions have been challenged, however, with arguments both from the theoretical and the statistical side of his analysis.[6]

Viscusi questions the widely claimed effects of the product safety regulation in the U.S.[7] His data concern, among other products, aspirin and related drugs for which child-resistant bottlecaps were required by the regulative authority in order to reduce the fatal poisoning rate.

The poisoning rate, indeed, decreased considerably in the period of observation, but this -according to Viscusi- results from other factors (e.g., decreasing sales) than from the prescribed safety caps. The accident data after being properly adjusted show, on the contrary, an increase in fatal poisoning despite child-resistant bottlecaps.

This finding may be taken as evidence for the lulling effect which is Viscusi's version of the risk compensation hypothesis: Parents having acquired drugs with child-resistant bottlecaps presumably take less care than otherwise, e.g., they leave the drugs at places in easy reach of their children and rely upon the product's safety features. But, unfortunately, these features do not seem to be as efficient as confident parents think. Parents, obviously, tend to underestimate the ingenuity of children scanning their environment.

The risk compensation hypothesis, thus, has in various versions, been well established in theoretical reasoning while the empirical evidence does not give a totally convincing picture of the issue. It is, obviously, not easy to control for the prerequisites of the theory. First, the additional safety features must be correctly perceived. Secondly, the individual safety calculus comparing benefits and risks must result into an interior optimum; otherwise, additional safety would meet a hitherto unsatisfied need which would prevent any compensating behavior. Thirdly, there must be a time-consistent evaluation of safety, e.g., the new features must not induce a more intensive strive for safety.

THE RISK COMPENSATION HYPOTHESIS AND NEW EMPIRICAL EVIDENCE

Our data collection was based on a consumer behavior model with six basic variables:

- two variables for the safety standard chosen in the buying and using phase:"built-in-safety" and "level of care".
- two variables describing the behavioral mode in which the decision for a certain safety standard in buying and/or using has been reached: "buying calculus" and "using calculus". The behavioral mode may, for instance, vary between purely spontaneous choice on one hand and very reflective and extensive considerations about what to do on the other hand.
- "strive for safety" and "risk perception" as the two attitude variables which are meant to steer the four process variables previously mentioned. Risk perception, as usual, stands for the more cognitive component of attitude whereas the strive for safety is the affective component.

The six variables alltogether form the keystones of the model which is presented in Fig. 2 in the format appropriate for LISREL-analysis. As usual we have the six variables as constructs presented by circles in notation as etas and ksis (In Fig. 2 we have two more circles because we divided the level of care-variable into two other constructs). The operationalization is performed by the corresponding indicators in the boxes.[8]

The directed lines between two variables indicate possible interactions which may be taken as special hypothesis. We shall come back to one of these hypotheses which may offer indirect evidence for or against risk compensation. But before that, as a first step, we inspect the corresponding behavior of our consumers in a more direct way.

We tried to capture the consumers' reaction to more built-in-safety[9] by a before-after-measurement. We gave as stimulus the information that the product from now on would be available only in a special version which incorporated certain obvious safety characteristics which had been used so far very seldom. Other product versions were no longer on sale anymore.

What will be the consumers' reaction to the prescribed addition in product safety? Will their intended level of care increase, decrease, or remain unchanged?

