EMANUEL V. TOWFIGH NIELS PETERSEN



ECONOMIC METHODS for LAWYERS

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Published by Edward Elgar Publishing Limited The Lypiatts 15 Lansdown Road Cheltenham Glos GL50 2JA UK

Edward Elgar Publishing, Inc. William Pratt House 9 Dewey Court Northampton Massachusetts 01060 USA

A catalogue record for this book is available from the British Library

Library of Congress Control Number: 2015943164

This book is available electronically in the **Elgar**online Law subject collection DOI 10.4337/9781783471676

ISBN 978 1 78347 166 9 (cased) ISBN 978 1 78347 167 6 (eBook)

Typeset by Servis Filmsetting Ltd, Stockport, Cheshire

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Contributors

Markus Englerth, Attorney-at-law with Danckert Huber Bärlein, Berlin

Sebastian J. Goerg, Assistant Professor of Economics, Florida State University

Stefan Magen, Professor of Public Law, Legal Philosophy, and Law and Economics, University of Bochum

Alexander Morell, Senior Research Fellow, Max Planck Institute for Research on Collective Goods

Niels Petersen, Professor of Public Law, International Law, and EU Law, University of Münster

Klaus Ulrich Schmolke, Professor of Private Law, Commercial, Company and Business Law, University of Erlangen-Nuremberg

Emanuel V. Towfigh, Senior Research Fellow, Max Planck Institute for Research on Collective Goods

Preface

Economic methodology has been gaining increasing attention in legal studies over the last few decades - for a while now in the Anglo-American discourse, and more recently also in continental Europe. Arguments based on economic thinking were first advanced in private law and then in other areas of law as well. Nowadays, nobody is surprised anymore to read of 'incentives' or 'actors' in a legal text, or - more recently - of 'nudges'. There is hardly a treatise on torts which does not contain reflections on the best insurability; in the field of emissions trading law, EU law specialists discuss the first allocation of certificates; and criminal law experts debate whether increasing the chances of detecting crimes would have a stronger deterrent effect than the mere increasing of sentences. Further prominent examples could be named for a whole string of legal areas, ranging from medical liability and intellectual property rights to tax and environmental law as well as antitrust and consumer protection law. In comparative law, economic theory is frequently used as a tertium comparationis, a standard of comparison. While law and economics in the initial stages primarily dealt with theoretical models, in recent times empirical findings have also increasingly been making their way into legal studies.

There is also a growing demand for legal scholars to justify legislation (already in force or about to be implemented) on the basis of evidence on human behavior – for example, from politics or neighboring disciplines. Is an intended legal measure really suited to fulfill its goal? Legal practitioners are thus increasingly compelled to assure themselves of the fundamentals of their own discipline. In order not to lose their clout to have a strong impact on society, they must become experts for behavioral interventions through law. Law and economics provides a suitable framework for this, in particular, if evidence from the behavioral sciences is taken into account.

These developments also mean there is an increasing demand for knowledge of social science methodology in general and of economics in particular to be passed on. How does one find access to this mode of thinking? What limitations have to be taken into account when introducing an economic argument into the legal discourse? How do we recognize a good, economically sound argument, and how can we debunk a poor one? And finally, how can we learn to make a valid economic argument ourselves? This textbook is an attempt to answer these questions. It addresses readers who are familiar with legal studies, yet have no previous knowledge of the social sciences, and who wish to become familiar with economic methods and to understand the appeal and the power of an economic argument in select legal contexts. The major areas of economic theory are briefly introduced, as far as they are relevant for legal studies. Furthermore, the book will give an overview of the empirical fundamentals of the social sciences, and of more recent approaches relating to behavioral theory.

Therefore, the book differs in its approach from conventional textbooks on law and economics. The idea is not to study certain legal areas through the lens of economic theory. First and foremost, it is about imparting information on methods rather than certain content-related theories. The book does not outline how specific economic insights should be understood in a legal context. Rather, it intends to be an aid to understanding economic arguments better and applying them to legal issues. Obviously, this textbook cannot do entirely without content-related knowledge, so that short introductions to some basic theoretical concepts of economics are provided – from microeconomics to public goods and public choice. Despite this emphasis on methods, the authors have gone to great lengths to show the importance of their remarks for legal studies, using examples from many of the different legal fields.

This textbook presents the basic economic models, since this project is about introducing economic methods to legal experts. In economics, too, as in jurisprudence, many of the assumptions and conclusions presented here without second-guessing are the subject of heated debate. Every topic presented in this volume is open to a host of theoretical and empirical variations and refinements – indeed, these are too numerous to reference them in their entirety. Interested readers are advised to refer to more specialized literature, which usually contains more refined models. References are provided at the end of each chapter, and the footnotes contain further references for specific questions.

The authors of the individual chapters are experts in their respective fields. However, the primary authors had the ambition to produce not an anthology of economic methodology, but rather a self-contained textbook. The concept and final harmonization are the work of the two primary authors. They revised all contributions in order to avoid overlaps and to ensure coherence and a consistent style. The book is based on the experience of a German language textbook; Stefan Voigt and Patrick Leyens from the Institute of Law and Economics at Hamburg University urged us to write an English language textbook according to the same concept, bridging a gap for 'black-letter law' trained lawyers into social science Preface

methods. Special thanks go to Brian Cooper for his thorough linguistic review of the individual contributions, to Rebekka Herberg for the final editing of the manuscript, and to Tara Gorvine, Erin McVicar, Claire Greenwell and David Fairclough at Edward Elgar for the professional and helpful handling of the publishing process.

We hope this book will be well received and are always grateful for ideas for improvement.

Emanuel V. Towfigh and Niels Petersen

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1. Economic methods and legal reasoning

Niels Petersen and Emanuel V. Towfigh

I. DEVELOPMENT OF LAW AND ECONOMICS

The modern economic analysis of law was developed in the United States in the second half of the 20th century.¹ There are several factors that contributed to this development. However, the main reason is probably a cultural one. The critique of legal realism with regard to the power of legal doctrine to determine the results of legal decisions has had a much stronger influence on legal academia in the United States than in continental Europe. With the disenchantment of legal doctrine, US scholars had to look for different fields of research activity. The economic analysis of law was one approach that tried to bridge this gap.²

The emergence of the Law and Economics movement in the US is often traced back to Ronald Coase's article on 'The Problem of Social Cost' in the *Journal of Law and Economics* in 1960. This article paved the way for the economic analysis of tort and contract law. In the 1960s, Guido Calabresi advanced the economic analysis of tort law, culminating in his book on accident law in 1970. Gary Becker then applied economic principles to areas of law which had previously not been susceptible to an economic analysis: to crime, racial discrimination or family life. In 1973, Richard Posner published his seminal textbook on the *Economic Analysis of Law*, in which he tried to present for the first time a comprehensive analysis spanning several different fields of law.

¹ For a detailed account, see Kristoffel Grechenig and Martin Gelter, *History of Law and Economics* (Working Paper, MPI Collective Goods, 2014).

² See Grechenig and Gelter, *The Transatlantic Divergence in Legal Thought*, 31 HASTINGS INT'L AND COMP. L. REV. 295 (2008).

II. POSITIVE AND NORMATIVE ECONOMIC THEORY

In the scholarly discourse, two approaches to economic analysis can be distinguished. We will briefly touch upon this distinction again in Chapter 2. First, we can use economic theory as a *descriptive* tool ('positive theory'). Economics, then, is a perspective to look at the world and to make sense of what we see. How do people behave – in terms of our theory? And why do they behave this way – in light of our theory? To see how well our positive theory reflects what we empirically observe, we derive hypotheses about the behavior we would expect to see in certain situations: We make predictions. We can then check in an empirical study (see Chapter 7) whether our predictions are correct, and evaluate our theory accordingly, adapting it if necessary. Second, we can use economic theory to postulate how the world should be ('normative theory') or we can evaluate different states of the world according to a normative standard. For example, welfare economics (as we will see in greater detail in Chapter 2) posits that a condition A 'is better than' a condition B if more people are better off materially under condition A. It thereby assumes a normative standard (it is good if people are prospering materially), and measured against this standard it makes a normative judgment ('is better than'). Of course, the line drawn between positive and normative theory is not always that bright and clear. Positive theory can carry implicit normative assumptions; and even the mere labeling of a behavior as 'rational' may be understood to contain a judgment. Moreover, positive theory may not only describe, but also affect behavior if people informed by economic theory expect their environment to behave in a certain way, and condition their own behavior on this expectation: If I expect everyone else to behave selfishly, as positive economic theory seems to imply, then my best reaction is to behave selfishly myself; my selfish behavior may, in turn, induce my environment to behave selfishly, which proves my suspicion that everyone else behaves selfishly ('self-fulfilling prophecy').3

The normative side of economic theory is the main reason why – despite the success of law and economics in the US – there has long been a fierce resistance against the economic analysis of law in other parts of the world, especially in continental Europe. This resistance was primarily based on the normative target that the economic analysis of law often had in

³ On this issue, see the very instructive study of Donald MacKenzie and Yuval Millo, *Constructing a Market, Performing Theory: The Historical Sociology of a Financial Derivatives Exchange*, 109 AMERICAN JOURNAL OF SOCIOLOGY 107 (2003).

the US. Law and economics was not just understood as an approach to explain legal institutions, but also as a guideline for reform to make them more efficient. Richard Posner once wrote that 'wealth maximization should guide public policy in all spheres'.⁴ Legal scholars in continental Europe thus feared that accepting economic analysis would lead to economic efficiency trumping other values – such as fairness and equity or, more concretely, distributive justice. This fear was even more pronounced as the economic approach did not limit itself to the analysis of economic fields of law, but also extended to criminal law or family law.

III. THEORY BUILDING AND RESEARCH IN SOCIAL SCIENCES

Economics is not the only academic discipline that studies human behavior. Other social sciences, such as sociology, anthropology, or psychology, analyze behavior from a different perspective. This book primarily focuses on the economic perspective. However, it refers to other disciplines wherever this is helpful. This particularly concerns psychological research, which criticizes some of the fundamental assumptions of economics. Despite all differences in the perspectives and the emphasis, the methods of the different social sciences are very similar. For this reason, the following remarks address the design of social science research in general.

Social science theories focus on the explanation of human behavior and social interaction. On the one hand, they are supposed to describe and explain social phenomena; on the other, they can allow for predictions: Do people comply with legal norms? Why do they comply? Under which conditions do they obey the law? Both tasks, the explanation as well as the prediction, are complicated by the fact that the occurrence of specific phenomena usually depends on several different factors that we cannot take into account in their entirety because of cognitive limitations.

To clarify this difficulty, let us consider an example from physics. Scientific relations equally depend on different influences. If I drop an object from a specific height, I can, in principle, predict how long it will take for the object to reach the ground. However, the object does not usually fall in a vacuum. For this reason, the time for it to reach the floor not only depends on the mass of the object and the distance it falls, but also on aerodynamic resistance, as well as the volume and the shape of the object. Therefore, a

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⁴ Richard A. Posner, *The Ethical and Political Basis of the Efficiency Norm in Common Law Adjudication*, 9 HOFSTRA L. REV. 775, 780 (1981).

prediction of the exact travelling time is only possible in theory. In practice, we usually do not have sufficient information for a precise prediction.

The same problem occurs in the context of social sciences. Whether or not a specific person complies with a legal norm depends on the circumstances. Different people have different degrees of law obedience. But even with regard to one specific person, compliance with the law may depend on the circumstances. Let's imagine a fictitious character, Melissa. Melissa would never kill a person. But the fact that she complies with the prohibition of homicide does not mean that she always complies with the law. Instead, she might at times cross the street at a red light. However, Melissa is not even consistent with regard to this one norm. When she is in a hurry and when nobody is on the street, it is more likely that Melissa will not comply than when she sees a policeman or a group of school children.

We can still observe regularities and characteristics of causal relationships. In reality, however, we rarely observe monocausal relations. Instead, the social phenomena that we observe usually have several causes. If we want to make claims about X and Y, we can therefore usually not make deterministic, but only probabilistic claims. Instead of saying that X automatically determines the occurrence of Y, we can only say that X makes the occurrence of Y more likely. Let us assume that there is a causal relationship between economic development of a state and this state's level of democracy.⁵ In such a case, we will not be able to say that a specific level of economic development automatically leads to a transition to democracy. Instead, democratization depends on many different factors. However, what we can say is that a higher level of economic development makes a transition to democracy more likely. We can thus make a probabilistic causal statement.

IV. SOCIAL SCIENCE METHODS AND LEGAL REASONING

In legal scholarship, research questions can stem from three different perspectives. First, legal scholarship is concerned with legal doctrine and the interpretation of norms. The main question in this research is:

⁵ There is a lively debate on this question in the social science literature. See, on the one hand, ADAM PRZEWORSKI, MICHAEL E. ALVAREZ, JOSÉ ANTONIO CHEIBUB AND FERNANDO LIMONGI, DEMOCRACY AND DEVELOPMENT: POLITICAL INSTITUTIONS AND WELL-BEING IN THE WORLD, 1950–1990 (Cambridge: Cambridge University Press 2000), and, on the other hand, Daron Acemoglu, Simon Johnson, James A. Robinson and Pierre Yared, *Income and Democracy*, 98 AM. ECON. REV. 808 (2008).

What is the law? Second, legal research can deal with legal reform. It can analyze the quality of existing norms and make propositions about how to improve them. The main question is: What should the law be? Finally, law can also be treated as a social phenomenon. This perspective analyzes the effect of law on society or certain social actors. The use of social sciences in general and economic methods in particular depends on the kind of perspective that is taken. For this reason, the different perspectives will be considered separately in the following.

A. Legal Doctrine

At first glance, social science methods do not seem to be of much value for legal doctrine. Doctrinal reasoning is a normative exercise, while the social sciences deal with the description and explanation of reality. Facts only come into play once the norm interpretation is completed and the norm is applied to the concrete case. However, the differentiation between norm interpretation and norm application is too cursory. Norm interpretation is no mathematical exercise. Many normative concepts depend on empirical assumptions. The following four sections show three examples of legal reasoning where the interplay between normative and empirical argumentation is particularly obvious.

1. Teleological interpretation

Teleological interpretation asks for the purpose of a norm – the *telos*. Teleological interpretation consists of two steps. First, we have to identify the purpose. This is principally a normative exercise to which social sciences do not have much to contribute. However, in a second step, we have to find the interpretation which best matches the aim that the norm seeks to achieve. In this second step, social sciences may play an important role. For example, norms that try to achieve an economic purpose cannot be interpreted without taking into account the relevant economic concepts.

Let us consider an example from US gambling law.⁶ In most states, gambling is heavily regulated. Usually, the state has a monopoly on operating lotteries, and the unauthorized offering of gambling activities is subject to criminal sanctions. The principal reason for such regulation is the addictive potential of betting and gambling. However, under the common law definition and most state laws, there is an important distinction between

⁶ The example is based on Emanuel V. Towfigh, Andreas Glöckner, and Rene Reid, *Dangerous Games: The Psychological Case for Regulating Gambling*, 8 CHARLESTON L. REV. 147 (2013).

games based on skill and games based on chance.⁷ Only games of chance are covered by the gambling prohibition, while the offer of skill games is usually allowed.

In the legal literature, there is an intensive discussion on whether sports betting is a game of skill or a game of chance. If it were qualified as a game of chance, it would be subject to severe gambling regulation. If it were considered as a game of skill, any private person would be able to offer sports bets for money. The question of whether sports bets are a game of chance or a game of skill is both an empirical and a normative question. Even a game of skill may include elements of chance. Nobody would argue that sports bets are totally independent of chance. The normative question is, thus, to what extent chance may be an element of skill games for them still to be considered as skill games. The empirical question that follows is to which extent sports bets are indeed dependent on skill.

With regard to the normative question, it is very difficult to determine an exact cut-off point. Are games that are made up of 51 percent skill and 49 percent chance still skill games? Consequently, one could argue teleologically. We have seen that the regulation of chance games is usually justified by their addictive nature. Sports bets should thus be subject to regulation if they have a significant addictive potential. However, this is again an empirical question. Emanuel Towfigh and Andreas Glöckner show in an experimental study that people have an illusion of control if they are betting in a field in which they claim to have expertise.⁸ Consequently, mixed games, which consist of elements of skill and chance, appear to be even more addictive than pure chance games. This suggests that such mixed games ought to be subjected to gambling regulation.

2. Proportionality

Many constitutional and supreme courts today recur to the proportionality test in their individual rights adjudication. The only prominent exception seems to be the US Supreme Court, even though elements of proportionality are also present in the US case law. Proportionality comes into play at the second stage of a two-stage individual rights analysis. After a court has found that a specific state measure has restricted an individual right, it usually has to shift its focus on whether the restriction can be justified. In this justification analysis, proportionality plays a pivotal role.

⁷ See id., at 160–61.

⁸ Emanuel V. Towfigh and Andreas Glöckner, *Game Over: Empirical Support* for Soccer Bets Regulation, 17 PSYCH., PUBL. POL'Y AND L. 475 (2011).

The proportionality test consists of four prongs. First, the restricting measure has to pursue a legitimate purpose. Second, the measure has to be rationally connected to the purpose, and third, it has to be the least restrictive of all equally effective means. Finally, courts have to balance the importance of the purpose and the extent to which the measure promotes this purpose with the importance of the restricted right and the severity of the restriction. Social science methods are relevant at the last three of these steps. To be rationally connected to the purpose, the measure has to have a causal effect on the latter. The less restrictive means test requires a comparison of alternatives, which implies a comparison of the effects of actual measure and the potential less restrictive alternative measures. In the balancing stage, courts finally have to make assumptions about the extent of the positive and the restrictive effect of the state measure. All these questions are empirical questions, and social science methodology can help us to approach these questions.

