deregulation would be most welcome to accompany this text. Even if deregulation of property-liability insurance pricing makes sense, any adjustments necessary to ensure a smooth transition need to be addressed.

Risk and Medical Decision Making, by Louis Eeckhoudt, 2002, Norwell, MA: Kluwer Academic Publishers

Reviewer: Patricia Born, California State University, Northridge

Risk and Medical Decision Making is a new addition to the "Studies in Risk and Uncertainty" series published by Kluwer Academic Publishing. Books in this series cover a variety of topics relevant to insurance research including risk, valuation, and decision making under uncertainty. This latest addition reviews and expands on the existing theories of decision making in the medical care context. This focus is motivated by the fact that, "unlike many financial risks that can be either divided or transferred to others (e.g., through diversification, insurance or social security) the personal aspects of medical risks are by essence indivisible and nontransferable."

While the models are developed in the context of diagnostic and therapeutic risks, they may be generalized for decision making in a variety of contexts.

The book contains an Introduction, followed by eight chapters divided into two parts. In the first part, the author focuses on medical decisions within the expected utility (EU) model. Part 2 addresses new non-EU models of choice including the "dual theory" of choice under risk. The reader should be familiar with the basic concepts of decision sciences, the use and notation of decision trees and the notion of risk aversion in the EU model. At the end of each chapter the author provides a summary of the key findings and several review questions (some solutions are provided).

In the Introduction (Chapter 1), Eeckhoudt provides a literature review to place his work in context. He notes that much of the book follows the seminal work in medical decision making by S. Pauker and J. Kassirer (PK) in the 1970s. These works included (1) optimal therapeutic decisions in the presence of diagnostic risks, and (2) the valuation of diagnostic tests, and relied on the EU model to evaluate risky situations. Eeckhoudt recognizes and classifies the developments that followed PK's work, and structures this book along two categories of research. First, he notes that models of medical decision making have been expanded to include background risks, or comorbidities. These models develop a concept of "prudence" to complement "risk aversion." Eeckhoudt provides several examples in the following chapters to illustrate this new concept. The second category of research involves new models of choice under uncertainty. Eeckhoudt notes that these new models deserve more attention because they give new intuitions about optimal behaviors. The last two chapters of the book provide a basic introduction to these areas of research.

Chapter 2 is devoted to a review of the 1975 PK paper, in which the decision is to treat or not to treat, when the patient may or may not have a disease. Thus, the decision tree involves four outcomes, which are stated in terms of "quality adjusted life years" or QALYs. The choice of whether or not to treat depends on the benefit of treatment (known), the loss of QALYs because a healthy patient is treated, and the utility function of the decision maker. Eeckhoudt evaluates the decision tree in the case of a risk neutral decision maker to obtain a threshold for treatment. He shows

that this threshold falls if the benefit of treatment increases or if, for a given benefit, the loss of QALYs for treating a healthy patient falls. When the problem is evaluated for a risk averse individual, the threshold falls because the treatment option is risk reducing; risk averse patients demand treatment more often than risk neutral patients.

Chapter 3 introduces the notion of prudence. The decision maker's treatment decision is confounded with background risk, which is described as a co-morbidity risk. In other words, it is assumed that the patient faces an uncertain risk of developing another health problem if the disease is present. The model may also be interpreted to allow for an unknown severity of the disease. In either case, the background risk is exogenous to the decision maker. However, as the model shows, it has an influence on the decision taken toward the controllable risk, at least for a risk averse patient. In fact, the effect of the background risk on the risk averse patient depends on the third derivative of the utility function, or U'''. Eeckhoudt refers to the work of M. Kimball (1990) who "defines an agent as prudent whenever a background risk induces him to behave in a more conservative way towards the risk he can manage." The decision maker's choice is prudent when $U''' > 0$, imprudent when $U''' < 0$, and unaffected by the background risk when $U''' = 0$.

Eeckhoudt evaluates a different form of medical decision in Chapter 4. Now it is assumed that the disease state is known (patient has the disease), and the decision to treat depends on the unknown effect of the treatment. It is assumed that in the absence of any treatment, the patient's QALYs remaining are known with certainty, but if treatment is initiated, the effect on the patient's QALYs depends on the success or failure of the treatment (the therapeutic risk). Eeckhoudt evaluates the decision for a risk neutral decision maker and finds that when the adverse effects of treatment become more important, treatment becomes a less attractive option. Interestingly, risk averse patients are less treatment prone toward therapeutic hazards than risk neutral patients. This is because the therapeutic option generates risk over the certain result if no treatment is initiated. When the model is extended further to include background risk, Eeckhoudt finds that treatment is used less often since the treatment threshold is reduced: "Faced with a new risk that he cannot control, the patient submits himself less often to the therapeutic risk."

Chapters 5 and 6 address the valuation of diagnostic tests, first for a risk neutral decision maker, and then under risk aversion. The medical decision addressed in chapters 2 and 3 is expanded to include three choices: treat, do not treat, or test. If the choice is to test, then the results of the test can be used to make a treatment decision. The test is perfectly accurate, so a positive (negative) test necessarily implies treatment (no treatment). Eeckhoudt finds that the risk neutral decision maker's decision to test depends on the test's information value, or the difference between the welfare level with the test and the relevant welfare level without the test. Chapter 6 evaluates the same decision for the more complicated case of a risk-averse decision maker. Eeckhoudt develops the model and provides graphs and tables to help illustrate the results, which show that the value of a test is first increasing, then decreasing, in the probability that the disease state occurs. That is, at low illness probabilities, risk averse physicians will be more prone than risk neutral ones to order diagnostic tests, but the opposite is true when the illness probability is high. This result implies that risk aversion does not always explain the practice of defensive medicine!