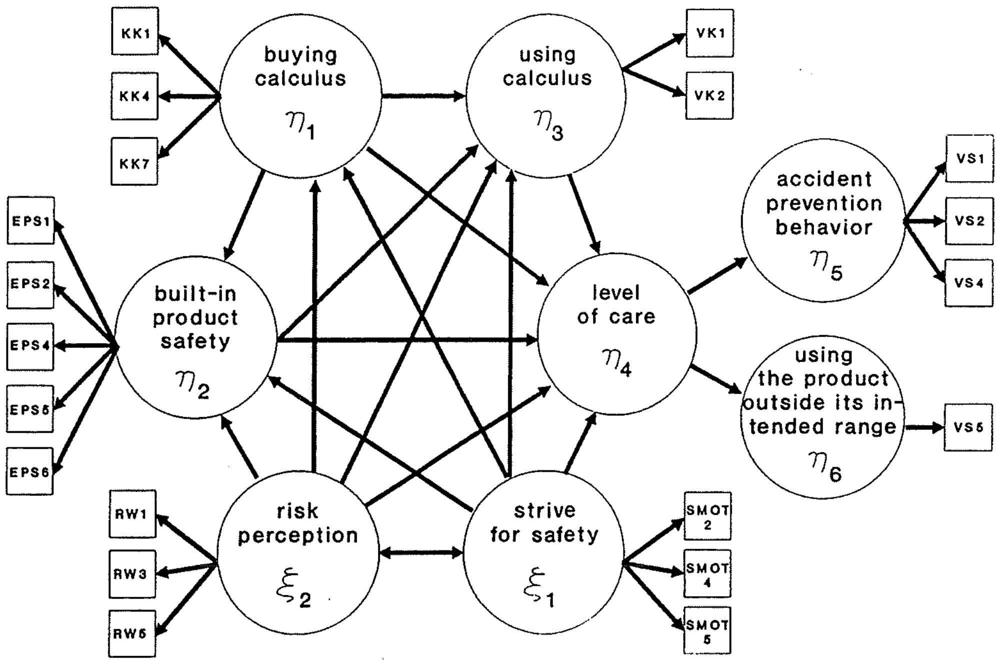
We measured the reaction in a simple and obvious way by asking for the level of care with three answer categories. We found that overall i.e. for the total sample in case of bicycles as well as in case of irons, that the level of care did not change in most cases.

Analyzing sample segments did not change the picture dramatically, and so, as our general conclusion, the risk compensation hypothesis is, though intuitively very convincing, according to our data, far away from empirical acceptance.

The reasons for this result which seems to be in line with most of the critics of the Peltzman study are not sufficiently clear so far and certainly need further elaboration. Our data give all evidence for interior optima ex ante; so we, obviously, did control this prerequisite.

Fig. 2: Lisrel-Model

Consumer Behavior Towards Risky Products (smoothing irons)



But we have very much reason to assume that the additional safety features do not leave the individual risk attitudes really unchanged. It is, on the contrary, very plausible to assume that the mere supply of more product safety, inevitably accompanied by some sort of communication may increase perceived risk and influence the individuals' strive for safety. The persistence of user habits may be another reason of our results. Finally, the additional safety attributes demand a higher product price, and price is commonly regarded as a cause for the choice of care while using the product. We might suspect here another reason for our result. It is hard to say, though, how the price factor could be controlled for surveys of real life where manufacturers tend to justify prices for premium products by safety arguments.

We discussed so far the direct evidence. We gain additional evidence of a more indirect kind by inspecting the interactions between built-in-safety and the level of care at a single point in time. The reader will remember that the increase in safety attributes was obligatory in the previous case of direct measurement before and after. Product versions providing less safety features were no longer available in the market. We now, however, try to find out whether consumers trade off built-in-safety and the future level of care in their choice between products offering alternative safety standards.

Such a trade-off, if detected in our data, could give some support to the risk compensation hypothesis. The substitution of additional safety features by less personal care is, after all, without doubts the very core of the compensation mechanism. Without this trade-off, however, we might have more reasons to distrust the working of the compensation hypothesis in the real world.

We analyzed the interaction between built-in safety (our variable eta 2) and the level of care while using the product (our variable eta 4) in a systematic way. We would not expect independence between both variables ("no interaction at all"), but more or less dependence in two alternative versions. "Dependence" is measured by the standardized betas of multiple regression, and the two versions differ in the sign of the coefficient.

The first plausibel version would be of a substitutional kind and corresponds to the compensation hypothesis: People buy larger amounts of built-in-safety in order to save care-taking efforts in the using-phase which would otherwise be necessary to ensure the required degree of safety during the consumption process. People (presumably with different attributes) are inclined to invest in extraordinary care during the using-phase and refrain, instead, from buying built-in-safety characteristics.