Let us consider two examples. In the seminal *Makwanyane* judgment, the South African Constitutional Court faced the question whether the death penalty violated the right to life that was guaranteed by the South African Constitution.⁹ The issue had been a constant point of debate between the grassroots level and the elites of the African National Congress (ANC). The elites of the ANC, in particular Nelson Mandela, predominantly opposed the death penalty because it had been used frequently against ANC members in the apartheid era. However, the death penalty was very popular among the grassroots members of the ANC and the general population. It was considered as a remedy to the rampant crime rate that plagued South Africa at the time. As no compromise could be found, the South African interim constitution was moot on the issue and delegated the question to the Constitutional Court.

In its judgment, the court argued that the death penalty was only consistent with the constitution if it was proportionate. It identified deterrence as the core purpose of capital punishment. The debate centered around the question whether the death penalty is the least restrictive means to achieve deterrence. The opponents of the death penalty had argued that long prison sentences were a less restrictive alternative. That a prison sentence is less restrictive to the right to life than the death penalty seems obvious. The pivotal point is whether it is equally deterrent. However, this is an empirical question about the deterrent effect of two different types of punishment, which needs to be addressed by methodological tools stemming from the social sciences.

⁹ S. v. Makwanyane, 1995 (3) SA 391 (CC).

The second example originates from the jurisprudence of the Canadian Supreme Court.¹⁰ The Canadian province of Quebec had established a public health insurance scheme. At the same time, it had banned private health insurance in order to avoid a defection of wealthy citizens from the public scheme. However, there was significant discontent with this state of affairs because there were some long waiting lists for certain medical treatments under the public scheme. The Canadian Supreme Court had to decide in *Chaoulli v. Quebec* whether this prohibition of private health insurance in combination with long waiting lists under the public scheme violated the right to life and to personal inviolability under the Canadian Charter of Rights and Freedoms.

The decisive question in this case was also an empirical one. The majority opinion and the dissenting judges disagreed on whether the introduction of private health insurance would lead to a deterioration of the services offered under the public scheme. While the majority recurred to the experience of other countries and other Canadian provinces and argued that private and public schemes could coexist, the minority countered that these experiences could not be transferred without qualification to the Quebecois context. This is, again, a question that cannot be addressed without recurring to social science methods.

3. Equal protection

Empirical arguments may also play a role in the context of equal protection guarantees. Sometimes, discriminations are straightforward. If a legal provision attributes certain benefits to men, but not to women, the latter are discriminated because of their sex. However, many of the problematic cases of discrimination today are subtler. Some provisions may use apparently neutral criteria of distinction, but still lead to a de facto discrimination of a vulnerable group. In other cases, a distinction is made, but it is difficult to identify whether one group is indeed treated worse than another. In some of these cases, empirical considerations can help us to establish whether the distinction does indeed lead to discrimination.

Brown v. Board of Education is one of the most famous judgments ever taken by the US Supreme Court.¹¹ The decision overturned an almost 60-year-old precedent. At the dusk of the 19th century, the Supreme Court had decided in *Plessy v. Ferguson* that racially segregated schools did not violate the equal protection clause as long as the quality of the 'black' schools was not worse than the quality of the 'white' schools – the famous

¹⁰ Chaoulli v. Quebec (Attorney General), [2005] 1 S.C.R. 791.

¹¹ Brown v. Board of Education of Topeka, 347 U.S. 483 (1954).

'separate but equal' doctrine. In *Brown*, the court made a U-turn and held that racial segregation violated the constitution. It found that segregation had a detrimental effect on black children even if the quality of the schools was the same. The separation of schools caused a stigma of inferiority for black students. In order to support this claim, the court cited corresponding psychological studies. The court thus used an empirical argument to justify that formally equal treatment could constitute discrimination.

4. The interpretation of standards

Finally, social science methods may help with the interpretation of open-textured standards. The legislature usually has the choice between different levels of specificity when it wants to regulate a certain subject matter. Very specific norms usually increase legal certainty and predictability. However, they are also more likely to be over- or under-inclusive. In contrast, standards provide less certainty, but give judges the flexibility to react to unforeseen circumstances. The optimal specificity of a norm usually differs according to the regulated subject matter.

One area where vague standards are the norm rather than the exception is constitutional law. As the decision-making costs for changing the constitution are usually high, judges have to have a certain level of flexibility to interpret constitutional standards according to changing social circumstances. One example of an open-textured constitutional norm is the guarantee of democracy that is enshrined in section 20 of the German Constitution. This norm stipulates that the German state has to be organized in a democratic manner and that the exercise of public authority has to originate from the German citizenry. However, the concept of democracy is not further specified.

The definition of democracy becomes crucial when we want to evaluate the transfer of legislative and executive powers to international or supranational institutions, such as the European Union. When the German Federal Constitutional Court assessed the constitutional compatibility of the European integration process in its Maastricht and Lisbon decisions, the democracy guarantee of the German Constitution was the core standard of assessment.¹² In the Lisbon judgment, the court held that the Lisbon treaty was, in principle, compatible with the German Constitution. However, it identified certain core competencies of the nation state that could not be transferred to the European Union, which it derived from the constitutional guarantee of democracy. These included, inter alia,

¹² See BVerfG, 89 BVerfGE 155 (12 Oct. 1993); 123 BVerfGE 267 (30 June 2009).

the determination of citizenship, the monopoly of the legitimate use of physical force, the budgetary sovereignty of parliament, and the legislative competency in criminal matters.¹³

The Constitutional Court argued that a functioning democracy depended on the existence of a public opinion.¹⁴ It continued by stating that the public discussion of political topics was inextricably linked to patterns of identification that were based on a common nation state, language, history, and culture.¹⁵ From this premise it drew the conclusion that the transfer of the core competencies of the nation state would lead to a structural democracy deficit. Even though the reasoning of the court is exclusively normative and deductive, it rests on certain implicit empirical assumptions. The vitality of a public opinion for the functioning of democracy is already an empirical assumption. Furthermore, the statement that such a public opinion necessarily depends on patterns of identification related to the nation state is also an empirical one.

Even though these questions are not related to economics in the strict sense, they require a social science methodology to be addressed. It is not by accident that these questions are broadly discussed in international relations, sociology, and social psychology. The Federal Constitutional Court does not make any effort to clarify these empirical assumptions, and it does not refer to the corresponding discussions in the social sciences. The mere sensibility for the problem would already have made the reasoning more convincing.

B. Legal Reform

In the United States, the discussion in legal scholarship predominantly focuses on the question of legal reform, rather than on the interpretation of the existing body of law. If one concentrates on the question of what an optimal law should look like, the estimation of the consequences of legal regulation is of fundamental importance.¹⁶ The legislature usually tries to achieve concrete regulatory goals. It seeks to reduce the greenhouse gas emissions of cars or the costs of the public health care system. There are usually several options to pursue these purposes. Consequently, the legislature has to make a prognosis which of these options is best suited

¹³ Id., at para. 249.

¹⁴ Id., at para. 250.

¹⁵ Id., at para. 264.

¹⁶ See ANNE VAN AAKEN, RATIONAL CHOICE IN DER RECHTSWISSENSCHAFT 156 *et seq.* (Baden-Baden: Nomos 2003).

to achieve the goal and which has the least negative side effects. Such a prognosis requires social science methods and theories.

C. Law as a Social Phenomenon

A third area of legal scholarship deals with law as a social phenomenon: What is the effect of law on society? Why and under what circumstances do people comply with legal norms? What is the effect of culture on law and legal interpretation? The legal argumentation framework is of little help in addressing these questions. It helps us to determine the interpretation of a norm, but it does not provide support if we look at the effect of the latter. Consequently, we need again to make use of the methodological toolbox from the social sciences – be it from economics, sociology, psychology, political science, or anthropology.

An example for this type of research is the old debate on the effectiveness of international law. International law is supposed to coordinate the conduct of states. It covers different fields, which range from the regulation of the use of military force in conflicts, over human rights to international economic law. The principal difference of international law compared to national legal systems is the lack of a central sanctioning mechanism. There is no global executive, no global police force, which could implement sanctions against infractions of international law. For this reason, some authors claim that international law is irrelevant.¹⁷

There has been a constant and controversial debate about this question. In particular, the law and economics literature has tried in recent years to identify factors because of which states possibly comply with international law even in the absence of central sanctions.¹⁸ Such incentives may include decentralized sanctions, which are carried out by other states, or the fear of a bad reputation, which might make future cooperation with other states more difficult. Furthermore, there are empirical studies that analyze whether the ratification of human rights treaties has a positive effect on the human rights record of the ratifying states.¹⁹

¹⁷ See JACK L. GOLDSMITH AND ERIC A. POSNER, THE LIMITS OF INTERNATIONAL LAW (Oxford: Oxford University Press 2005).

¹⁸ See, in particular, ANDREW T. GUZMAN, HOW INTERNATIONAL LAW WORKS (Oxford: Oxford University Press 2008); JOEL P. TRACHTMAN, THE ECONOMIC STRUCTURE OF INTERNATIONAL LAW (Cambridge: Harvard University Press 2008).

¹⁹ See Oona A. Hathaway, *Do Human Rights Treaties Make a Difference*?, 111 YALE L.J. 1935 (2002); Eric Neumayer, *Do International Human Rights Treaties Improve Respect for Human Rights*?, 49 J. CONFLICT RES. 925 (2005).

D. The Limits of the Economic Analysis of Law

The previous sections of this chapter have pointed out the positive potential of social science methods in legal scholarship. However, the application of economic methods in legal reasoning also has its limits. In the following, two limits will be particularly highlighted. On the one hand, the efficiency orientation of economic models has to compete with alternative normative goals in the legal context. On the other hand, questions of research design in empirical studies often have implicit normative implications that have to be taken into account when lawyers rely on empirical studies.

1. Efficiency and distribution

We have already seen that economics has both a positive and a normative dimension. Positive studies try to show which regulation is the most efficient among several alternatives. The normative strand of economics would draw the additional conclusion that the most efficient regulation is automatically also the best regulation because it is an expression of the cumulated preferences of the affected individuals. According to the Pareto principle, a measure is justified if it makes at least one person better off without impairing the position of any other person. (see Chapter 2, section II.A). This principle will rarely face opposition – as nobody loses in such a scenario. The problem is that such a situation rarely occurs in reality. Usually, we face trade-offs: A certain group gains while another group loses.

For this reason, the economists Nicholas Kaldor and John Hicks developed a principle according to which measures are economically efficient if the individuals who gain could theoretically compensate those who lose (see Chapter 2, section II.B). The sum of the positive and the negative effects of the measure thus has to be positive. The problem with this principle is that the compensation is only a theoretical one. A measure that would benefit the richest 10 percent of the population to the detriment of the remaining 90 percent might be unjust. However, according to the Kaldor-Hicks principle, it would be economically efficient if the cumulated gains of the 10 percent outweighed the cumulated losses of the 90 percent. As a normative standard, efficiency according to Kaldor and Hicks could thus lead to significant distribution problems.

Nevertheless, there have been attempts among economists to justify efficiency as the normative gold standard. The most interesting attempt is probably a thought experiment of the Nobel laureate John Harsanyi.²⁰

²⁰ John C. Harsanyi, *Cardinal Utility in Welfare Economics and in the Theory of Risk Taking*, 61 J. POL. ECON. 434, 434–5 (1953).

Harsanyi imagines an original position, in which all citizens decide about the shape of their society. However, in the original position, they do not know which position they will have in the society once it is established ('veil of ignorance'). They do not know whether they will be rich or poor, intelligent or stupid, beautiful or ugly. Harsanyi assumes that people will take their decision on the basis of their expected value. This 'expected value' can be calculated by multiplying the utility of all possible social positions with the likelihood that they will be attained and by adding these values up. A measure that benefits the rich would thus increase the total expected value if the total benefit of the rich were higher than the total loss of the poor.

Let us consider an example to clarify the idea even if it might oversimplify the model. Let us assume a society with five people. In the egalitarian scenario, each member of the society would possess 2,000 USD. The expected value of this scenario would thus be 2,000 USD. Now, let us consider the inegalitarian scenario, in which one person would gain 8,000 USD on top of his 2,000 USD, while all the other four members would each lose half of their 2,000 USD. The total welfare in this scenario is higher. The cumulated fortune equals 14,000 USD, compared to 10,000 USD in the inegalitarian scenario. In the original position behind the veil of ignorance, the expected value of each member of the society would also be higher. Each person would have a 20 percent chance to become the rich person, and an 80 percent chance to become one of the other members of society. The expected value would thus be 2,800 USD, and the individuals in the original position would opt for the inegalitarian option.

The assumption behind the model is that individuals only look at the expected value if they choose between different scenarios. However, the empirical evidence points in a different direction. Psychologists and experimental economists point out that human beings are usually risk-averse (see Chapter 8, section III.B.2(c) on risk aversion). If the chances to win the main prize of the lottery are low, people opt for the safe bet rather than for the risky option with the higher expected value. Moreover, most individuals have an inequality aversion. Thus, Harsanyi's assumption that the expected value is the main driver of decisions between different welfare scenarios is questionable. Consequently, the maximization of economic efficiency cannot be the only normative reference point for legislation and legal decision-making.²¹

²¹ Certainly, it would be possible to make the model more complex and take risk and inequality aversions into account. A Kaldor-Hicks-efficiency accounting for inequality aversion probably meets little resistance. However, it would also

2. Normative implications of research design questions

The results of social science studies do not represent unquestionable truths. Rather, they always rest on specific assumptions. Lawyers have to be aware of these assumptions if they want to use social science insights for their normative reasoning. Theoretical economists usually work with mathematical models to make explanations or predictions. Models usually try to represent what we observe in reality, but to reduce complexity at the same time. Just think of the model of a sailing ship or a map. That means that they cannot take into account all factors that occur in reality. Instead, they have to focus on the most important ones for the relationship they want to explain. Furthermore, they have to make certain assumptions that can be more or less convincing. The most famous assumption of classical economic theory is probably the assumption that people act rationally (see Chapter 8, section III.B on this assumption). We can only use the insights of a specific model for normative reasoning to the extent that we buy into the assumptions of the model.

This is also valid for empirical research. There is no neutral observation of reality. Instead, researchers have to choose a specific perspective, and this perspective determines to a certain extent what they observe. Empirical studies are usually interested in causal relationships. To determine such causal relationships, the variables constituting these relationships have to be measured. Such a measurement has two steps: First, the variables have to be defined; second, they have to be operationalized. The definition seeks to identify the decisive characteristics of a concept. In the operationalization phase, researchers look for indicators for measuring the variables.

The definition of concepts in particular requires normative judgments, which have an effect on the result of the study. Let us assume we want to conduct a study on the effect of certain social policy measures on the poverty level of a state. For such a study, we have to define the concept of poverty. Conceptually, there are at least three ways to define poverty. We can measure poverty in an absolute, a relative, or a subjective way. An absolute indicator would identify monthly per-capita income as a poverty threshold. People earning less than this threshold would be qualified as poor.

Relative poverty would be measured in relation to the median income. One could, for example, argue that people earning less than 60 percent of the median income should be qualified as poor. Relative income has the

render the concept practically meaningless because it would probably add too much complexity.

advantage of taking into account that prices usually depend on the general level of welfare. A budget that allows for a modest life in Berlin may not be sufficient for survival in Tokyo. However, the concept is also sensitive to the variance of income. If there is huge disparity in income, poverty may rise under the relative definition. Nevertheless, the relative threshold does not necessarily say anything about what people who are poor can actually buy.

A subjective measure of poverty could, finally, be based on a questionnaire trying to determine whether the subjects could afford certain necessary expenses during the last month. According to the subjective measure, some people could be qualified as poor even if they have a sufficient monthly budget, but decide to spend the money on non-necessary expenses. The subjective measure would thus also take into account the ability of people to budget.

There is no right way to define poverty. Rather, it is the subjective decision of each researcher on which definition of poverty he or she wishes to base a study. This decision usually depends on the research interest of the study. If income inequality is the central concern, then a relative definition of poverty may be the most promising one. If researchers are concerned with the question whether people can meet certain basic standards of living, the absolute or the subjective measure might be preferable. For lawyers, it is pivotal to be aware of the normative implications of these conceptual decisions in order to avoid having to rely on results of empirical studies in contexts that differ substantively from the assumptions of the study.

V. AN OVERVIEW OF THE ECONOMIC METHODS TREATED IN THIS BOOK

There are different ways to approach economic research. This book will predominantly deal with economic theory. Economic theory tries to model relationships that we observe in reality in order to explain and predict social phenomena. Nowadays, these models are almost exclusively expressed in mathematical terms. Mathematics is used because it promises a more exact representation of concepts than verbal language. Verbal concepts can often be vague at the margins. Mathematics has the advantage that it does not share the ambiguity of language. As this book is primarily geared towards lawyers, it tries to describe the economic concepts in a verbal language so that students and scholars can intuitively grasp these concepts even if they do not have any formal training in economics. Economic models are based on specific assumptions. The relevance of an economic model thus depends on the robustness of its empirical assumptions. Let us assume an economic model analyzing the careers of judges in order to draw conclusions for the efficiency of the judicial system.²² This model assumes that the careers of judges predominantly depend on the sophistication of their judgments. The conclusions of the model regarding the efficiency of the judicial system are not convincing if we believe that judges' careers, in effect, rather depend on the number of cases that a judge decides during the year, or on their political affiliation.

In order to test the robustness of economic models, we can make use of the methods of empirical economics. There are two main strands of empirical economics – on the one hand, experimental economics and, on the other hand, econometrics. Experiments test causal relationships in a controlled setting. Often, people are asked to come to a laboratory to take part in economic experiments. These experimental subjects are usually randomly divided into at least two groups. When there is a statistically significant difference in the measured variable, this difference can be attributed to the difference between the treatment groups of the experiment. Experiments therefore have the advantage that there is a certain control of the environment.

