Handbook of the Economics of Risk and Uncertainty

VOLUME 1

by

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The literature on the economics of risk and uncertainty has had a far reaching impact on our understanding of individual choice, market behavior, and public interventions to enhance market performance. This work has not only broadened the domain of economic inquiry but also has established the frameworks that are used in the design and evaluation of policies. The chapters in this Handbook provide self-contained but advanced treatments of these important topics.

Risk taking and attitudes toward risk in economics can be said to start at the level of the individual. Compared with most branches of consumer theory, theories and models of attitudes toward risk almost always have an axiomatic foundation. The most important of these, the classical model of expected utility risk preferences and probabilistic beliefs, has a well-defined analytical framework and has received dozens (if not more) axiomatic formulations. Although initiated by mathematician John von Neumann and statistician Leonard Savage, the axiomatics of the classical model has gone on to become almost exclusively the domain of economists (Chapter 1 Karni).

The field of individual attitudes toward risk and individual beliefs under uncertainty has also seen much more than its share of philosophical discussion and debate. The key axioms of the classical model — the so-called ‘Independence Axiom’ and ‘Sure-Thing Principle’ — were initially viewed as being as much an inherent feature of ‘rational choice’ as the principle of transitivity. However, this view has been subject to debate by both economists and philosophers (Chapter 2 Hammond and Zank). The arguments have typically centered on the implications for individual choice in situations of dynamic decisions, and when ex post decisions are, or are not, consistent with ex ante plans. An important question in this debate is whether or not agents who do not conform to the classical axioms are subject to ‘Dutch book’ arguments, in which they can be systematically exploited.

Starting with the foundational work of Kenneth Arrow and John Pratt, the expected utility model has gone to provide the framework for an extensive literature on individual behavior toward risk, both how risk aversion varies with an individual’s wealth and how it varies across individuals (Chapter 3 Meyer). It also plays an important role in the characterization and comparison of risk in economic environments, as studied, for example, by Michael Rothschild and Joseph Stiglitz. As seen in the subsequent chapters of this volume, this work provides the basis of much of the economic analysis of...
individual and market behavior in the field of insurance as well in situations of incomplete information. Analysis of risk aversion also plays a central role in the evaluation of other public policy decisions involving risk.

To measure individual willingness to engage in risk-taking activities, experimental and empirical methods (Chapter 4 Holt and Laury) have operationalized the standard models of risk aversion. Researchers have developed several different methodologies for estimating individual risk aversion, including certainty equivalent pricing tasks, choices from lottery menus, and preferences revealed by investments in risky assets. In addition to developing average measures of risk aversion, several studies have identified systematic differences in risk-taking behavior, such as differences by gender and age. These risk aversion measures have in turn proven to be instrumental in predicting the effect of individual risk aversion on economic behavior, such as decisions in auctions and bargaining situations.

The properties of well-behaved markets involving different aspects of risk serve as a frequent starting point for economic analysis. Building on the pioneering work of Kenneth Arrow and others, there developed a large literature in which these theoretical insights have been applied to analysis of insurance issues. These contributions have established the framework for setting insurance rates for risks that can be addressed through financial transfers, such as property and liability risks (Chapter 5 Dionne and Harrington). The practical problems of insurance pricing that have been illuminated by economic analysis include assessments of the role of moral hazard and adverse selection, as well as the structure and appropriate degree of regulation of insurance markets. The pricing and regulation of insurance encompasses a broad range of economic considerations, including the establishment of adequate capital requirements.

A distinctive contribution of the field has been in identifying new phenomena that arise when risks are a factor. Often in the presence of risk and uncertainty, markets function quite differently than is hypothesized in idealized economic models of a risk-less world. The presence of risk and uncertainty creates a potentially valuable role for information, which in turn generates a host of economic issues arising due to potential asymmetries in information, which have been explored in seminal work by George Akerlof and A. Michael Spence. The broad range of information-related topics include, among many others, the market effects of used cars that are “lemons”, in which sellers know more about the quality than does the buyer, adverse selection problems in which the high risk individuals find being insured particularly attractive, and signaling phenomena in which people develop credentials to convey their underlying productivity (Chapter 6 Hermalin). Similar informational asymmetries may influence the functioning and outcomes in contracting situations.

Even in the case of risks to health, it is desirable to monetize the risks so that the value of reductions in mortality risks can be viewed in terms comparable to other expenditures. Following the insight of Thomas Schelling that the appropriate focus is on
valuation of small risks of death rather than certain deaths, economists have estimated the tradeoff between risk and money in a variety of market contexts, yielding estimates of the value of a statistical life (Chapter 7 Viscusi). For several decades, many governments throughout the world have used these values to provide the basis for assessing the benefits for all major risk and environmental policies. Other studies have utilized stated preference approaches to examine the heterogeneity of the value of statistical life for outcomes such as cancer and deaths from terrorist attacks. These analyses also have found that severe health impacts reduce the marginal utility of income, which in turn has implications for optimal levels of insurance.