Table 1
Modification in Level of Care

Results for irons

	Level of Care in %		
	Decrease	Increase	Constant
Total sample	6,49	13,97	79,54
Age: 14-40	6,62	15,81	77,56
41-90	8,12	13,03	78,85
Sex: Male	8,60	16,37	75,03
Female	6,38	12,85	80,77
Income: 0-2499	7,69	16,10	76,21
2500- >5000	7,14	13,99	78,87
Children with age < 5 Yes	10,28	13,83	75,69
No	6,92	14,41	78,67
High rp/High sfs	4,19	11,62	84,19
High rp/Low sfs	9,29	13,39	77,32
Low rp/high sfs	4,20	12,84	82,96
Low rp/Low sfs	11,41	18,18	70,41

rp = risk perception sfs = strive for safety

Results for Bicycles

	Level of Care in %		
	Decrease	Increase	Constant
Total sample	5,74	11,83	82,42
Age: 14-40	5,90	11,25	82,85
41-90	6,04	10,49	83,47
Sex: Male	5,87	12,53	81,60
Female	7,31	11,25	81,43
Income: 0-2499	4,79	13,03	82,18
2500- >5000	8,03	11,87	80,10
Children with age < 5 Yes	6,67	13,78	79,56
No	6,25	17,28	76,47
High rp/High sfs	2,44	10,00	87,56
High rp/Low sfs	5,88	5,88	88,24
Low rp/High sfs	5,87	12,44	81,69
Low rp/Low sfs	8,44	12,67	78,89

rp = risk perception sfs = strive for safety

The other version, opposed to the compensation hypothesis, is the complementary type of interaction: People do take great pain ensuring consumption safety and do both, i.e., buy extra amounts of built-in-safety as well as exercise high levels of care in the using phase. Other people do not care for built-in-safety attributes and do not invest time and efforts in using the product in a safe manner either.

Our data analysis does not seem to contribute to the substitutional version of the hypothesis so far. The interaction is represented by a standardized beta coefficient which is negative in case of bicycles, but not significantly apart from zero. With respect to smoothing irons we found a positive interaction of .228 which gives evidence in favor of the complementary version.

Table 2
Numerical Results of the Interaction Between Built-in-Safety and the Level of Care

	Bicycles built-in safety eta_2	Level of care eta_4	Irons built-in safety eta_2	Level of care eta_4
Total sample	n.s.[1]		0,228[1]	
Age: 14-40	0,476[2]		0,551[2]	
41-90	0,689[2]		0,851[2]	
Sex: Male	0,563[2]		0,776[2]	
Female	0,586[2]		0,643[2]	
Income: 0-2499	0,756[2]		0,711[2]	
2500 - >5000	0,295[2]		0,667[2]	
Children with age <5				
Yes	0,419[2]		0,924[2]	
No	0,593[2]		0,650[2]	
High rp/High sfs	n.s.[2]		0,876[2]	
High rp/Low sfs	0,676[2]		0,921[2]	
Low rp/High sfs	n.s.[2]		0,581[2]	
Low rp/Low sfs	0,502[2]		0,542[2]	

rp = risk perception sfs = strive for safety
[1]calculation via total model (with all six hypothetical variables included)
[2]calculation via partial model (only two hypothetical variables included)
significance with @=.05.

The data analysis so far concerned the total sample. We may take a closer look at our hypothesis while calculating the beta coefficients for sample segments[10]. We may segment the sample, as before, with respect to sociographic as well as to psychographic parameters. In addition, we may form segments according to the consumers' attitudes towards safety, as expressed by risk perception and the strive for safety.

The main result - the complementary interaction - remains unchanged: People do either both, i.e. invest as well in built-in-safety and exercise high level of care, or seem to be kind of daredevils who prefer to live without both. A substitutional interaction which would back the risk compensation hypothesis has no empirical support so far in our data.

OUTLOOK

The marketing implications of empirical findings in favor or against the risk compensation hypothesis are quite obvious. Whether the risk compensation works or does not work, is of highest relevance for product policy as well as for the communication area. Suppose it works, for instance, then much of the product liability legislation aiming at a considerable decrease in the number of accidents takes indeed place on most insecure grounds, as Viscusi seems to suggest. Fore example, communicating the new safety features may well be inefficient, because it encourages dissatisfied consumers to decrease their level of care.

Since, however, the risk compensation does not seem to be such a universal phenomenon of real life, as some critics of product liability legislation assert, we may have more consumer satisfaction with safer products than the compensation theory does pretend. For example again, communication about new safety attributes might work quite well, and increasing built-in-safety is not such an inefficient tool for getting the numbers of accidents down after all.

But the discussion of this point and of consumer behavior towards risky products in general is not at all at its end; we seem on the contrary, to be here at the very beginning.

[1] Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products (85/374/EEC).