However, the scope of experiments is limited. There are often research questions that cannot be addressed through studies in a controlled environment. For example, if we want to explain the conduct of states or societal phenomena, it is not possible to observe these in a laboratory setting. For this reason, econometrics has the reverse approach. It does not try to generate data in a controlled laboratory setting. Instead, it relies on field data. The advantage is obvious: Econometric studies usually have a higher external validity than experimental ones. However, this advantage comes at a significant price: We have to be aware of the danger that the observed effects depend on unobserved and often even unobservable variables, whose effect cannot be filtered out as in the controlled setting of an experiment. The best approach thus always depends on the research question. This will be explained in more detail in Chapter 7 of this book, which deals with empirical methods.

²² See, e.g., Giuliana Palumbo and Enrico Sette, *Career Concerns and Excessive Signaling in Courts* (Working Paper, Bank of Italy, 2009).

FURTHER READING

- BECKER, GARY S., THE ECONOMICS OF DISCRIMINATION (Chicago: University of Chicago Press 1957).
- Becker, Gary S., Crime and Punishment: An Economic Approach, 76 J. POL. ECON. 169 (1968).
- CALABRESI, GUIDO, THE COSTS OF ACCIDENT LAW (New Haven: Yale University Press 1970).
- Coase, Ronald H., The Nature of the Firm, 4 ECONOMICA 386-405 (1937).
- Coase, Ronald H., *The Problem of Social Cost*, 3 JOURNAL OF LAW AND ECONOMICS 1–44 (1960).
- Dworkin, Ronald, Why Efficiency?, 8 HOFSTRA L. REV. 563-90 (1980).
- Grechenig, Kristoffel and Martin Gelter, *The Transatlantic Divergence in Legal Thought: American Law and Economics vs. German Doctrinalism*, 31 HASTINGS INT'L AND COMP. L. REV. 295–360 (2008).
- Harsanyi, John C., Cardinal Utility in Welfare Economics and in the Theory of Risk Taking, 61 J. POL. ECON. 434–5 (1953).
- KLINK, BART VAN AND SANNE TAEKEMA (eds), LAW AND METHOD: INTERDISCIPLINARY RESEARCH INTO LAW (Tübingen: Mohr Siebeck 2011).
- Kornhauser, Lewis, A Guide to the Perplexed Claims of Efficiency in the Law, 8 HOFSTRA L. REV. 591–639 (1980).
- Petersen, Niels, Avoiding the Common Wisdom Fallacy: The Role of Social Sciences in Constitutional Adjudication, 11 INT'L J. CONST. L. 294–318 (2013).
- POSNER, RICHARD A., ECONOMIC ANALYSIS OF LAW (9 ed., New York: Aspen Publishers 2014).
- Towfigh, Emanuel V., *Empirical Arguments in Public Law Doctrine: Should Empirical Legal Studies Make a 'Doctrinal Turn'?*, 12 INT'L J. CONST. L. 670–91 (2014).
- TYLER, TOM R., WHY PEOPLE OBEY THE LAW (2 ed., Princeton: Princeton University Press 1990).

2. The economic paradigm Emanuel V. Towfigh

I. THEORETICAL ASSUMPTIONS

The discipline of economics nowadays is not so much characterized by its object of investigation, but rather by its methodological approach. This approach is shaped by a number of ideas, concepts, and assumptions that underlie most aspects of economic thought and that are also the basis of the economic analysis of the law. We refer to this perspective as the 'economic paradigm'. The economic paradigm encompasses a number of overarching ideas. First, from a methodological perspective, economists generally focus their study on individual behavior rather than, for example, on 'systems' (that may consist of individuals but where individual behavior is not the main descriptor) or 'neuro-cognitive mechanisms' (the processes that drive individual behavior): this is called *methodological individual*ism. Moreover, economists assume that resources are scarce, which is why individuals face choice problems. How do people solve these choice problems? In line with methodological individualism and the scarcity assumption, economists have developed the behavioral model of the homo economicus: The idea is that individual actors behave rationally in that they choose decisions that maximize their individual utility. This model of homo economicus has been criticized with various valid arguments; however, in the absence of an equally conclusive alternative behavioral model, it is still the prevalent concept in economics, and therefore also in the economic analysis of law.

A. Methodological Individualism

The first of the constituting ideas of the economic paradigm is methodological individualism. This means that economists only consider the actions of individuals in their scholarly endeavors. Collective decisions – say of states or corporations – thus, from this angle, do not follow from a logic of some sort of autonomous 'collective will', but can rather be traced back to and explained by the interaction of individual decision-makers.¹ However, even under the postulation of methodological individualism, economic theory does not purport to explain or predict individual behavior in the sense that it would claim to explain or predict the behavior of each and every specific individual decisionmaker. It rather focuses on *patterns of behavior* that can be observed when the behavior of many individuals is considered *in aggregate*. In other words, methodological individualism leads us to see patterns of human behavior that emerge if we look at the 'average' behavior of a large number of subjects confronted with the same situation: Economics looks at types of 'normatized' behavior (see Chapter 1, section III when we talk about Melissa). As lawyers, we are familiar with such an approach, for example when we analyze the consequences of a court decision not only with a view to the specific case decided, but regarding the class of (in legal terms) similar cases, allowing us to make statements about the broader influence of that decision on the development of the law.

B. Scarcity of Resources

Economics can be interpreted as a research program dedicated to the study of choice problems under scarcity of resources. If our resources for acquiring goods are limited, we have to choose between goods, and economics both tries to explain decisions in these terms and aims to help make 'good' decisions.

In the economic paradigm, the idea of scarcity becomes relevant when putting our wants and needs in relation to the means we have to satisfy them: While human needs are boundless *in principle*, the means to satisfy them are limited *in principle*. The relevant desires need not be limited to material commodities; they can also be intangible in nature: Security, knowledge, or even a legal order can be 'scarce' in the economic sense of the word. Because of the scarcity of resources, *choice* is an essential moment of human decision-making. The economic problem of scarcity

¹ It is important to distinguish *methodological* and *normative* individualism (for a definition of normative theory, see Chapter 1, section II above): While the former merely describes a methodological perspective, the latter claims that this is the way we should see and interpret the world, and how we should actually behave; the individual decision determined by one's self-interest would thus be the only acceptable normative currency. There are many reasons to be critical of normative individualism, which is why it has never become mainstream in economic thought (even though critics of the behavioral model of homo economicus have at times suggested so). Moreover, the economic paradigm does not require this assumption.

can thus be translated into a *decision problem*. The individual making such a choice is guided by her *preferences* and limited by *restrictions*.

1. Preferences

The inner motives of the decision-maker are called 'preferences'. They are independent of actually viable opportunities for action. Let us look at a concrete example from everyday life: Someone may prefer chocolateflavored ice cream to vanilla-flavored ice cream, and vanilla to strawberry:

chocolate	>	vanilla
vanilla	>	strawberry

These options may be ordered *transitively*, such that

chocolate > strawberry

follows from the two relations. Then, we can create an *ordinal ranking* of these options, that is, order them in a fixed sequence:

- 1. chocolate
- 2. vanilla
- 3. strawberry

The ordinal ranking does not permit statements about the 'distance' between options, nor about a quantifiable 'value' of each of the options. So the decision-maker cannot say he likes chocolate 'twice as much as' vanilla. However, he may be *indifferent* between two options, that is, he may enjoy two flavors equally. Moreover, we assume that every decision-maker can voice a preference for each of the flavors, that is, his preference order is *complete*.

Many economic models work with two further assumptions: First, they assume that we cannot conduct *interpersonal comparisons* – so, with a view to the example given above, the first decision-maker could not say she likes vanilla more than the second decision-maker likes chocolate. Second, economic models are usually based on the assumption that preferences are *constant* (at least for the time considered by the model). While preferences remain an important theoretical factor in the construction of choice problems (and, more specifically, for utility functions; see also section C.1), the assumption of preferences remaining constant shifts the focus away from the preferences, towards restrictions and incentives when trying to account for changes in behavior. From a law and economics perspective, this focus is especially sensible as there would not be much room for

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legal intervention if changes in behavior were only or even mostly due to changes in preferences.

2. Restrictions and incentives

Restrictions describe exogenous conditions that the decision-maker faces and that limit his action space. These limits are not only due to the scarcity of resources; they are also an effect of the behavior of other individuals or of institutional, informal, temporal, or informational constraints. Again, 'restriction' is a broad term that can encompass any good, material or intangible, that can be scarce (e.g., money, time, security). Every rise in cost aggravates scarcity and tightens the restriction; every decrease relaxes it (such loosening of restrictions is commonly referred to as an *incentive*). For example, we could establish a 'chocolate-flavor ice cream tax'; such a tax would work as a restriction on a limited student budget, as it tightens the scarcity problem of money with regard to chocolate-flavor ice cream (without actually limiting the available monetary budget). A reduction of the price for strawberry-flavored ice cream, on the contrary, may increase the incentive to choose this flavor. Restrictions and incentives can thus raise or reduce the price of a choice for a decision-maker. In the same way, law, customs, and traditions can also be considered restrictions in the economic sense of the word (such as our ice cream tax). Criminal law is an obvious legal example for the increase of costs connected with specific (penalized) decisions.

Under the economic paradigm, only restrictions are variable while, as mentioned, preferences are invariant. This is because restrictions that follow from rules (or, to use the economic term, institutions) are easier to determine and to modify. If economists think about influencing human behavior, they habitually consider modifying restrictions and incentives, not preferences; and when they attempt to explain changes in behavior that can be observed in the world, they generally look for a change in restrictions. So if one can observe a reduced consumption of ice cream in a population, the economist will watch out for a raise in costs (be it monetary or, say, due to new information on health risks); but she will not ask whether the preference order of the consumers has changed.

C. The Behavioral Model of the Homo Economicus

The behavioral model of the homo economicus that is at the heart of the economic paradigm is, in turn, based on two assumptions. First, decision-makers are considered to evaluate the choice options with view to their utility (*utility theorem*); second, individuals will always choose the option that promises greater utility to them (*rationality assumption*).

1. Utility theorem

In economic theory, we assume that decision-makers calculate the 'utility' following from each of the different options presented to them when assessing the value of the options. In popular science, 'utility' is often equated with the big word 'happiness'. While it is debatable whether this translation is philosophically adequate, it does show that in principle any kind or currency of utility (monetary, temporal, emotional, in taste) can be considered when calculating the utility of a decision. Some law and economics scholars have claimed that only such utility should be considered that can be expressed in *pecuniary* currency (cash is king!), because this would allow (at least some rough) interpersonal comparisons;² however, this view never became prevalent, mostly because it seems implausible to limit the motives of decision-makers – and the explanatory power of economic scholarship – to money maximization.

If we allow for utility to be composed of a variety of motives, then a decision guided by one's self-interest does not need to be to the detriment of others. Indeed, self-interest could actually also find expression in *altruistic behavior* if such altruistic behavior is of high ethical value to a decision-maker and therefore increases the individual utility he draws from a certain action. Therefore, the evaluation of alternatives for action according to the expected utility connected with each choice does not carry a moral dimension, but only reflects the neutral supposition that people act upon their preferences and independently evaluate what in this sense is 'good' for them (or 'makes them happy').

The *utility theorem* expresses the assumption that every decision-maker has a subjective, 'inner' *utility function* which assigns a distinct value to every possible choice. As utility does not have to be monetary, the payoff generated by a decision is not limited to a pecuniary currency, but can differ by decision-maker and might even be expressed in multiple currencies simultaneously. When concerned with individuals, economic theory usually assumes that the utility can be expressed as a *willingness to pay* (see Chapter 3, section II.D.5): If I am willing to pay \$10 for a large bowl of ice cream, then this reflects the utility that I draw from eating (or having) that large bowl of ice cream. When analyzing the behavior of firms, economists equate the utility to corporate profit. The utility function can be expressed in formal mathematical terms. The ability to denote the utility function (and the optimization task that comes with it; see below) in precise terms for the necessities of economic analysis should not fool us to believe that

² See the 'early' Posner, for example Richard A. Posner, *Utilitarianism, Economics, and Legal Theory*, 8 J. LEGAL STUD. 103 (1979).

this kind of calculation is the (cognitive) mechanism that yields human behavior, or that human behavior is fully determined – we are totally unaware of and cannot even express in vague terms our own individual utility function! So again, the utility function is a fiction, a supposition; and as this hypothesis is workable and delivers pretty good results, we pretend this is the way humans arrive at their decisions (*'as-if assumption'*).

In economic models, moreover, we usually assume that – everything else equal (ceteris paribus) – an additional unit of a good adds utility: Two scoops of ice cream are better than one. We call this *positive marginal* utility, and we assume that it is independent of the number of units of the good we already possess. That means we ignore the possibility of negative marginal utility, for example that 11 scoops of ice cream might evoke a feeling of sickness (after all, we could sell the eleventh scoop instead of consuming it ourselves). However, even if we do not face disutility from an additional unit of a given good, the utility of goods may depend on the amount of goods. The utility drawn from the first scoop of ice cream is largest, and while the second and third scoop still add utility, the value added is lower. And it makes a huge difference whether I earn \$1,000 a month or \$2,000, while the same difference may seem insignificant if I earn \$1,001,000 or \$1,002,000 in the same period. Therefore, most economic models assume a positive but *decreasing marginal utility*, which means that the additional utility of an additional unit continuously declines.

Now there may be uncertainty as to whether it will actually be possible to realize the payoff. The utility of chocolate ice cream only materializes if it tastes good – a property that we cannot necessarily determine only by looking at it. In these cases, we can resort to what economists call *expected payoff*: We multiply the utility with the probability of its realization. If I can win \$2 with a 50 percent probability in a coin-flipping game, then the expected utility of that game is \$1.

The concept of expected utility has an additional practical advantage: Even with ordinal preference rankings, we can make statements about the



Quantity of consumed ice cream

Figure 2.1 Decreasing marginal utility

distance between the ranked options. Turning once again to our ice cream example, we can ask a decision-maker whether she prefers to get a scoop of vanilla-flavor ice cream with certainty (i.e., a probability of 100 percent), which she ranked second, or whether she would prefer instead to get chocolate (her first-ranked choice) with a probability of 50 percent and strawberry (her third-ranked choice) with the remaining 50 percent probability. Modifying this *lottery* by changing the probabilities allows one to make visible the *trade-offs* between middle, best, and worst payoffs.

The curvature of the utility function (i.e., the nature of the marginal utility), together with the lotteries mentioned, also allows us to consider *risk preferences* in our behavioral model. Consider the choice between a gamble to receive \$100 or \$0 with each 50 percent probability, on the one hand – or a 'safe bet' that would pay \$50 with certainty (100 percent probability), on the other: *Risk-neutral* individuals would be indifferent between the two options, as they promise equal expected utility; their utility function is *linear*. Individuals choosing the safe bet can be described as *risk-averse*; they have a decreasing marginal utility and thus their utility function is *concave* (see Figure 2.1 above). Finally, individuals who choose the gamble can be considered *risk-seeking*: they have an increasing marginal utility, their utility function is *convex*. Most economic models operate with some sort of risk aversion.

2. Rationality assumption

As we can phrase the individual utility function in formal, mathematical terms, we can also express decision problems as analytical *optimization tasks*. The option that yields the highest utility shall be chosen, or to say it in the language of mathematics: for each given decision task, we look for the maximum of the utility function. The *rationality assumption*, the keystone of the economic paradigm, enunciates the expectation of the behavioral model that decision-makers act *rationally* in the sense that they invariably choose the option that yields the highest utility.

To be able to act rationally in this strict sense, the individual decisionmaker needs to react to changes in the environment: Then, on the one hand, the decision depends on the (constant) preferences of the decisionmaker which are, on the other hand, confronted with the (variable) restrictions in the world around her; she evaluates this situation with her individual utility function. This as-if model of human behavior presupposes that the decision-maker disposes of all relevant information regarding all possible choices and their utility, that is, that in these basic models we assume *complete information*. However, as complete information is rare in the untidy world we face when making decisions day by day, we rather typically face *risk* and *uncertainty*. More recent models of human behavior therefore avoid this assumption (see Chapter 4). But relaxing this assumption comes at a cost: The 'rationality' of a decision may no longer be measured 'objectively' for any given situation, but only from the perspective of the decision-maker, accounting, for example, for his individual risk profile.

The rationality assumption faces some skepticism, especially as a number of empirical studies have shown that decision-makers, in certain types of situations, do not act rationally in economic terms (see below, section D. Limits of the Model). We will deal with these patterns of nonrational behavior in depth in Chapter 8 (Behavioral Law and Economics). Yet, the rationality assumption is warranted as long as we consider that more nuanced refinements are required under certain circumstances, especially as the economic paradigm, as it is interpreted nowadays, gives leeway to departures from strict rationality and submits the resulting 'anomalies' to an independent line of methodologically strict research.

The economic paradigm as described here is therefore the building block of *economic decision theory* (also known as Rational Choice Theory) with its specific applications (e.g., in Micro-Economics or in New Political Economy) and its expansions (e.g., from Decision Theory to Game Theory or to Behavioral Economics), all of which will be described in greater detail in the next chapters of this book.

D. Limits of the Model

One of the powerful feats of the economic paradigm is that its positive theory actually allows one to derive *empirically testable hypotheses*. So do people actually behave in the way the economic model of human behavior predicts?

1. Empirical challenges

On the one hand, empirical and especially experimental studies have shown that in certain situations – for example, on *markets* or in *auctions*, basically in every highly competitive environment – the average behavior of those subjects observed was indeed well predicted by the homo economicus model. That does not mean that every individual behaves in the way the theory predicts, but you do not observe systematic deviations: In simplified terms, the empirically observed derivations from the theoretic predictions cancel each other out, and thus theory predicts average behavior fairly adequately.