Chapter 7 expands on the results of Chapters 5 and 6 to show the effects of background risk. The chapter provides an overview, as the models are more technically difficult than the other models shown. Eeckhoudt shows that for risk neutral decision makers, co-morbidity risk does not affect information value, and therefore does not affect the treatment decision. However, risk averse individuals will react to co-morbidity risk if they exhibit decreasing or constant absolute risk aversion. In other words, if risk aversion does not increase with health (QALYs), co-morbidity risks increase the value of a test because they act as though they were an increase in the severity of the index condition.

The two chapters in Part 2 are devoted to alternative models of choice under risk. Chapter 8 introduces the dual theory (DT) or risk proposed by M. Yaari in 1987. Eeckhoudt suggests that in the EU model, "the behavioral assumptions of risk aversion, neutrality or proneness come into the picture through a transformation of the outcomes." Under Yaari's dual theory, the outcomes "are accepted as such but the decision maker is assumed to transform the probabilities." For example, to obtain risk aversion the decision maker is assumed to over weight the probability of the worst outcome and under weight that of the best one. In the analysis of the treatment decision where there are just two possible outcomes, the dual theory leads to the same qualitative conclusion as the EU model. That is, risk aversion lowers the treatment threshold. Eeckhoudt argues that the consistency of the result follows from the fact that "once risk aversion is defined in any model its qualitative impact on the treatment threshold should then always be the same: it should give a comparative advantage to the risk reducing strategy which, in the presence of diagnostic risks, is—as we know—the treatment option."

Chapter 9 expands on the dual theory model of Chapter 8 to evaluate the value of an imperfect diagnostic test. While the binary choice situation in the previous chapter indicates no difference between the conclusions of the EU and dual theory models, the difference is marked when there are more than two choices. Eeckhoudt proposes a situation in which the decision maker faces a sequential lottery with an imperfect diagnostic test, and shows that the two theories yield different results and recommendations. Eeckhoudt provides a numerical example to highlight this result and save technicalities. Most important in this comparison of theories are the assumption of linear probabilities and the presentation of the choices. In his conclusion to Chapter 9, Eeckhoudt alludes to a debate over whether the EU model is appropriate when its results are impervious to the presentation of sequential decisions. Indeed, the dual theory suggests different results, depending on whether the decision is modeled as a normal (folded back, eliminating options that are suboptimal) or extended (sequential) decision.

The Conclusion summarizes the objectives of the book and notes the drawbacks to the concise summary format of the text. Eeckhoudt recognizes that several important topics, such as the multidimensional nature of medical decisions and the financial impact for the patients and/or insurers, are important to the field but are not given consideration. Nonetheless, the author provides substantial narrative for the models, so that the reader can easily trace the steps in their development. When conclusions are stated, they are often reinforced with an alternative interpretation. In many cases, Eeckhoudt provides helpful graphical representations to highlight his results. This

textbook will be most valuable to researchers who study decision making within the medical field. It may also be useful as a textbook for a course on medical decision making, if supplemented by additional background on medical risks.

Taking Technical Risks—How Innovators, Executives, And Investors Manage High-Tech Risks, by Lewis M. Branscomb and Philip E. Auerswald, 2001, Cambridge, MA: The MIT Press

Reviewer: Maurizio Pompella, University of Siena

The difficult life of technical innovators and the gaps which have to be covered in order to cross the "death valley" (where the majority of innovative projects fail) give a satisfactory idea of how tough is the way from scientific breakthroughs to market prototypes, or throughout the book—in other words—how difficult it is to control purely technical risks and market risks at the same time. The financial gap between funding of research and resources to be invested to put the projects in practice, the research gap between the initial idea and a market-suitable product, and also the trust gap—or the information asymmetry—between technologists and managers, may seriously affect the underwriting of high-tech risks. Technical breakthroughs no longer coincide with products themselves, as it was once; there is now a difference between an innovating concept and a product ready to be launched. This is the central subject of the book, and also a very typical insurance topic, as everybody can see and realize, although this is not emphasized throughout the work as it could have been. In fact, the risks necessarily related to all innovative projects are normally shared, and risky activities may be undertaken—under insurance mechanisms—which would not have been possible otherwise.

At the very heart, the problem originates from the fact that different, sometimes conflicting interests stand on the valley sides. On the one hand "inventors" and technologists are responsible for research and follow the reasons of science, often paying attention to feasibility more than to the impact of proposed innovations. On the other hand investors, and particularly managers, are responsible for decision-making processes and risk firm reputation and money, so that they follow the reasons of market.

The volume takes the form of a monograph that is divided in chapters, as usual; among the chapters a series of papers ("contributed essays") can be found, however. These were mostly chosen from the commissioned contributions of a report on "Managing Technical Risks," which was sponsored by the Advanced Technology Program of the NIST (National Institute for Standards and Technology) in the late nineties. Together with the academics, a series of practitioners were involved in the project, and two preliminary workshops were organized to approach the matter. Thus, most of the "added value" comes from the choice to combine continuous, often implicit, reference to theory—from Schumpeter on—with the point of view and the experience of professionals, whose opinions are quoted throughout the book.

The Introduction is devoted to elucidate the aims and structure of the book. On the other hand, the first chapter (*Between Invention and Innovation*)—having introduced the discussion and presented two case studies—offers a useful definition of *success* and *failure* in terms of objectives. Institutional, personal, and project objectives are discussed to evaluate technical uncertainties and failure risks. The corresponding