Many of the most challenging insurance and medical policy issues involve individual life and health, which are irreplaceable (Chapter 8 Philipson and Zanjani). The central economic challenges of insurance, such as moral hazard and adverse selection, first gained prominence in the medical care area. Economic analyses of these issues are central to the debate over the appropriate level of health insurance as well as the regulation of medical technologies and pharmaceuticals. Medical innovations, ranging from new prescription drugs to research and development for rare diseases, are often major contributors to individual health. Ensuring that new technologies are both safe and effective involves a continuing effort to strike an efficient balance between these often competing concerns.

Analyses of risk and uncertainty also have a constructive role in providing guidance with respect to how safety regulations can be structured effectively. The general task is not to achieve a zero risk society but to attain a reasonable level of risk that would be observed if markets functioned effectively or if government policies met efficiency norms. An extensive set of regulations addresses risks of products and jobs (Chapter 9 Kniesner and Leeth). Often the greatest incentives for safety are generated by market forces and by liability laws, such as the workers’ compensation system. Regulations can potentially be effective, but their potential has not always been fulfilled. Economic analyses play a fundamental role in illuminating the rationale for these regulations, the benefits and costs of these efforts, and the evaluation of their performance.

The challenges posed by complex choices involving risk and uncertainty may also affect the soundness of governmental policies. Because government policies are subject to public pressures and because government officials are human, biases such as the presence of ambiguity aversion may be institutionalized in government policies, such as environmental programs. Proper application of economic analysis can overcome such biases. Another role for economic analysis is in terms of the conceptualization of very difficult policy choices. The policy issues raised by environmental uncertainties may be so far reaching that sound economic analyses can facilitate better understanding of issues that otherwise may appear intractable. For example, the risks associated with climate change have attracted considerable attention among economists as there are tremendous uncertainties regarding the extent of climate change, the societal impacts that will be
generated, and the appropriate discounting of long-term environmental effects that will affect future generations (Chapter 10 Aldy and Viscusi).

Risks differ in their magnitude and their distribution in manners that alter the ability of markets to handle them effectively. Very large risks and correlated risks pose particular problems both for individuals and for insurers. Natural disasters and attacks by terrorists represent examples of such catastrophic events. Catastrophe insurance is generally quite attractive to the prospective insured, but private insurance markets may be inadequate to provide such coverage. Making sufficient levels of insurance available may entail a governmental role in insurance, perhaps coupled with policy restrictions such as zoning laws to limit risk exposures (Chapter 11 Kunreuther and Michel-Kerjan). If it is difficult to deny disaster assistance ex post, mandatory insurance may be desirable, but such requirements raise equity and affordability issues.

As a refutable hypothesis on individual behavior, the classical expected utility/subjective probability model is also subject to experimental testing (Chapter 14 Hey). The original thought experiments of Maurice Allais led to an extensive amount of experimental testing by economists, revealing that such systematic violations of the Independence Axiom indeed occur. Current experimental work largely focuses on the phenomena of ambiguity and ambiguity aversion as introduced by Daniel Ellsberg, and again, typically finds the types of violations of the Sure-Thing Principle, and of the existence of probabilistic beliefs, that he hypothesized. Psychologists, and to a growing extent economists, have also documented phenomena such as framing effects and reference point effects, which question the classical model (and most of its proposed alternatives) at a more foundational level. Although originally studied in the context of choice under uncertainty, these phenomena also extend to consumer decisions in other contexts.

Such systematic violations of the classical Independence Axiom have led to the development of a large number of alternative theories of individual risk taking (Chapter 12 Quiggin). Most (though not all) of these models retain the property of transitive preferences over risky prospects, but replace the Independence Axiom with weaker versions. Researchers have revisited much of the theory of individual attitudes toward risk, exploring which of the classical results are and are not robust, or how they differ, under such weaker hypotheses on preferences.

The systematic violations of the Sure-Thing Principle and of the existence of probabilistic beliefs have also led to a more recent but very active literature on the phenomena of ambiguity and ambiguity aversion (Chapter 13 Machina and Siniscalchi). Because of their recency, and because they must delve deeper into the nature of uncertainty, current models of ambiguity aversion are more diverse and more loosely specified than the earlier alternative models, and certainly more than the classical model. The study of how ambiguity and ambiguity aversion affects market behavior and optimal policy is just beginning and remains almost completely unexplored.
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