On the other hand, psychologists in particular have conducted a host of experiments that helped establish the insight that in many contexts people's behavior systematically deviates from the theoretic predictions.

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We will look at these deviations in greater detail in Chapter 8, but to give you a sense, let us briefly consider two exemplary findings:

- In the *ultimatum game*,³ where a player can decide which share of an endowment he and another player get, pending the acceptance of the other player ('take it or leave it offer'), experimental subjects on the receiver side consistently reject the offer if it is small, even in cases when theory would predict they would content themselves with such a sum (thus indicating a preference for non-strategic punishment); and, like a mirror image, those players sending the offer propose to give away a much higher share than classical rational choice would predict (probably because they anticipate the non-rational preferences of the receivers).
- In *framing experiments* (see Chapter 8, section III.B.2.(d)) it was shown that the mere description of a situation a factor that should be irrelevant according to standard economic theory fundamentally changes the behavior of the participants: If it is called 'Community Game', people cooperate that is, they act less rationally, according to economic theory, but take home more money than if everyone had acted rationally; call it 'Wall Street Game' to see cooperation break down and selfishness prevail people then act more in line with the predictions of economic theory, that is, they behave more rationally, but they earn less money.⁴

2. Biases and non-rational behavior

The empirically observable deviations from rational choice have been coined 'biases'; some people speak of 'irrational behavior'. To some extent, this qualification is justified because human decision-making does at times suffer from typical and systematic mistakes. Cognitive psychologists and neuroscientists have often been able to connect such mistakes to those parts of the cognitive apparatus that are concerned with perception. So, similar to the way our brain is bound to make mistakes of which visual tricks and optical illusions take advantage, we also make certain types of mistakes when taking decisions.

Still, one should be careful to decry as 'irrational' such behavior that is not in line with rational choice predictions. If you consider the empirical

³ Werner Güth, Rolf Schmittberger and Bernd Schwarze, 3 J. ECON. BEHAV. ORGAN. 367 *et seq.* (1982).

⁴ Varda Liberman, Steven M. Samuels and Lee Ross, *The Name of the Game: Predictive Power of Reputations versus Situational Labels in Determining Prisoner's Dilemma Game Moves*, 30 PERSONAL. & SOC. PSYCHOL. BULL. 1175 (2004).

results of ultimatum game experiments, fairness (or distributive) considerations might play an important role: Maybe we are *inequity-averse*, and a fair distribution of money that randomly fell into our lap seems like a better solution. Or we sense that not offering the other player enough money might make him decline the offer, which would make us worse off, too. If, from an endowment of \$20, somebody offered you a dime and kept \$19.90 for himself - would it not be 'worth the fun' to decline the dime just to destroy his income? Or would 'punishing' him that way lest he make other such offers in future be 'wrong' (even if we presume we will never again meet *that* particular person)? And consider the 'name of the game' situation: If people who refuse to behave in the selfish-rational way prescribed by economic theory earn more money than the rational players, can we say that they behave irrationally in the common sense of the word? A more appropriate term to qualify behavior that cannot be explained by Rational Choice Theory and that alludes to the underlying economic model might therefore be 'non-rational' behavior.

3. Relaxing the assumptions: The behavioral turn

Now what do we make of all this? Should we abandon the economic paradigm? Should we modify it? Should we ignore the empirical insights and stick to the model? The obvious consequence is that we need to be cognizant of the limits and always consider the importance of context (ecologi*cal validity*) in both our theoretical and empirical endeavors – especially as lawyers. Other consequences are less evident, or have problems themselves. It seems inopportune to abandon the conclusive and parsimonious model of homo economicus altogether in the absence of any theory that is better suited to explain human behavior and allows us to create testable hypotheses. We can enrich the model with important additional parameters such as risk preferences or the degree of inequity aversion. But we have to be very diffident with such additions: If we observe that people drink strong coffee every morning before work, and if we therefore insert a need for strong coffee every morning before work into the utility function our theory relies on, then the empirical observation that we have a strong coffee every morning before work is pointless. Moreover, the more variables we consider (the more 'degrees of freedom' we permit), the more probable it becomes statistically to make a right prediction with a wrong theory: that is how the Ptolemaic geocentric model got so much right.

To implement the insights from psychology and, more generally, empirics, economics took a 'behavioral turn'. Today, a branch of (Law and) Economics, *Behavioral (Law and) Economics*, busies itself with the critical inquiries to the classical economic model of behavior. Many modest relaxations of the assumptions of traditional theory are tested, and countless experiments try to shed some light on the mechanisms underlying the systematic deviations from theoretical predictions, in the hope of discovering robust behavioral patterns that can lead us to a more sophisticated theory of human behavior. The psychologically informed behavioral approach is characterized – and distinguished from the traditional economic model of rationality - by modifications to theory following from what has been identified as the 'three bounds': bounded self-interest, bounded rationality, and bounded willpower (see Chapter 8, section III). However, to date Behavioral Economics still has the status of a 'microtheory'; it cannot provide a conclusive general model of behavior, but is always limited to situational statements. This is innocuous where we have intimate knowledge of the context and of ecological parameters that may influence decision-makers; but where we are not aware of the specifics of a situation, a general theory of behavior remains a necessity. This understanding is why classical and behavioral approaches to economics coexist harmoniously today.

II. WELFARE ANALYSIS AND EFFICIENCY

Even if the methodological point of departure of economic research is to be seen in the individual's behavior, the main interest of economists lies in describing and explaining social phenomena and in solving societal problems, and economists often do not content themselves with empirical stocktaking. In fact, there is an important line of economic thinking that takes a normative route, in that it tries to design institutions in such a way that the common weal is promoted. The development of adequate measures is the subject of Welfare Economics. Welfare economists ask in which way increases of collective welfare or, if possible, social optima can be reached (based on, but transcending individual utility). Their core concept is *efficiency*: The more efficiently a society is organized, the greater is its welfare. But what are appropriate measures of efficiency, and how can we evaluate economic policy or political systems in terms of efficiency?

The first step towards such an evaluation is *descriptive*. We need to try to understand, explain, and predict the effects of economic policies on an individual level. But the ultimate objective is normatively to evaluate the impact of the policy on overall social conditions. This is an intricate undertaking: Merely 'adding up' individual utility would require comparability of preferences of different individuals – but we saw that preferences are subjective and *incommensurable* (i.e., non-comparable). In early attempts to measure welfare, this problem was simply ignored, which allowed interpersonal comparisons of utility. For the reasons discussed above,
this assumption could not be sustained. To deal with incommensurable utilities, economists resorted first to the *Pareto criterion*, and later to the *Kaldor/Hicks concept*, both of which avoid the problem of subjective preferences and at the same time can be considered a scientifically objective basis for Welfare Economics. Today, as is shown in Chapter 3, economists usually work with continuous, intrapersonal and interval-scaled utility functions based on preferences for goods.

From the point of view of legal scholarship, it is important to note that these efficiency criteria are widely agnostic of the imaginable different ways of allocating goods to individuals. The objective that is of paramount importance to many lawyers – a 'fair' distribution of goods – is irrelevant for many economists, as long as the different mechanisms of distribution that are considered do not affect the efficiency of allocation.

A. Pareto Efficiency

The efficiency concept by Vilfredo Pareto⁵ relies on the principles of the *sovereignty of consumers, non-paternalism*, and *unanimity*. Subjective preferences of individuals are regarded as being autonomous and are as such respected without differentiating between 'good' or 'bad' preferences (sovereignty). The only utility relevant to society is the individual's utility; the state is non-autotelic (i.e., not an end in itself), which rules out any kind of state paternalism. Unanimity means that any change of the allocation of goods requires the consent of everyone affected so that each individual has the right of veto – but this right is only exercised when the individual is worse off, not in cases of indifference (and individuals are considered 'honest', for the sake of the argument). To determine whether an individual is better or worse off because of the measure (or indifferent), she consults her inner utility function – that is, she herself is the standard, not an external social planner.

Against this backdrop, the Pareto criterion postulates that a given situation A is better than an alternative situation B if after comparison of the subjective individual preferences at least one individual is better off in situation A, while no individual is worse off:

• When compared to another situation, a situation is considered *Pareto-superior* if the utility of *one* individual is increased, with *no other* individual facing a decrease in utility.

⁵ VILFREDO PARETO, MANUEL D'ÉCONOMIE POLITIQUE (Paris: V. Giard & E. Brière, 1909), Ch. VI, No. 33 and Appendice, No. 88, 89.

- If we can imagine a situation that would constitute a Pareto improvement vis-à-vis the current situation, then the current situation is *Pareto-inferior*.
- If we cannot imagine any Pareto improvements to the current situation, then this state is *Pareto-optimal*.

A Pareto-optimal state is always characterized by *efficient production*, *efficient consumption*, and an *efficient structure of production*. An efficient production requires a state in which the production of a given good cannot be increased without limiting the production of another good; efficient consumption is achieved if, without new production, further trade for mutual benefit is not possible; and an efficient structure of production is warranted when production and consumption are optimally aligned to each other.

The concept of Pareto efficiency can be criticized with a number of arguments. From a legal perspective, the most substantial critique goes to the heart of the very program of Welfare Economics: Pareto optimality does not consider the *initial distribution of goods* and may therefore give rise to fairness concerns. The ignorance vis-à-vis the initial state is all the more dissatisfying if the distribution of goods has been uneven in that first moment, because in these situations redistribution from the affluent to the less prosperous can never be achieved efficiently: It would always lead to the affluent being worse off, and thus to them exercising their veto. Thus, the Pareto concept actually *fosters the status quo ante*. This, however, is not helpful for measures of social policy, as there will hardly be a scheme that will privilege someone without being to the detriment of somebody else. As a mere market criterion, the Pareto concept is therefore of limited value for the economic analysis of the law.

B. Kaldor/Hicks Criterion

A concept developed by and named after Nicholas Kaldor and John R. Hicks⁶ claims to overcome the deficiencies of the Pareto criterion. Similar to the Pareto criterion, their *compensatory criterion* also considers individual utility to be the basis for evaluations of efficiency, but it does not require a positive stance or indifference by every individual vis-à-vis any given policy, as it allows for the benefits and the losses of a social choice to accrue to different individuals: A policy change is considered

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⁶ Nicholas Kaldor, *Welfare Propositions of Economics and Interpersonal Comparisons of Utility*, 49 ECON. J. 549 (1939) and John R. Hicks, *The Foundations of Welfare Economics*, 49 ECON. J. 696 (1939).

welfare-enhancing if the gains of the better-off individuals would be sufficient to *compensate the losses* of the worse-off individuals, and if at least one individual would be better off after compensation. The compensation does not actually need to be paid; it suffices if it were possible without the welfare increases of the winners being used up by the compensation. Most applications of *cost-benefit analysis* rely on this definition of efficiency.

The merely hypothetical compensation of the losers leads us to the main criticism of the Kaldor/Hicks criterion. The critics doubt that a state of the world can be preferable to another one if the losers are not *actually* redressed. Welfare economists reply by saying that their exercise is not concerned with the solution of problems of income distribution. Moreover, an actual compensation will be impracticable more often than not – the group of individuals that would need to be compensated is typically hard to identify; the expense of effectuating the compensation would lead to losses in efficiency and drastically reduce the welfare enhancement. But the Kaldor/Hicks criterion faces another, even more serious, challenge. If we measure the allocation of gains and losses (and with it the necessary compensation) by the willingness to pay of the individuals concerned, then more affluent individuals are privileged: They are equipped with greater assets, and the decreasing marginal utility of their income allows them to pay a higher price. As a higher willingness to pay reflects a higher utility. according to the Kaldor/Hicks concept, the wealthier individuals will typically be the ones who would need to compensate the poorer – but this compensation is never consummated, so the wealth gets accumulated at the upper end of the prosperity scale and this mechanism is repeated with every measure. Finally, the valuation of the potential compensation also creates problems. As the compensation is not measured in utility, but in monetary terms, what we consider may not be societal welfare, but only a hypothetical willingness to pay. This is particularly problematic with intangible goods.

FURTHER READING

- Allingham, Michael, Choice Theory: A Very Short Introduction (Oxford: Oxford University Press 2002).
- BAIRD, DOUGLAS G., GAME THEORY AND THE LAW (6 ed., Cambridge, Mass.: Harvard University Press 2003).
- COOTER, ROBERT AND THOMAS ULEN, LAW AND ECONOMICS (6 ed., Boston: Addison-Wesley 2012).

HINDMOOR, ANDREW, RATIONAL CHOICE (Basingstoke: Palgrave Macmillan 2006).

POSNER, RICHARD A., ECONOMIC ANALYSIS OF LAW (9 ed., Austin: Wolters Kluwer 2014).

3. Demand, supply, and markets Alexander Morell

I. INTRODUCTION

This chapter covers the fundamentals of economics: demand, supply, and markets. In law, you can apply the concepts that are covered in this chapter to many different contexts. Think of a dispute in which neighbors want to prevent an airport from working at night. Imagine you were a policy-maker, judge, or government official having to decide the issue. In any case, you would want to use law as a means to resolve the dispute. The dispute is about scarce resources. You cannot have both quiet nights and planes flying at night. Any legal resolution of the dispute will allocate rights and thereby resources (nightly peace for neighbors or the opportunity to make money to the airport). You have seen in the economic paradigm (see Chapter 2, sections I.B and II) that economics deals with the allocation of scarce resources. Applying a standard of efficiency would recommend allocation of the right to determine whether the airport can work at night with the party that values it most. The section on demand will tell you how economists think about the value of goods – for instance. the value of quiet nights. You have been briefly introduced to the notion of utility and to the fact that it is decreasing at the margin (see Chapter 2, section I.C.1). Now you will learn how utility is constructed from tradeoffs and how demand is constructed from utility and how value in economic terms is inherently relative.

In the section on supply, you will see how it crucially rests on the concept of costs and how a business that produces a good or a service (airborne transportation at night, for instance), imposing costs on third parties (sleeping neighbors), can be a threat to efficient allocation. Here legal intervention can be required to let firms consider the full costs of their activity. Finally, the section on markets will explain how markets help trade off costs and benefits, how they determine the price of scarce goods, how they help allocate them efficiently – and when they fail. Taxes and a working liability regime may alleviate our worries about the airport's neighbors.

II. DEMAND

Economists mostly employ the notion of value in either of two senses. Either they speak of value, referring to value in exchange. This notion of value is synonymous with the notion of price. We shall deal with this meaning of value later in the section on markets. In this section, we treat 'value' in a slightly different sense. We ask how individuals value goods. Prices in this and the next section will be something we treat as given. The two meanings of value are connected in that the value of any good in exchange can only be as high as the extent to which people appreciate the good. The concept of valuation in economics is inherently relative. People can value things very differently. But relativism in economics goes further. There is no absolute measure for value. We will see that it is a misconception that money could objectively measure economic value. Economists measure a person's valuation of a good in the same person's valuation of other goods.

A. Valuation of Goods

The concept of demand rests on a theory of how people make choices in this world. The theory rests on the following assumptions.

1. Assumptions underlying a theory of rational choice

The first assumption of this theory is peoples' capacity to rank options in a systematic order. The theory demands that for a choice, for example, between a bottle of wine and a piece of cheese, you are able to say whether you prefer the wine over the cheese, the cheese over the wine, or whether you find the wine and the cheese equally attractive. This assumption is known as the assumption of completeness. It does not mean that at any given point in time you consciously know the complete ranking of all options one could possibly encounter. But it means that in principle you can build a rank order of that kind for any choice you encounter. The ranking of options people build goes by the name of 'utility' – higherranking options provide more utility to the individual than lower-ranking ones.

The second assumption of the theory of choice is that, if you say that you prefer the wine over the cheese and you say that you prefer the cheese over a bowl of crackers, one can correctly conclude that you prefer the wine over the crackers. This assumption, which is called the transitivity assumption, means that the rank order of options is internally consistent.

Given the first two assumptions, people with a limited budget can maximize their utility by choosing the highest-ranking options. It is assumed that, given the rank order of options, people would rather choose higherranking options than lower-ranking ones. People are assumed to follow this principle with perfection so that they always choose the highestranking attainable option.

The third rather technical element of the theory of rational choice is continuity. If you prefer a bottle of wine over a piece of cheese, you also prefer anything sufficiently close to a bottle of wine (say, a tiny bit more or less wine) to a piece of cheese. This assumption merely means that small changes in options do not lead to huge changes in the rank order. The purpose of this assumption is to allow the expression of utility in mathematical functions and ultimately the application of mathematical methods of maximization to utility.

It is important to keep in mind that any of these rankings order options by utility for one particular individual. Using probabilities, von Neumann and Morgenstern managed to say something about how far options are apart on the scale of utility (see Chapter 2, section I.C.1). But any comparison of utilities across individuals is inherently meaningless. While I may be able to say that I like a bottle of wine twice as much as a piece of cheese, I cannot say that I like a bottle of wine twice as much as you do.

Furthermore, the world is complex. To say anything reasonable, we have to focus. For this purpose, economists use the *ceteris paribus* assumption. By this assumption, all things but those expressly varied remain unchanged. So you may like the wine more than the cheese, but you like the chat with the person selling the cheese. For this reason, you end up preferring to buy cheese. An economist would take the liberty to assess the utility of the groceries separately by assuming that your feelings about chatting with the seller remain unchanged no matter what groceries you buy. So every time we say that you trade off cheese for wine, you may think of a choice between two bundles of goods: everything you have and a bottle of wine versus everything you have and a piece of cheese.

Finally, economists generally assume that more is better. 'Goods' are things that increase utility in principle. This assumption is obviously questionable if you think of wine (hangover!), but it simplifies things enormously within the realm of reasonable quantities of consumption.