[2] See Standop, D., Zur Anpassung der Unternehmenspolitik an ein verschärftes Recht der Produzentenhaftung, in: Die Betriebswirtschaft 38 (1978), 189-202; Standop, D., Das neue Produkthaftungsgesetz, in: Wirtschaftswissenschaftliches Studium 17 (1988), 521-523; Noon, J., Marketing Management & Products Liability, in: European Journal of Marketing 15 (1981), 2, 3-31.

[3] See for example Wilde, G. J. S., Theorie der Risikokompensation der Unfallverursachung und praktische Folgerungen für die Unfallverhütung, in: Hefte zur Unfallheilkunde 130 (1978), 134-156; Wilde, G.J.S., The Theory of Risk Homeostasis: Implications for Safety and Health, in: Risk Analysis 2 (1982), 209-225; Peltzman, S., The Effects of Automobile Safety Regulation, in: Journal of Political Economy 83 (1975), 677-725; Viscusi, W. K., Regulating Consumer Product Safety, Washington, London 1984, Viscusi, W. K., Consumer Behavior and the Safety Effects of Product Safety Regulation, in: Journal of Law and Economics 28 (1985), 527-553.

[4] Becker, G., A Theory of the Allocation of Time, in: The Economic Journal 75 (1965), 493-517; Lancaster, K. J., A New Approach to Consumer Theory, in: Journal of Political Economy 74, (1966), 132-157.

[5] Peltzman, S., The Effects of Automobile Safety Regulation, in: Journal of Political Economy 75 (1983), 681.

[6] Graham, J. D., Garber, S., Evaluating the Effects of Automobile Safety Regulation, in: Journal of Policy Analysis and Prevention 2 (1984), 202-224, Robertson, L. S., A critical analysis of Peltzman's 'The effects of automobile safety regulation', in: Journal of Economic Issues 11 (1977), 587-600, Nelson, R. R., Comments on Peltzman's paper on automobile safety regulation, in: Manne, H. G., Miller, R. L. (Eds.), Auto safety regulation: the cure or the problem?, New York 1976, 63-71.

[7] See Viscusi, W.K., The Lulling-Effect: The Impact of Child-Resistant Packaging on Aspirin and Analgestic Ingestions, in: American Economic Review 74 (1984), 324-327; Viscusi, W.K., Regulating Consumer Product Safety, Washington, London 1984; Viscusi, W.K., Consumer Behavior and the Safety Effects of Product Safety Regulation, in: Journal of Law and Economics 28 (1985), 527-553; Viscusi, W.K., Product Liability and Regulation: Establishing the Appropriate Institutional Divison of Labor, in: American Economic Review, Papers and Proceedings 78 (1988), 300-304.

[8] Global fit indices for LISREL-models are the GFI, AGFI, RMR and the ratio between Chi^2 and the degrees of freedom. The detection of poor data fitting in special parts of the model is possible by analyzing the "fitted residuals"-matrix. But it is important to note, that all these criteria have not the power of critical cut-off values. The examination of the safety behavior model in case of smoothing irons leads to the following results:

Chi^2 (d.f.)	231,16 (147)
Chi^2 /d.f.	2,57
GFI	0,963
AGFI 0,943	
RMR 0,036	
n	596

The "fitted residuals"-matrix shows only one value greater than 0,1. The Q-Plot is in accordance with the 45° dotted line. These results have been well in line with the usual standards of LISREL type analyses (see for example Frazier, G.L., Gill, J.D., Sudhir, H.K., Dealer Dependence levels and Reciprocal Actions in a Channel of Distribution in a Developing Country, in: Journal of Marketing 53 (1989), 50-69; Michaels, R.E., Day, R.L., Joachimsthaler, E.A., Role Stress Among Industrial Buyers: An Integrative Model, in: Journal of Marketing 51 (1987), 28-45; Dwyer, F.R., Oh, S., Output Sector Munificence effects on the Internal Political Economy of Marketing Channels, in: Journal of Marketing Research 24 (1987), 347-358.

[9] For example irons: Increase of built-in-safety via pilot light, acoustic warning when non-moving, heat resistant cord; bicycles: Increase of built-in-safety via storage battery for continous light while standing, maintenance-free brakes, fraction-safe frame.

[10] The reason why the coefficients for the sample segments are estimated separately is twofold. First it is not guaranteed that the sample size remains high enough for such a complex model. Second the sample is segmented according to variables which are themselves elements of the model. Therefore it could be difficult for LISREL to find adequate estimates.