2. Indifference curves: Measuring a good's value in another good

These few assumptions suffice to make some progress in formalizing the notion of relative value. Assume you have a certain endowment in wine and cheese. Then think: If you had to give up half a bottle of wine, how much cheese would you need in addition to be as happy as you were with your original endowment? The amount of cheese you need gives



Figure 3.1 Indifference curves

you the value of that half bottle of wine you gave up expressed in cheese. Economists have formalized this way of thinking in graphs they call 'indifference curves' (see Figure 3.1). Each indifference curve depicts all combinations of wine and cheese (or any other goods) that give a given person the same amount of utility.

So, for the preferences depicted by the indifference curve, an individual with four glasses of wine and two pieces of cheese (point B) would be just as happy as before if he or she gave up three glasses of wine for four pieces of cheese (point C). The slope of a line between the two points on the curve represents the 'exchange rate' of wine into cheese, which we call *rate of substitution*. If we imagine that both goods can be split into very small units that can be exchanged, we see that the slope of the curve in a given point (see, e.g., the line tangent in B) represents the rate of substitution for an arbitrarily small quantity is called the *marginal rate of substitution*.

Looking at the curve, you see that the marginal rate of substitution (i.e., the slope of the curve) is changing (compare the tangent in B and in C). The indifference curve starts falling steeply and then gets flatter and flatter. This is with good reason: normally we like having a bit of many things more than we like having a lot of one thing. This is expressed by the curvature. Wine with cheese is much better than only cheese or only wine. So once the individual only has wine (point A), but no cheese, she is willing to give up a lot of wine for very little cheese. And on the other end of the curve (point D), the individual has only cheese and is thus ready to give up a lot of cheese to obtain a little wine. In the middle of the curve, the individual holds a healthy combination of wine and cheese and therefore



Figure 3.2 Perfect substitutes

Figure 3.3 Perfect complements

trades wine for cheese in relatively equal quantities. What is true for wine and cheese is true for many goods. Nobody can live on either bread or water. You may prefer to live in a city with both a cinema and a concert hall because going to concerts on some nights and to the cinema on others is more entertaining than being bound to go always to the cinema or always to concerts.

We can imagine different relationships of substitution between two goods. Goods can be substitutes or complements. If goods are *perfect substitutes*, this means you do not care whether you have one or the other because either good fulfills your needs. As they are perfect, perfect substitutes are rare in reality. Sugar and sweetener come close. Also, many people would treat different varietals of white wine as substitutes, say, Pinot blanc and Chardonnay. Indifference curves for perfect substitutes are therefore straight. The marginal rate of substitution is constant all along the indifference curve. No matter what your endowment in sugar and sweetener is, you are always willing to give up a spoon of sugar for a corresponding dose of sweetener (see Figure 3.2).

Goods can also be *perfect complements*. That means you can only make use of one good in the case where you have the other. The standard example is right shoes and left shoes. If you have a spare left shoe, you are ready to give it up for nothing because without a fitting right shoe it is of no value to you. The indifference curves for perfect complements look like those in Figure 3.3. The relation between most goods lies between these two extremes. Take wine and cheese. On the one hand, you like to combine the two. On the other, you are always ready to compensate a loss in one with a gain in the other.

3. The assumptions and the indifference curves

You can relate the indifference curves to the assumptions stated above. We assumed that *more is better*. Consider an individual's endowment represented by a given point on the individual's indifference curve. Now imagine the individual gets something more without being forced to give up anything in return. You see that her utility increases. That means she does not move along the indifference curve she started out from. But she moves on to a different indifference curve northeast of the original curve representing a higher utility level. So in the diagram, we can imagine an infinite amount of indifference curves representing all the different levels of utility the represented individual may experience (see Figure 3.4). The further one moves out northeast, the higher the level of utility. This is how indifference curves represent that more is better.









We also assumed *completeness*: The indifference curves, in principle, can represent a ranking of all options the individual may face. We saw how it ranks different bundles of good A and good B. The individual prefers any bundle on a higher indifference curve to the one she holds. She is indifferent between the one she holds and any bundle on her indifference curve. And she prefers the bundle she holds to any bundle on any lower indifference curve. Although we have so far confined ourselves to indifference curves of merely two goods, we could extend the number of goods by adding dimensions. We could draw a three-dimensional diagram on three goods, and mathematics gives us the tools to work with multidimensional indifference curves on a multitude of goods, if we desire. So indifference curves are flexible enough to represent a complete preference system. But in fact to picture tradeoffs between the consumption of one particular good and all other possible consumptions in a multitude of goods, we can also rest in two dimensions. We can look at the good of interest plus a second good representing all possible consumption. This second good is called money. When we spend money for the good that is of interest to us, the amount of money we pay represents (close to) all consumption opportunities we forego by putting our resources into this particular good. So if we replace wine by money, our two-dimensional diagrams are actually pretty general.

We also assumed *transitivity*, that is, internal consistence of preferences. This assumption is represented by the fact that indifference curves cannot intersect. We said that all points on an indifference curve represent the same level of utility. The fact that the point where the indifference curves intersect lies on both indifference curves indicates that both indifference curves represent the same level of utility. We also said that the further northeast an indifference curve lies, the greater is the level of utility it represents. If you look at the left side of the intersection in Figure 3.5, you see that one indifference curve has to represent a higher level of utility. But this contradicts the first statement that both indifference curves represent the same level of utility. So the preferences represented by intersecting indifference curves are inconsistent and thus excluded by the assumption of transitivity.

Finally, the fact that there is always enough room for another indifference curve between two indifference curves reflects the assumption of *continuity*.

B. Maximizing Utility

The theory of choice underlying the concept of demand says that agents maximize their utility by the choices they make. So imagine you plan a quiet evening with wine and cheese for yourself. You have set aside two bottles of wine for that purpose, but you forgot to buy cheese. So you can offer one of your neighbors wine in return for cheese to save your evening. You know that in your neighborhood of gourmets your wine trades for four pieces of cheese a bottle.

So how much wine are you going to trade in for cheese? A diagram can help. The fact that you have two bottles of wine and we know the exchange rate in your neighborhood will identify which bundles are actually attainable for you and which are out of reach. You can either keep the two bottles and have no cheese. Or you could give both away for eight pieces of cheese, or else you can do anything in between. This way of thinking gives



Figure 3.6 Maximizing utility under a budget constraint

you a straight line between the two bundles 'two bottles of wine and no cheese' and 'eight pieces of cheese and no wine'. This line is called a budget line or *budget constraint*. You can reach every bundle southwest of or right on the budget constraint. And all bundles above it are beyond your reach.

You will not pick an allocation below the budget line because any allocation below the budget line means you leave 'money' on the table. You will pick an allocation right on it. But which one will maximize your utility? For this we have to consult the indifference curves. You want to attain the highest level of utility. Therefore you want to be on the indifference curve furthest out northeast in the diagram. So you pick the point where the budget line is just tangent to the highest possible indifference curve (see Figure 3.6).

In a more formal way of saying things, you pick the point where your personal marginal rate of substitution of wine into cheese (the slope of the indifference curve at a given point) is just equal to the price of cheese expressed in wine in your neighborhood (the slope of the budget line). You can also say that you keep buying cheese for wine until your marginal utility of cheese measured in wine is just equal to the price of cheese in wine. Or you can say you will keep trading wine into cheese as long as the next unit of cheese you acquire gives you more utility than the extra quantity of wine you give up for it. You stop as soon as the next unit of wine gives you just as much utility as the extra quantity of cheese you get for it.

C. Changes in Price

You may have heard that if the price goes down demand goes up. This is the *law of demand*. In the diagram a change in price is represented by



Figure 3.7 Changes in price

Figure 3.8 Substitution and income effect

a change in the slope of the budget constraint (see Figure 3.7). Imagine in the cheese and wine example that the 'price' of cheese has fallen. You will be able to exchange a bottle of wine for up to six instead of only four pieces of cheese. Then you know you can have either two bottles of wine or 12 pieces of cheese or any allocation between that. Due to the price change, the budget constraint gets flatter. But what will the price change do to your consumption? Surely you will get more cheese because now it is cheaper. This effect is called *substitution effect*. But the decrease in the price of cheese also makes you richer. It pushes out the budget constraint. So because you do not have to pay so much to acquire an adequate amount of cheese, you may also keep more wine. This effect is called the income effect. Graphically we can separate the two effects. We take the diagram you know. We push out the budget constraint by four pieces of cheese on the horizontal axis to represent the fact that the decrease in price now allows you to trade your wine for up to 12 pieces of cheese. Then we walk along the indifference curve from which we started until we find the point at which it has the slope of the new budget constraint. The increase in the purchase of cheese (and the decrease in wine kept) is due to the substitution effect. This is the move from the dashed circle to the solid hollow circle in Figure 3.8. Then you go out northeast to the indifference curve just tangent to the budget constraint. This move represents the increase in utility which the decrease in price gave you. The increase in consumption of both wine and cheese that comes with this move represents the income effect. This is the move from the solid hollow circle to the filled circle in Figure 3.8. Performing the same steps in backward order gives you the logic of an increase in price.

D. Demand Functions

The demand function tells us how consumption of one good reacts to the price of that good if we keep all other things constant.

1. Demand curves of individuals

We can derive the changes in consumption of a particular good from a plot of indifference curves like we just have when investigating what happens to consumption if relative prices change. Then we can plot a function giving us an amount of consumption for each possible price of the good. Convention demands to have prices on the vertical axis and quantities on the horizontal axis. If prices are high, demand is low. If prices are low, demand is high. So the demand curve is falling, representing the law of demand. Normally we express prices in money because money represents all tradeoffs the person may face. But here we take the liberty to express the price of pieces of cheese in units of wine – just to remind you that money is not necessary for the theory of choice and that money represents tradeoffs just like the one between wine and cheese.



Figure 3.9 Individual demand



2. Aggregate demand curves

Extending these demand functions to many individuals conceptually is an easy exercise: We sum up all the quantities all the individuals buy at a given price and thus derive a new demand curve telling us how much a group of people consumes at a certain price. Take the individual demand in Figure 3.9 and imagine there were two individuals whose demand could be represented by that function. Now create an aggregate demand function of the two. At a price of ¹/₄, both individuals consume four units. So on aggregate they consume eight. At a price of ¹/₆, both individuals consume five units so on aggregate they consume ten. And if the price drops to zero, both individuals consume seven units, so at this price aggregate demand is 14 units. Now draw a new line through these points and you derive the aggregate demand function for the two individuals in Figure 3.10.

3. Demand elasticity

Before we can turn to supply, we have to look at two more properties of demand functions. The first is the slope of the demand function. If a demand function falls steeply, this means that the quantity demanded does not change much when prices change. To see this, imagine a vertical demand function: no matter what the price is, the consumer always consumes the same quantity. We say that if demand does not react to changes in price very easily, demand is 'inelastic' (Figure 3.11). Accordingly, demand that reacts to changes in price very easily looks flat and is labeled 'elastic' (Figure 3.12).







4. Working with the demand curve

The two most important ways to use the demand curve as a tool for analyzing real-world phenomena are moves along the fixed demand curve and moves of the demand curve itself. When analyzing the world with the help of the demand curves, we translate real-world phenomena into either a move along the demand curve or into a move of the demand curve. Moves along the demand curve basically represent changes in price. They usually consist in an application of the law of demand. If the price rises, consumers demand less. If the price falls, consumers demand more.

Moves of the demand curve mean that the good in question is valued

more or less by consumers. The typical reason for shifts of the demand curve is a change in the individuals' budget. If an individual has more wine to trade for cheese, she is willing to pay more wine for the same amount of cheese. This shifts demand upwards. Another example of a shift of the demand curve is represented by Figure 3.10. Here the shift of the demand curve is not due to a change in the individual's budget, but to a second individual entering the economy. Now if the price of cheese is ¹/₆, total demand is not five pieces anymore, but ten.

5. Consumer surplus

From demand curves, we can also derive one measure of how well-off consumers are. (Now we will finally use money to express price.) Think of an individual's demand function first. So far, we read it as saying how much an individual will buy at what price; for instance, if the price is high, the individual buys only one good. But that also tells us that the individual valued the first unit of the good enough to pay a high price. So we can also read an individual's willingness to pay (see Chapter 2, section I.C.1) from a demand function. For the first unit the individual is willing to pay a lot, for the second a little less, for the third even less, and so on. If the person now buys a quantity 'q' at an intermediate price 'p', you can say that she 'earned' the difference between what she was willing to pay and what she actually paid. The surface below the demand curve and above the price is then what the person earned in the exchange. So if that surface grows, we can conclude that utility increases. If it shrinks, utility declines. This surface is called 'consumer surplus' (see Figure 3.13). If you use market demand instead of an individual's demand you derive the consumer surplus for the market.



Figure 3.13 Consumer surplus

We can conduct the same exercise on demand functions of many individuals. Generally it remains true that aggregate utility increases as consumer surplus grows and decreases as it shrinks. But if we analyze demand functions of many individuals, we have to bear in mind that we cannot compare utility between individuals without making further assumptions. So to be sure that indeed aggregate utility increases, we have to know that it does increase for every single individual. As long as we look at price changes of one product only, this will generally be the case. But netting changes of consumer surplus on different markets with different consumers is a trickier exercise. The consumer surplus is one of the measures we use to assess efficiency in markets. An allocation is efficient according to the consumer surplus standard if consumer surplus is maximized.

6. The airport example (1)

So let us briefly pause and apply some of what we learned to the dispute between the airport and its neighbors. We learned that in economic terms a quiet night is valued as much as neighbors are willing to give up for it. All opportunities they may give up for quiet nights may be represented by money with approximation because the money an individual has represents most consumption opportunities of an individual. So assume the legal order assigns the right to an injunction to the airport's neighbors. With this right, neighbors prevent the airport from working at night. Now consider two scenarios.

In the first, the airport foregoes high profits by being barred from working at nights. Then the airport could transfer such opportunities of consumption to the neighbors that these neighbors value more highly than the quiet nights. This transfer is possible by a transfer of money. In return, neighbors pass on the right to the injunction to the airport. This would be a Pareto improvement (see Chapter 2, section II.A). The neighbors would be at least as well-off as with quiet nights and the airport would be slightly better off keeping a part of its additional profits from working at night.

In the second scenario, the airport foregoes low profits. Now the foregone profits would not suffice to transfer opportunities of consumption to neighbors, which they value more highly than quiet nights. Accordingly, the neighbors keep their right to injunction and the airport remains quiet at night. This is Pareto-efficient (see Chapter 2, section II.A), because letting the airport work at night does not constitute a Pareto improvement.

From this example, it appears that because value in economics is inherently relative and subjective, a fundamental challenge is to know the neighbors' valuation of quiet nights. But if the law grants a tradable right, we can be confident that the possibility of the exchange of rights will reveal the valuation of goods and help foster efficient allocation. We will come back to this point at the end of this chapter because the 'possibility of exchange' in this argument may potentially face severe impediments.

III. SUPPLY

All the wine and cheese from the examples has to come from somewhere. Firms supply them. They aim at making profits by selling their products. We can imagine these firms as special people who do not have preferences, but who work for a different goal: they maximize profits. The most central concept to the supply side is costs. Firms cannot produce out of thin air. They incur costs. But they would want to spend little and gain a lot. In this section, we only look at costs. We do not net them with revenue (i.e., price times quantity sold) yet.

A. Opportunity Costs

The concept of costs used in economics is that of opportunity costs. Costs of production are the opportunities a firm has to forego when deciding to invest into a particular project. So imagine your wine business inherits the family château from your grandmother. Now, as you acquired it free of charge (we abstract from tax), you may be tempted to think that using the château to produce wine would be free for you. This is not how economists think. They would tell you that in fact by using the château to produce wine you are foregoing the opportunity to rent it out to either tourists or another winemaker. So in fact the costs of using the château are equal to the rent you could have earned on it.

Some German lawyers and politicians had not fully appreciated this logic at the time the European carbon cap and trade system was introduced. At the time, emission certificates were handed out to (some) firms, including energy-producing firms, free of charge. Some people hoped that this would prevent firms from raising the price of electricity. But prices rose nonetheless and some lawyers called for the antitrust authority to prevent electricity producers from raising their prices because they claimed the free certificates did not constitute a cost increase. Now that you know the concept of opportunity costs, it should be evident to you that as long as the certificates could be sold on the market for money (which they could at the time), using them would mean foregoing the opportunity of selling them. So using a certificate to emit CO_2 would come at a cost equal to the market price of the certificate, independently of whether the firm had to pay to acquire the certificate or not. Therefore, now that you have internalized this logic of opportunity costs, you would rightly dismiss the opinion that the increase in price infringed upon antitrust law.

B. Some More Important Notions of Costs

Just as we interpreted money as representing all possible consumption when we talked about demand, we will now dispense with thinking in a multidimensional space by interpreting money as representing all possible investment opportunities. And there is a second simplification we will use, which is called *cost minimization*. You can produce one specific output level at very different cost levels. Think about your château. To grow grapes may require manpower and machinery. If you only employ manpower, your château may look very romantic, but the people you employ may take pretty long to harvest and bring home the grapes. If you employ only one aid and a lot of machinery, that person may not be much faster. For instance, she cannot drive the truck home and harvest the next chunk of berries at the same time. Finally, you might employ some machinery and several aids. Probably that will lead to lower costs than both input combinations before. It should be obvious that, for a given output level, minimizing costs is in your interest because you run your château aiming to maximize profits and all cost savings will add to your profits. For the economic analysis, this means a substantial simplification. Because we know that you as any firm work hard to minimize costs, we only need to consider the minimal costs for any possible level of output. This results in a convenient cost function where every single level of output corresponds to one single level of costs.

To see what types of costs are associated with producing a good, think again of your château. If you decide to produce merely one barrel of wine a year, you may confine yourself to a very small vineyard; you may only use part of the château for wine production, while you can rent out the other parts you do not use; you may be able to do the business alone, only investing a couple of hours a week while you can use the remaining hours for leisure or for working as a lawyer. In other words, your wine production does not cost you a lot. If you want to extend production, your costs will increase. You will have to extend your vineyard, foregoing the rent you received for it from your neighbor. You have to use a larger part of your château for wine production, by which you forego rent from visitors. You have to work more and maybe even employ an aid.

You may also realize that there are different categories of costs. Some costs change with extension and contraction of output and some do not. You cannot use the cellar where you have the barrels as a restaurant, no matter whether you produce 3 or 30 barrels. So this foregone income does not vary with output. Also, you need the same tractor no matter whether you produce 3 or 30 barrels. Costs for machinery often do not vary with output. These invariable costs are called *fixed costs*. Work, however, may increase drastically if you scale up from 3 to 30 barrels. Costs that do vary with output are called *variable costs*, for which labor is a typical example. The distinction between fixed and variable cost has a time dimension. In what we call the 'short run', the distinction is completely appropriate. In the 'long run', however, all costs change with output so that all costs are variable. While the machinery you employ may not change with small variations of output which are possible from this week to the next, it will change as you substantially expand your output over the next three years. We will focus on the 'short run' now.

In later exercises, it will turn out useful to look at the costs attributable to a particular unit of output. For this purpose, we look at how much a unit of output costs on average at a given output level (*average costs*). And we can also look at how many of these costs per unit are fixed (*average fixed costs*) and how many are variable (*average variable costs*). Now think about how these costs would evolve if output increased. Fixed costs per unit will certainly decrease. Because they do not change with output they just are divided by a larger number of output units driving the fixed costs per unit down. Think of the tractor you bought to grow your wine. Maybe it was $\in 10,000$. If it has a life span of ten years and you produce three barrels a year with it, the tractor costs you roughly $\in 333$ per barrel. If you produce 30 barrels per year, the tractor only costs you $\notin 33$ per barrel.

How average variable costs change with output is less clear-cut. Ultimately, one assumes that earlier increases in variable costs induce greater increases of output than additional increases in output that come on top later. The idea is that the effectiveness of these investments starts being constrained by the investments in fixed costs at some point. Think of the cellar. It may be easy to scale up from three to ten barrels. But at some point fitting more barrels in the cellar will become more and more difficult and may hamper your work with the barrels that are already in the cellar. Therefore, average variable costs are mostly assumed to increase as output increases. Combining the decreasing average fixed costs and the increasing average variable costs yields a u-shaped function that maps the output to *average costs* (see Figure 3.14).

It is also important to distinguish *social costs* from *private costs*. All notions of costs introduced in this section on supply are private costs. They are borne by the firm alone. Social cost is the sum of all costs a certain activity imposes on all members of a certain economy. Social costs





Figure 3.15 Marginal costs and supply

will be treated in the section on externalities below and briefly feature in the next airport example.

C. Special Costs and the Supply Curve

The last – and most important – notion of costs that we discuss here is *marginal costs*. Technically, marginal cost is the slope of the total cost function in a given point. This slope indicates how much a small change in output changes total costs. We can interpret marginal costs as representing the cost of producing the next incremental unit. Mathematically, the slope of a function is represented by its first derivative. So the marginal cost function.

We mentioned before that variable costs are ultimately assumed to increase with output because the effectiveness of incremental investments in variable costs is constrained by the investment in fixed costs. From this we conclude that the marginal costs are also ultimately increasing because the interpretation of marginal costs is very similar to that of variable costs (the cost of producing the next incremental unit).

This is so important because any producer will produce an additional unit if the costs of that particular unit are smaller than the additional incremental revenue he will make with it. Therefore identifying the level of output a producer will supply requires finding the level of output where marginal cost equals marginal revenue.

Note that this is exactly the same technique we used when analyzing consumer choice as a maximization of utility. There we looked for the quantity at which marginal utility was equal to the price. The marginal utility represented the marginal benefit and the price represented the marginal cost. Here now, the marginal benefit is the marginal revenue and the marginal costs are even called just that. Equalizing marginal benefits and marginal costs is a standard maximization method in economics. In fact, the marginal cost function's significance goes further. Its part above the average variable costs (the bold part of the marginal cost curve in Figure 3.15) is the supply curve. For prices below the average variable costs, the firm will not operate because in total it will pay more to produce than it will earn. For the part of the marginal cost curve above the average variable costs, the marginal cost curve indicates how much a supplier is willing to bring to the market for a given price. Therefore, we can read the level of supply from the marginal cost curve, if we know the price.

So we have the supply curve for an individual supplier and we can turn it into a market supply curve by adding up all output that could be produced at or below a given level of marginal costs. This is exactly the same operation as we conducted above when adding up all quantities market participants would demand at a certain price.

Just as we could talk about elasticity with regard to demand, we can talk about elasticity with regard to supply. Supply is elastic if it reacts strongly to changes in price (the supply function is flat). If it does not, supply is inelastic (the supply function is steep).

D. Producer's Surplus

The producer's surplus is the revenue minus the marginal cost (see Figure 3.16). The logic is similar to the consumer's surplus. The marginal cost curve indicates at what minimal price the producer would have brought the unit to the market. The fact that he gets more for it means he earns by selling it. So the area above the supply curve up to quantity 'q' and below the price 'p' is the producer's surplus. The producer's surplus, however, should not be confused with profits (see Figure 3.17). Although the producer makes a surplus, he can still make losses in total, forcing him to leave the market. The fixed costs do not show up in the producer's



Figure 3.16 Producer surplus

Figure 3.17 Profits

surplus. So if the fixed costs are too high, they can offset the producer's surplus and the producer makes a loss. Profits mean revenue minus average costs.

IV. THE MARKET

Now we can put supply and demand in a market and see what happens when they meet. But before we do that, we have to specify how we imagine the market.

A. Perfect Competition

The baseline model of a market used in economics is that of perfect competition. Perfect competition means that no single agent in the market can influence the price. Only agents' powerless but self-interested actions jointly generate the price. The model is very much inspired by Adam Smith's dictum of the 'invisible hand'. So we imagine an infinite multitude of buyers in the market who each make up a mere tiny fraction of demand. They all maximize their utility. And we imagine an infinite number of sellers who each make up a tiny fraction of supply and all maximize profits. The fact that we imagine each agent to make up only a tiny fraction of his/her market side means that whenever a seller bids higher than others, all the buyers will go elsewhere and whenever a buyer bids lower than others, sellers sell to other buyers. This represents the fact that in perfect competition no single actor can influence the price. All agents are 'price takers'. This goes with thinking of a market that yields a single price. We have implicitly made this assumption all along in this chapter.

So what will be the price of a good under perfect competition? We know that the price will be equal to the marginal cost of production (i.e., on the supply curve), because at any given price any supplier will adapt his output so that the last unit he supplied will just yield a revenue equal to the cost of producing that unit. At the same time, we know that the price will be equal to the marginal willingness to pay (i.e., on the demand curve), because a consumer will keep buying as long as the price she pays makes her give up just a little less utility than she earns by acquiring the next good. It is the point where the demand curve (marginal willingness to pay) and the supply curve (marginal cost of production) intersect that indicates the price 'p'. Also, this point gives us the quantity 'q' in which the good is brought to the market and consumed (see Figure 3.18).

Is this outcome efficient? As a measure of efficiency on markets we

typically take the sum of consumer surplus and producer surplus (total surplus). If it is maximized, the allocation is Kaldor-Hicks-efficient (see Chapter 2, section II.B). We check whether the market realized the maximum of what consumers and producers could have earned in total. Looking at the diagram, we can see that a price equal to marginal costs and marginal willingness to pay maximizes the joint surplus. If the price increased, we would have to read the quantity at the market from the demand curve and would see that the quantity decreased. Then a little part of the big triangle representing the surplus would not have been realized, that is, would have been lost. That is why we call the 'lost' triangle 'deadweight loss'. If we artificially lowered the price below the competitive price, producers would bring less quantity to the market and again a part of the total competitive surplus would not be realized. So the welfare is maximal under perfect competition. Note that the allocation generated by a perfectly competitive market is Pareto-efficient, too. Nobody can be made better off without making anybody worse off. This is the so-called *first welfare theorem*: Any market equilibrium under perfect competition is Pareto-efficient. It has been shown that in theory a general equilibrium is possible where each market of the economy is in competitive equilibrium and this constitutes an equilibrium between all markets. Later in this chapter we will see some of the reasons why theory and practice fall apart here. Note also that Pareto-efficiency does not say anything about the distribution of surplus between consumers and firms. If supply is flat and demand is rather steep, producer surplus is small and consumer surplus is large. If supply is steep and demand is flat, the reverse is true.

In fact, you could have known right from the beginning that a price that equalizes the marginal cost with marginal utility will maximize total surplus. Why? Because equalizing marginal cost and marginal utility (a marginal benefit) is a maximization procedure like we encountered when





Figure 3.18 Price under perfect competition

Figure 3.19 Price under a monopoly

maximizing consumer surplus and when maximizing the firm's profits. Equalizing the marginal costs and the marginal benefits will yield a maximum – here, the maximum of total surplus in money.

B. Goods as Bundles of Rights

So if the market leads to automatic coordination on efficient outcomes. why do we need legal intervention in a market economy? We will see many reasons in the following paragraph. But even if we assume that indeed all markets in a market economy were perfectly competitive, we would need the law to define what can be traded on markets. So far, we worked with goods that were easy to grasp, wine and cheese. But we have also seen more abstract tradable goods like airport neighbors' rights to injunction. So we see that 'tangible product' is an inappropriate definition of 'good'. In fact, what was traded was ownership in wine or cheese. And what we were particularly interested in was the right to consume that comes with ownership. This is not as trivial as it seems. Many markets do not exist simply because property rights are not defined or are unenforceable. There is no transferable ownership in humans. So not even you yourself can sell yourself as a slave. Goods in the sense of this property rights approach are bundles of rights you can transfer. This function of the law is not at all neutral, which we see in the field of intellectual property rights. Which markets exist and how they work is shaped by legal practitioners defining property rights in their daily business. Intellectual property law has the very purpose of making new ideas tradable. That way, you can think and you can earn from your ideas not only by putting them into practice, but also by specializing in having brilliant ideas and selling them on to companies that specialize in running the infrastructure to put brilliant ideas into practice. This will in all likelihood allocate the ideas to the company best positioned to realize the idea.

V. MARKET FAILURE

We say that markets fail if the allocation of goods by free markets is not efficient. We present you with four reasons why this can happen: market power (1), externalities (2), asymmetric information (3), and non-private goods (4). Many remedies against market failure are forms of legal intervention. Therefore market failure will be analyzed in more detail in the following chapters. Externalities will reappear in the chapter on public choice (see Chapter 6, section I). Different degrees of market power (see Chapter 4, sections II.A and IV.D) and different forms of non-private goods (see Chapter 4, section III.C.2) will be treated in the chapter on game theory and collective goods. Asymmetric information will be a core topic of the chapter on contract theory (see Chapter 5, section III). But before we look at how to deal with market failure, we have to understand why markets fail.

A. Markets without Competition

The first reason why markets may not attain efficiency is the absence of competition. If there is only one seller in a market, he can increase prices above the competitive level without having to fear that buyers would buy from a competitor instead. Because a monopolist does not fear that consumers will switch, he is not a price taker. He can set the price. But he is not completely unconstrained in choosing his price. Buyers always have the option not to buy.

The monopolist who can determine price is maximizing profit differently than a price taker in a competitive market. A price taker equalizes his marginal costs of production and his marginal benefit - the same price for every unit. The monopolist also equalizes marginal costs of production and marginal benefits. But his marginal benefit of producing another unit is the price he gets for the next unit minus the revenue he loses because his extended output lowers price. His marginal benefit is not the same for every unit. Consider a numerical example assuming demand falls by one euro with every additional unit supplied. If the monopolist produces one unit, the price in the market will be at, say, €10. If he produces one more unit, the price falls by one to $\notin 9$. So the monopolist loses $\notin 1$ on the first unit, but earns €9 on the second. His additional earnings from producing the second unit are therefore €9 he earns on it minus €1 he loses on the first – which makes €8. The production of the third unit depresses the price to €8. The sale of the third unit brings €8 accordingly, but on the first and the second the monopolist loses two more euros in total. The incremental benefit of producing the third unit is $\in 6$. You see that the marginal income falls (10, 8, 6...) at twice the rate at which the demand curve (10, 10, 10, 10)9, 8...) falls (see Figure 3.19). And that is actually a general rule. The monopolist will equalize marginal cost of production with his marginal revenue to maximize his profits (see Figure 3.19). Thus, the quantity q_m sold under monopoly will always be less than if the market had equalized marginal cost of production and marginal utility of consumption, that is, demand (see Figure 3.18). Correspondingly the monopoly price 'p_m' will be higher than the competitive price.

If you compare total surplus of the monopoly market and the competitive market (Figure 3.19 and Figure 3.18), you will find that it is smaller under a monopoly. You see that the monopoly pricing not only shifts wealth from the consumers to the supply side, but additionally destroys welfare, which is simply lost. The monopolist's excessive prices result in a deadweight loss.

Abolishing the deadweight loss by intensifying competition, for instance by forcing greater output through competition policy, is not a Pareto improvement, because the monopolist loses and the consumers gain. It is a Kaldor-Hicks improvement because consumers gain enough to compensate the monopolist.

Monopolies are normally instable. If you saw a single ice cream vendor at a beach on a hot summer day, selling his ice cream successfully at ridiculously high prices, would it not strike your mind to sell ice cream at the beach, too? Monopolies' supra-competitive profits incite entry into the market. But there are stable monopolies and most of them are stable for one of two possible reasons. Either the law prevents market entry. Latin notaries exercise their business in geographic areas in which no other notary is allowed to settle. Or the cost structure of a business is such that the market only allows one firm to run its business profitably. This cost structure, which is called a *natural monopoly*, is characterized by large economies of scale. Under economies of scale, the average costs fall as output increases. Usually this is the case if large fixed costs are involved. Take the railroad as an example. Building a railroad network is immensely expensive. And these costs do not change with output because no matter how many guests your railroad company transports, you have the same expenses for your network. In extreme cases, you may only be able to bring your average costs below a price customers would be willing to pay in the case where you serve the whole market. This is what would be called a natural monopoly.

Between perfect competition and monopoly, there are many forms of markets with a limited number of competitors. Here competitors are neither price takers nor can they determine the price alone. The price is formed as a function of all the actions of competitors, but all the competitors' actions influence each other. Here competitors take into account that they can determine prices in strategic interaction. This strategic interaction is analyzed with the help of game theory (see Chapter 4).

The field of law dealing with keeping up competition is competition law. In Europe, Article 101 of the Treaty of the Functioning of the European Union (TFEU) deals with preventing undertakings that would compete from acting jointly like a monopoly (see Chapter 4, section II.A). In the US, Section 1 of the Sherman Act (ShA) does the same. The merger control regime pursues the same purpose with different means. Article 102 TFEU and Section 2 ShA are meant to prevent undertakings with market power from preserving, extending, or exploiting it to the detriment of efficiency.

B. Asymmetric Information and Hidden Action

What information the parties to a market transaction have at their disposal can crucially influence the market outcome. If you cannot be certain about the quality of a used car you may be unwilling to pay a high price. Sellers of good cars may react by refraining from selling so that only low quality cars are traded. (On adverse selection, see Chapter 5, section III.A). An employer may be willing to pay a high wage to a hard working employee. But if the employer cannot observe the employer's effort the latter will shirk. Foreseeing this, the employer will not pay a high wage (on moral hazard, see Chapter 5, section V.A). In both examples there is potential for additional value increasing transactions, which are foregone because one party lacks information. To see that information can influence the market result, remember the last paragraph on market power: The monopolist sets a price above the competitive price. This generates a dead weight loss by preventing some buyers from buying although their willingness to pay exceeds the costs of production. There is an information aspect to this story. If the monopolist knew each individual buyer's willingness to pay he could set a multitude of prices: one for each buyer. He could charge each buyer her willingness to pay. That way every buyer whose willingness to pay exceeds the production costs would be supplied. Efficiency would be attained. Distribution would, however, get even more unequal. The monopolist would appropriate all surplus. One reason why this perfect (or first degree) price discrimination is typically hard to implement is that the monopolist lacks the necessary information. The other reason is that the monopolist often cannot prevent reselling, which spoils price discrimination: under the monopolist's attempt to price discriminate a low valuation buyer could buy cheap and sell on to a high valuation buyer who will then refrain from buying from the monopolist. If all buyers act that way the monopolist will only sell to low valuation buyers earning less than if he had set a single monopoly price.

C. Externalities, Transaction Costs and the Coase Theorem

The theory of markets assumes that all costs and benefits of producing and consuming the good are borne by the parties to the market transaction. Often that is a reasonable assumption. If you have a glass of wine you bought from your favorite winemaker, he will probably have borne most of the cost of production and you will pay the costs and reap the benefits of consumption. But that is not always the case. Think of the airport's neighbors. An airport generally sells starting and landing capacity to airlines. But the noise is a cost for the neighbors, who are normally not a partner in the transaction over starting and landing capacities. If the costs of production are partly borne by a party outside of the market transaction, then these costs are not represented in the supply function. This leads the supply function to be too flat, leading to an excessive quantity being sold at the market price (see Figure 3.20). We call costs or benefits that are imposed on third parties outside of transactions *externalities*. Externalities are omnipresent. Smokers might disturb eaters at a neighboring table. Drivers use a parking space without purchasing it from the children who could otherwise play soccer there. And in most countries, power stations contribute to global warming by emitting CO_2 without making it subject to a transaction.

In a famous paper, Ronald Coase pointed out that the mere fact that someone's activity exerts an externality on somebody else does not mean that market transactions are inefficient. He claimed that, in the absence of transaction costs, the allocation of rights (i.e., the right to exert an externality or the right to prevent an externality) did not have an effect on efficiency because trade would allocate the rights efficiently. Remember, if the law had assigned a tradable right to injunction to the airport's neighbors, and if the airport's nightly profits had sufficed to make both neighbors and airport better off, the airport could have bought the right and both neighbors and airport would have profited and been better off (for more on the Coase Theorem, see Chapter 5, section I.A).

There remain two caveats. The first features in Coase's theorem explicitly. It only applies to 'absent transaction costs'. We have abstracted from transaction costs, too, in the example above. In fact, the situation with one airport facing many neighbors is a typical situation where transaction costs are high. Transaction costs are all costs agents need to incur purely to make a transaction. Typical examples are the costs of searching for information or of searching for the right trading partner, costs for legal advice or for drafting a contract. However, emotional impediments to trade could also feature as transaction costs or strategic considerations that prevent agents from agreeing. The latter is very likely to be the case in the airport example if we have a plurality of neighbors, each of whom holds a right to full injunction. In such a case, the airport needs to purchase all neighbors' rights to injunction. The neighbors' rights are worthless to the airport if one of the rights is missing. So you can imagine the situation as though all rights to injunction are worthless to the airport, except for the last one, which it buys. Therefore the neighbor who is the last to sell can ask for the highest price. So no neighbor wants

to sell early, but all neighbors want to be the last to sell. That way nobody starts selling at all. This is called a hold-out problem. As a result of these strategic transaction costs, it is far from clear that, in the airport example, free transactions would actually allocate the right to injunction to where it is valued most.

The second caveat is distribution. Coase talks about efficiency only. While under Coase's assumptions efficiency is unaffected by the allocation of rights, this allocation of rights does affect the distribution of wealth. Imagine the right to decide whether planes can take off at night lies with the airport. If profits were high, the neighbors would not value quiet nights enough to compensate the airport for foregoing its nightly profits. If profits were low, then the neighbors' willingness to pay would suffice to compensate the airport and the right would shift to the neighbors, in the absence of transaction cost. But you see that this time neighbors do not increase their endowment. Here neighbors either have to bear the noise or pay. In the previous example, they either had quiet nights or compensation. So the neighbors are worse off in the second example, although efficiency is attained in both examples. Consequently, while a policy-maker aiming for efficiency may be indifferent regarding the allocations and may focus instead on minimizing transaction costs, the agents are very much interested in where rights are allocated. So agents may try hard to influence the policy-maker. This opens a universe of research questions, which we deal with in the chapter on public choice (see Chapter 6).

With his insight that in the absence of transaction costs rights are allocated efficiently by free transactions, Coase laid the ground for the economic analysis of the law. As far as the law aims for efficiency, where transaction costs are low, it should confine itself to defining tradable property rights. That way, agents could simply resolve inefficiencies by means of transactions. In reality, however, the world is full of transaction costs, as we saw in the airport example. Here, by means of economics, the law can identify the efficient allocation of rights and aim at bringing it about.

D. Non-Private Goods

Markets work well if the traded goods are private goods. A private good is excludable, that is, you can exclude others from consuming it. And private goods are rival, that is, if you consume it nobody else can consume it. If you own some cheese, you can make sure that you keep it for yourself (excludable) and if you eat it there is nothing left for others (rival). If the goods traded lack these characteristics, a market cannot allocate them efficiently. Take common pool resources as an example. Common pool resources are rival, but non-excludable. Fishing in the European seas is a field of application. If all European fishermen go out and fish as they like, the sea will be empty of fish soon. All fishermen jointly have an interest to keep in the sea a healthy population of fish to feed people for the years to come. But any one fisherman is better off if he fishes a lot, no matter whether his fellow fishermen adhere to the initial plan or not. As this is true for all fishermen, they fish too much. The market for fish does not resolve the problem; in fact, it exacerbates it. European law tries to tackle this problem through the legal intervention of quotas. We will go into this and similar problems in more depth when we talk about law and the theory of strategic interaction in the next chapter (see Chapter 4, section III.C.2).

E. The Airport Example (2)

Again, let us pause to apply some of what we have learned in the sections on supply and on markets to the airport example. Forget the neighbors' right to injunction for a moment. Assume the airport was working on a market where airports supply 'slots', that is, time during which airplanes can land, load, and start again. Airlines use these slots as inputs to the services they produce. Assume all airports in the market are identical and all have neighbors who feel disturbed by nightly flights. And assume that our airport has a market share of 10 percent. The market would be competitive so that a model of perfect competition was a reasonable approximation. Then Figure 3.20 would represent a system of demand and supply of slots according to which 300 slots would be supplied in the market.

Would the neighbors feature in the demand curve? In principle, they could buy slots if their valuation was high enough and transaction costs were absent. But quiet nights are non-excludable. If Mrs. Rich buys the airport slots and keeps them, she sleeps quietly. But she cannot prevent Mr. Smith from also enjoying nightly peace. At the same time, quiet nights are non-rival. The fact that Mrs. Rich sleeps quietly does not make nights noisier for Mr. Smith. So the airport's neighbors will probably not invest in slots, due to a public-good dilemma amongst each other. The neighbors are not represented in the demand function for slots. We can assume that all slots are bought by airlines so that people living close to our airport would have to support 30 (10 percent of 300) planes taking off and landing each night. What other interventions could resolve the conflict between the airport and its neighbors?

The problem is that the supply curve represents the *airport's* marginal costs. But all neighbors have costs from every plane crossing their roofs at night. Of course it makes a difference whether three planes disturb



Figure 3.20 Supply and marginal Fi social costs

Figure 3.21 Pigouvian tax

your sleep or 30. So the marginal cost curve does not represent the total marginal costs of allowing planes to land and take off. That way, supply and demand intersect at a quantity that is excessively high in terms of efficiency.

The so-called 'social marginal costs' would be steeper.¹ Efficiency would require basing the supply on the social costs of an activity. And if we take the social marginal costs as the supply curve, we see that fewer airplanes would fly at nights (200 on the market and 20 at our airport). The law can let the airport approximate the marginal social cost curve by imposing a tax on every plane taking off and landing (a so-called 'Pigouvian tax'; see Figure 3.21). But it is challenging to assess the correct size of the tax. Liability for damages can work in a similar way. Imagine if the airport had to pay a lifetime rent for every neighbor who falls ill as a result of the noise. Every plane would increase the probability of a neighbor falling ill. With this probability, the probability of the airport being liable for damages would also rise. This increase in expected costs from liability to damages would feature in the marginal costs of the airport. In this way, liability rules can help to make firms consider social costs, which do not feature in the private cost function.

¹ Here we assume that the more planes you have already suffered from, the more annoying the next plane is. Maybe you find it more plausible that all planes are annoying to the same degree; in that case, the social marginal cost function would be higher than the private marginal cost function, but parallel.

VI. CONCLUSION

In this chapter, we learned that demand is determined by how individuals value goods. We learned that value in this sense is inherently relative and is measured in other goods. And we saw that this knowledge can be applied to clarify to whom rights should be allocated. We further learned that supply is determined by costs and that the economists think of costs as foregone opportunities. The most central notion of cost is the marginal cost, which can be interpreted as the cost of producing the next incremental unit. And we saw that the law can help to make sure that all costs of an activity really feature in supply, for instance by liability regimes. Finally we saw that markets lead to efficient allocation if they are perfectly competitive, if there are no externalities, if information is symmetric and if the goods traded are private goods. If markets fail because these assumptions are not fulfilled, the law can provide fixes.

FURTHER READING

- Akerlof, George A., The Market for 'Lemons': Quality Uncertainty and the Market Mechanism, 84 Q. J. ECON. 488 (1970).
- Arrow, Kenneth J. and Gérard Debreu, *Existence of an Equilibrium for a Competitive Economy*, 22 ECONOMETRICA 265 (1954).
- Coase, Ronald H., The Nature of the Firm, 4 ECONOMICA 386 (1937).
- Coase, Ronald H., The Problem of Social Cost, 3 J. LAW & ECON. 1 (1960).
- COOTER, ROBERT D. AND THOMAS S. ULEN, LAW AND ECONOMICS (6 ed., Boston: Pearson 2012).
- Demsetz, Harold, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967).
- NEUMANN, JOHN VON AND OSKAR MORGENSTERN, THEORY OF GAMES AND ECONOMIC BEHAVIOR (Princeton: Princeton University Press 1953).
- NICHOLSON, WALTER AND CHRISTOPHER SNYDER, MICROECONOMIC THEORY (10 ed., Mason: Thomson 2008).
- OSTROM, ELINOR, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (Cambridge: Cambridge University Press 1990).
- Pigou, Arthur C., Divergences Between Marginal Social Net Product and Marginal Private Net Product, in THE ECONOMICS OF WELFARE II (Arthur C. Pigou ed., 4 ed., New Brunswick: Transaction Publishers 1932), Chapter IX.
- PINDYCK, ROBERT S. AND DANIEL L. RUBINFELD, MICROECONOMICS (8 ed., Boston: Pearson 2012).
- SMITH, ADAM, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS: TWO VOLUMES IN ONE (Chicago: Chicago University Press 1994).
- VARIAN, HAL R., INTERMEDIATE MICROECONOMICS: A MODERN APPROACH (8 ed., New York: Norton 2010).

4. Game theory and collective goods Stefan Magen

I. GAME THEORY AND LAW

Game theory is a general, analytical theory of rational choice in strategic interactions. While it was focused on the analysis of games in the literal sense in its very beginnings, game theory has since advanced to being an indispensable theoretical tool for economics and many other social sciences. This introduction intends to explain the basic terms and concepts of this complex and efficient theory. It will be confined to classic game theory, which analyzes strategic interactions of individual actors based on the assumptions of rationality and self-interest (homo economicus), and leave out behavioral and evolutionary game theory.¹ To keep the barriers for jurists low, the mathematical formalism, which is constitutive for game theory, will be kept to a minimum and not formally introduced, but verbally explained.

A. Individual Choice and Strategic Interdependence

Game theory focuses on decision-making situations that are characterized by *strategic interdependence*. These are situations in which the result of an actor's decision also depends on the decisions made by another actor or actors. However, we only speak of true strategic interdependence if the actor has to take this interdependence into account when making a rational choice. In markets characterized by perfect competition, for example, there are so many market participants that no actor can strategically influence the behavior of the other market participants (see Chapter 3, section IV.A). Any individual market participant is thus playing against

¹ Behavioral game theory is part of behavioral economics (see Chapter 8). It addresses, experimentally as well as theoretically, how bounded rationality and social preferences influence strategic behavior. Evolutionary game theory theoretically analyzes the evolution of strategies depending on their success in strategic interactions.

nature, as it were. Despite interdependence of interests, markets with perfect competition thus lack strategic interdependence. Correspondingly, a monopolist in a market with no competition would equally not be faced with a strategic decision-making problem insofar as he has no (potential) competitors whose behavior he would have to take into account (see Chapter 3, section V.A). In the economic analysis of markets, game theory is therefore mainly concerned with markets between the extremes of perfectly competitive and monopolistic markets. An example of this will be given below (see section II.A).

B. Game Definition, Normal Form and Extensive Form

In game theory, games are mathematical models. They consciously ignore the great variety of real-world situations in favor of isolating specific aspects which are then subjected to formal analysis. For this, we must formally define the game by determining the essential elements of a game: the *players*, the *rules* (actions, move order, information), the possible *outcomes*, and the *payoffs* associated with them (i.e., how outcomes are valued according to the preferences of the players). There are two ways to define a game, which are to a large extent but not fully equivalent, namely the so-called *normal form* (or strategic form) and the *extensive form*. The main difference between the two is that in the extensive form the order of moves and the available information are explicitly modeled, while for the normal form both these aspects have to be specified in addition to the model (if not, it is usually assumed that the players).

In the following, we will introduce the normal form game and explain fundamental solution concepts (section II). Then an overview of the basic constellations of strategic interdependence will be provided (section III). Subsequently, extensive form games will be discussed (section IV) and the modeling of law and informal institutions sketched (section V).

II. GAMES IN NORMAL FORM

A. The Cartel Dilemma

As an example for a strategic decision-making problem, we will take two companies that strive to obtain monopoly rents in a market they control. Let us assume that the companies would be able to increase their profits (compared to a competitive market), if they tighten their supply and raise their prices. However, in contrast to a monopolist, an individual duopolist cannot attain this by *unilaterally* tightening his own supply, because the monopoly rent depends on total supply, which the other duopolist also influences. A duopolist intending to maximize his profits therefore has to anticipate the other's behavior and take it into account. It might, for example, be advantageous for the latter to react to his competitor's supply reduction with an increase in his own production. In simplified terms, this decision-making problem can be modeled as follows:

1. Players, rules and outcomes

Firstly the players, the rules, and the outcomes of the game have to be defined. The *players* are the two duopolists, D_1 and D_2 . They may choose different production outputs. For the purposes of modeling, they are reduced to two *actions*, namely the production of a small supply (S) and the production of a large supply (L). Regarding the *move order*, we will further assume that D₁ and D₂ draw simultaneously and only once (simultaneous one-shot game). Regarding the available information, it is usually assumed that all players know the possible actions, all previous moves, and the payoffs of all players; in other words, they have perfect and complete information (see section IV.C). If the players chose simultaneously, it is assumed that the other player's move is not known. In our case, D_1 and D_2 know the actions from which they and the other player may choose (S and L), as well as the resulting respective payoffs. However, in making their decision, they do not know how the other player will decide. From all the possible combinations of the actions available to D_1 and D_2 , four possible game outcomes result, namely (a) both choose the small supply, so (S/S); (b) both choose the large supply, so (L/L); (c) and (d), one of the two chooses the small, the other the large supply, and vice versa, so (S/L)and (L/S).

2. Preferences and payoffs

For each one of these outcomes, the player's *payoffs* H_i have to be determined. Payoffs indicate how each player assesses the outcome according to his preferences. Depending on the purpose of the model, payoffs can be interpreted in different ways (as an ordinal ranking, as a cardinal utility, as willingness to pay, or as monetary payoffs) (see Chapter 2, section I.C.1). For the purpose of this introduction, following a widespread convention, we will assume in the following that players' preferences are self-interested, meaning that players evaluate outcomes only in light of the consequences of an action for themselves. This excludes other-regarding preferences like altruism or preferences for fairness (see Chapter 8, section III.A). So our duopolists do not care whether their actions affect the other negatively or positively.

Payoffs are an *essential* element in determining the *nature of the game*. If a game-theoretic model is intended to elucidate real-life problems, the merits of the analysis depend on how many assumptions from which the payoffs are derived are theoretically founded and empirically adequate. In our example, we base payoffs on a very simplified version of *duopolistic* competition in order to sketch market outcomes resulting from different supply amounts.² First, we will assume that the small supply amounts together correspond to the amount that a profit-maximizing monopolist would offer. If both duopolists intend to collude at the consumers' expense, they would have to choose that amount – thus playing (S/S) – and would jointly realize the monopoly profit. We will further assume that large supply amounts, taken together, equal the supply level if D_1 and D_2 were not colluding, but competing, thus leading to profits well below what a monopolist would earn (depending on the specifics of the market, economic profits may be reduced to zero or may range somewhere in between monopoly profits and perfect competition). Thus, if the duopolists play (L/L), they miss (a fraction of) the monopolistic profit. If we only look at these two outcomes, the interests of D_1 and D_2 seem to be in line, because both prefer (S/S) over (L/L). However, we also have to consider what happens if only one of the duopolists chooses the lower collusive supply amount, while the other offers the larger, more competitive amount. Let us assume that in this case the competing duopolist can raise his profits even beyond the joint collusion, while the profit of the duopolist still restraining his supply will sink even below his profit in the case of mutual competition. So when D_1 and D_2 play (S/L) or (L/S), one of them gets the highest possible payoff, and the other the lowest. In this respect, the interests of D_1 and D_2 run counter to each other.

3. Game matrix

Normal form games with two players and a finite number of strategies can be depicted in a matrix that, in the case of two available actions, takes the simple form of a 2x2-matrix (so-called 2x2-bimatrix games). The possible actions of D_1 are represented in the rows, so D_1 can choose between the upper or the lower row. The possible actions of D_2 are represented in the columns, so D_2 can choose between the right and the left column. The four cells resulting from the intersections of rows and columns represent the four possible game outcomes. Depending on the decisions of D_1 and D_2 , one of the four cells is chosen (S/S, S/L, L/S or L/L). In each cell, payoffs

² For different models of duopolistic competition, see DAVID M. KREPS, A COURSE IN MICROECONOMIC THEORY 325 *et seq.* (1990).
		D ₂ chooses	
		small amount	large amount
D ₁ chooses	small amount large amount	3, 3 4, 1	1, 4 2, 2

 Table 4.1
 Game matrix of the cartel dilemma

for D_1 are shown on the left-hand side and the ones for D_2 are shown on the right-hand side (see Table 4.1).

B. Solution Concepts

A game of this kind provides a formal description of a strategic decisionmaking problem. Now the question is how a rational player should decide and solve the problem, hence, what the best choice of strategy is. The so-called solution or equilibrium concepts deal with this issue. Solution concepts try to determine optimal strategies for each player. In game theory, strategy is a technical term, defined as a complete plan of action decided *ex ante*, which specifies for every possible move which action is to be chosen. In games such as above, in which the players only move once simultaneously, the set of possible (pure) strategies simply consists of the possible actions. But imagine the duopolists would choose sequentially – D_1 first, and then D_2 – and D_2 would know D_1 's decision. D_2 might now want to choose differently, depending on how D_1 has chosen before. In this situation, any strategy of D₂'s has to specify two choices of action, contingent on D₁'s two possible decisions. We will come back to that when we introduce extensive form games. The important thing to keep in mind here is that strategies can be more complex than actions because they require a *complete ex ante plan* of action for every eventuality. Which outcomes ensue from a strategy choice obviously depends on the choices of all players. Solution concepts are therefore not concerned with isolated strategy choices, but with how the choices of players fit together. Solution concepts are about combinations of the players' strategy choices, called strategy profiles. A strategy profile contains one, and only one, possible strategy for every player (e.g.: D_1 colludes, D_2 colludes). It thus implies a particular outcome (G, G) and its payoffs (3/3). Equilibria or rational solutions are generally understood as strategy profiles (combinations of strategies) that contain only best strategies for every player. So what is a best strategy? This is the crucial question and the answer is given by socalled solution concepts. The basic solution concepts in game theory are

the concept of *dominance* and the so-called *Nash equilibrium*. Both will be explained below. There are also several refinements to the concept of a Nash equilibrium, an important one of which is subgame perfection, which will be introduced at a later point when discussing sequential games in the extensive form.

1. Dominance

Given strategic interdependence, which strategy is to be considered the best has to be determined in relation to the possible decisions of the other players. However, if one strategy *always* leads to the *highest payoffs* for one player, regardless of how the other players behave, it can readily be considered the best choice for this player. Such a strategy is said to be a dominant strategy of this player because it 'dominates' his other strategies. If there is a dominant strategy for every player, the game has an equilibrium in dominant strategies. Whether a player has a dominant strategy can be read from the matrix of a game. For this one has to go step by step through all available choices of a player. For each choice one has to look which decision is most advantageous, *given that the other player chooses one way or another*. In our example, one would thus have to ask two questions for D₁. The first is: Which decision would be advantageous for me if D₂ chose the smaller amount? In the matrix, D₂ would then play the left-hand column (highlighted in gray) (see Table 4.2)

In this case, D_1 would have to choose between the upper and the lower cell of this column. So D_1 would look at the first column and compare the payoffs in the upper and lower cells, so 3 and 4. Since these numbers represent his preference order, D_1 would choose the higher of the two payoffs. Which cell a player prefers can be denoted, for purposes of illustration, by arrows depicting preference relations, for D_1 's choices with vertical arrows (\uparrow and \downarrow) next to D_1 's payoffs. So if D_2 were to choose the left column, D_1 would choose the lower row. The answer would thus be: If D_2 colluded, D_1 would compete. The second question D_1 has to ask is: Which decision would be of greater benefit to me if D_2 chose the larger amount? To answer this, one can look at the right column and compare the payoffs on the left in the upper and lower cells, so 1 and 2 (see Table 4.3). It is rational for D_1

Table 4.2	Preference	order for D
	./	./

		D ₂ chooses	
		small amount	large amount
D ₁ chooses	small amount large amount	↓ 3 , 3 <u>4</u>, 1	1, 4 2, 2

		D_2 chooses	
		small amount	large amount
D ₁ chooses	small amount	3, 3	↓ 1 , 4
	large amount	4, 1	<u>2</u> , 2

Table 4.3 Dominant strategy for D_1

Table 4.4 Preference order for D₂

		D ₂ chooses	
		small amount	large amount
D abaasas	small amount	$3, 3 \rightarrow$	1, 4
D_1 chooses	large amount	4, 1	2, 2

Table 4.5 Dominant strategy for D₂

		D ₂ chooses	
		small amount	large amount
D abaaaa	small amount	3, 3	1, 4
D_1 chooses	large amount	$4, 1 \rightarrow$	2, <u>2</u>

in this case to compete as well. This means that it is beneficial for D_1 to compete in both cases, thus representing a *dominant strategy* for him.

Inversely, D_2 is thinking about the same questions. However, D_2 is not choosing between the rows (upper/lower), but between the columns (left/right), always based on the assumption that D_1 chooses one or the other row. Which column D_2 prefers, given that D_1 has chosen a specific row, is expressed by horizontal arrows (\rightarrow and \leftarrow) next to the payoffs of D_2 . The result is that D_2 would compete if D_1 colluded (see Table 4.4).

If D_1 competed, D_2 would also want to compete (see Table 4.5). So competition is a dominant strategy for D_2 as well.

Taken together, the preference arrows, which denote if a player has an incentive to diverge from a decision, result in a movement diagram that points to the equilibrium outcome (see Table 4.6).

The diagram shows that the game has an *equilibrium in dominant* strategies, with both duopolists choosing the large amount and thus not

		D ₂ chooses	
		small amount	large amount
D ₁ chooses	small amount large amount	$\begin{array}{c} \downarrow 3, 3 \rightarrow \\ 4, 1 \rightarrow \end{array}$	↓ 1, 4 <u>2, 2</u>

Table 4.6 Movemer	ıt diagram
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colluding. This also indicates that the duopolists cannot achieve the collusive outcome, although this would be beneficial for both. Individual and collective rationality diverge here, which is characteristic for the *prisoner's dilemma* in particular and cooperation problems in general (see below, section III.C). However, the *cartel dilemma* is a peculiar case, because the dilemma duopolists are facing is *socially desirable*. Given the negative external effects of cartels on the consumer and the economy (not represented in the game matrix), it actually serves the wider common good if cooperation between duopolists fails. Cooperation detrimental to third parties or society is often dubbed *collusion*.

2. Nash equilibrium

The so-called *Nash equilibrium* is also based on the idea of a situation in which none of the players has an incentive to deviate from his equilibrium strategy. However, it is a weaker solution concept than that of dominance, since it does not require the equilibrium strategy to be the best answer irrespective of the behavior of the other players, but *only if the other players also play their equilibrium strategies*. More specifically, a strategy profile is a Nash equilibrium if every player's equilibrium strategy is the best answer to the equilibrium strategies of all other players, so that none of the players have an incentive to *deviate unilaterally* from their strategy, provided that the others play their equilibrium strategies. In a sense, the decisions of the players support each other in the Nash equilibrium.

The concept of the Nash equilibrium can be illustrated by the example of setting technological standards. Let us assume that two companies (A and B) have developed successor technologies for DVDs. Company A has produced standard X, while company B has produced standard Y. Both companies can either introduce their own standard in the market or adopt the standard of their competitor in exchange for a license fee. If both technologies are introduced in the market, it can be assumed that, due to the consumers' uncertainty, the demand for the new technologies will be weaker, so that A and B will make the lowest profit (in terms of an ordinal preference order, we denote it with 1). If a company succeeds in establishing

		Company B chooses	
		standard X	standard Y
Company A chooses	standard X standard Y	$\uparrow \frac{3,2}{1,1} \rightarrow$	$\begin{array}{c} \downarrow 1, \leftarrow 1 \\ \underline{2, 3} \end{array}$

 Table 4.7
 Game matrix of the standardization game

its own standard, it will make the largest profit (which we will denote as 3). In this case, the other company will make a larger profit than if both standards exist side by side, but because of the license fee the profit will be lower (we denote it with 2). This gives us the game shown in Table 4.7.

Again, one can ask which decision is preferable for a player if the other one behaves one way or another, and denote the preference order with arrows. One can see that there are no dominant strategies in this game: Its own standard X is preferable for company A, but only if company B also chooses to adopt this standard (upper left cell). However, if company B chooses its own standard Y, this standard is also preferable for company A (lower right cell). So both standard X and standard Y provide a Nash equilibrium. This can also be inferred with preference arrows. A cell from which an arrow points away cannot be an equilibrium because the arrow implies an incentive to deviate from this outcome. Conversely, cells with no arrows pointing away from them are Nash equilibria. They can be marked by underlining the payoffs. Sometimes there is neither an arrow pointing to a cell nor away from it. Then the party is merely indifferent between this outcome and another. This outcome is nevertheless a Nash equilibrium, but only a weak one. However, if all arrows point towards an outcome, as in the above example, we speak of a strict Nash equilibrium. As far as our standardization problem is concerned, the game has no single solution, but two equilibria. In such a case, the solution concept of the Nash equilibrium only states that it would not be rational not to play an equilibrium (if one assumes that the other player also behaves rationally and also plays an equilibrium). In games with several equilibria, the choice of equilibrium becomes the central problem. For this reason, games with multiple equilibria are called *coordination games*. Both equilibria of our standardization game are further characterized by the fact that they are valued differently by the companies A and B: Company A would prefer X as the standard, but if Y should be established as the standard, then it has no incentive to hold to X as the standard. Besides the coordination problem, the game is burdened with a conflict. Games of this type are known by the term 'battle of the sexes' (see section III.B.1).

3. Equilibria in mixed strategies

In the example above, we assumed that the players choose one of the available equilibrium strategies (either standard X or standard Y). But game theory also allows for choices which decide for a strategy only with a certain probability (e.g., standard X with a probability of 1/3, standard Y with a probability of 2/3; the sum of probabilities has to be 1 always). Strategies where players pick from several strategies with a certain probability based on a random mechanism are called *mixed strategies*. In contrast, a strategy simply chosen (with probability 1) is called a *pure strategy*. Importantly, mixed strategies can also be in a Nash equilibrium. Indeed, not every game has an equilibrium in pure strategies, but any game has at least one equilibrium in mixed strategies.

Take, for instance, the police's fight against drug-dealing locations. Let us assume, for the purpose of simplification, that there are only two locations in a city, namely A and B, where drug dealers and consumers can meet to conduct business. The police force is only large enough to control one location at a time. As long as the police does not condone the drug trade to keep it under control, the police and the dealers are 'playing' a *discoordination game* (similar to matching pennies): The police wants to control the locations where the drug trade takes place, but the dealers want to transact their business where the police does not check. The matrix of such a game could look as shown in Table 4.8.

This game does not have an equilibrium in pure strategies. Because for every one of the possible combinations of pure strategies, one of the players would be better off if he changed his strategy. If the police controls location A, it is better to deal at location B. If the dealing takes place at B, it is better to control at B. If B is being controlled, it is better to deal at A, and so on. Put differently, for any cell there is an arrow pointing away from it. However, this does not mean that it does not make a difference, for those involved, how they behave. On the contrary, it is essential for them to keep the other players from anticipating their behavior, that is, to act unpredictably. If the dealers knew, for example, that the police always controls A, they would shift to B. In situations such as these, it is best for the opponents to switch between

		Drug dealers deal in	
		А	В
Police controls in	A	$2, -4 \rightarrow$	$\downarrow 0, 4$
	В	10,4	2,←−4

Table 4.8 Game matrix of the discoordination game

the alternatives according to a random pattern, in other words, to 'mix their strategies'. In doing so, it is not always best to choose all strategies with the same probability. If police controls of B are usually more successful, because B can be controlled more effectively, then more frequent controls of B might lead to better results. In that case, it might be better for the drug dealers to deal more in A. If both police and dealers keep adjusting the probabilities of their behavior until none of those involved can improve their situation by further adjusting probabilities, they have reached an equilibrium in mixed strategies. In the above example, this means that the police as well as the drug dealers choose the locations A and B with probabilities of $\frac{1}{2}$. This equilibrium, like all equilibria in mixed strategies, cannot be inferred from preference arrows, but has to be calculated.

III. TYPES OF GAMES

With the cartel dilemma, the standardization game, and the police versus dealer game, we have already become familiar with three different types of games, namely a 'prisoner's dilemma', a 'battle of the sexes' and a variation of 'matching pennies'. In the following, we will present a typology of important games based on 2x2 bimatrix games. This typology should provide a first overview of what kind of strategic problems may result from the interdependence of interests, for individual actors as well as for the common good. Three features of a game are essential in this respect: First, in which order players rank possible outcomes; second, which equilibria a game has, if any; and third, if these equilibria correspond to social welfare.

A. Simple Motives

If in a game the interests of the players are either completely concurrent or completely opposed, one can speak of a game of simple motives. This is the case in harmony games and pure coordination games, on the one hand, and pure conflict games, on the other.

1. Harmony

Harmony games, such as shown in Table 4.9, are characterized by the absence of any kind of strategic problems.

Both players rank the outcomes in the same order here, so there is no conflict about which outcome to choose. The game has only one equilibrium (in dominant strategies), so that there is no coordination problem

		В	
		cooperates	defects
A	cooperates defects	$\begin{array}{c} \underline{4,4} \leftarrow \\ \uparrow 2,2 \leftarrow \end{array}$	3, 3 ↑1, 1

Table 4.9Example of a harmony game

Table 4.10 Example of a pure conflict game

		В	
		cooperates	defects
A	cooperates defects	$\begin{array}{c} 4, 1 \rightarrow \\ \uparrow 2, 3 \rightarrow \end{array}$	<u>3, 2</u> ↑1, 4

either. Moreover, the equilibrium is also Pareto-optimal, so that individual and collective rationality are not in conflict.

2. Conflict

Pure conflict games, in many respects, have the opposite characteristics of harmony games. Actors do not rank the outcomes in the same, but in the opposite order, as in the example in Table 4.10.

This is a constant-sum game, a class of games of which the best-known member is the *zero-sum game*.³ In constant-sum games, one player's gain exactly corresponds to the other player's loss. Other pure conflict games may lack this strict symmetry, but all have the property that any improvement for one player leads to some deterioration for the other and vice versa. This also implies that every possible outcome is Pareto-optimal. Some conflict games, such as the police versus dealer game, do not have an equilibrium at all (in pure strategies) and are thus unstable, while others, such as the example above, have one. Whether many legal disputes are adequately modeled as pure conflict games is questionable. The reason is that even if the underlying conflict is a zero-sum situation, bringing it before the courts usually produces additional material and immaterial

³ Technically, a zero-sum game is defined as a game in which in every outcome the sum of payoffs of all players is zero. This is not the case in the game depicted in Table 4.10, in which payoffs sum up to 5 in every outcome. However, constantsum games are analytically equivalent to zero-sum games.

costs which both parties might like to avoid. This introduces a partially common interest in the situation (so it might be better modeled as a hawk-dove game, see section III.B.2).

3. Coordination

In pure coordination games, there is no conflict, but players have to choose between several equally ranked equilibria. Their interests are concurrent, but undecided between several options. One well-known example is on which side of the street the drivers should drive in traffic. It essentially makes no difference whether the decision is for right-hand or left-hand traffic, but to avoid accidents the decision should be congruent. The problem can be modeled as in Table 4.11.

The game has two equilibria, between which there is neither a conflict, nor a welfare gap. In this case, one speaks of a *pure coordination game*. Pure coordination presents a strategic problem insofar as the actors have to coordinate on one of the equilibria. How easy or difficult this is depends on several additional factors. If those involved are able to *communicate*, they can easily agree on an equilibrium beforehand (which both would have an incentive to implement, since there is no conflict impeding a concurrent choice). If those involved act successively and can observe their actions, then the one who acts first can lead the way and pick one equilibrium strategy, and there is no reason why the other player should not follow suit. In interactions, which are repeated often with the same actors, an equilibrium may emerge over time and will then be stable. But if the actors only interact once and cannot communicate beforehand, coordination can be problematic. This is all the more true the more equilibria there are to choose from. For example, if one wants to meet in a foreign city, any accessible location can be an equilibrium. If it was forgotten to agree on a meeting point beforehand, it can be helpful to choose a location that, for any reason, is likely to draw the attention of the other actors (so-called focal points). For example, hoping that the other person gets the same idea, one could wait at the main train station. Especially in modern mass societies, quite a few institutions have the function of creating such focal points

		В		
		left	right	
A	left right	$\uparrow \frac{2,2}{1,1} \rightarrow$	$\begin{array}{c} \downarrow 1, \leftarrow 1 \\ \underline{2, 2} \end{array}$	

that facilitate coordination in the absence of personal agreements. In train stations or airports, there are usually clearly marked meeting points, which facilitate mutual coordination. Traffic regulations perform a similar function, insofar as road users have a common interest in avoiding accidents.

B. Mixed Motives

Games between the aforementioned extremes of completely concurrent and completely opposed interests are called games with mixed motives. They model situations in which the interests in various ways partly concur and are partly opposed. Many of these games bear rather flowery names. Among them are the 'battle of the sexes', the 'hawk-dove game', and the 'stag hunt', but also cooperation games, such as the 'prisoner's dilemma'.

1. Battle of the sexes

We have already been introduced to the battle of the sexes in the form of a standardization game (see section II.B.2): Two companies want to agree on a common technological standard, but each prefers its own standard. Games of this kind are *mixed coordination and conflict games*. They have two equilibria that both players prefer over the other outcomes of the game. Both equilibria are also Pareto-optimal. Insofar as the players want to meet on one of these equilibria, it is a coordination game. But in a battle of the sexes, there is also a conflict regarding the selection of the equilibrium. This conflict jeopardizes coordination, because each player will try to establish a different equilibrium, the one that is most advantageous for him or her, respectively. The strategic problem of such situations lies in the social *costs of the coordination failure*, namely the danger of coordination failing due to diverging interests and the entire interaction ending up with a result that is unfavorable both individually and collectively.

2. Hawk-dove game

Quite a few conflicts which present as zero-sum games if analyzed in isolation appear in another light if one considers that a dispute itself leads to losses, be it that it creates material or immaterial costs or that the dispute destroys the trust between parties and thus prevents continued cooperation. This aspect, which is also characteristic for many legal problems, can be modeled with the *hawk-dove game*. Like the battle of the sexes, the hawk-dove game is a *mixed coordination and conflict game*. It presents as shown in Table 4.12.

Let us assume that two parties are in a dispute. If both are uncompromising and act like hawks, the conflict escalates and both suffer heavy losses. That is the least favorable outcome of the game, which both

		В		
		dove	hawk	
A	dove hawk	$\begin{array}{c} \downarrow 3, 3 \rightarrow \\ \underline{4, 2} \end{array}$	$\uparrow \frac{2.4}{1,\leftarrow 1}$	

Table 4.12Example of a hawk-dove game

wish to avoid. It would be better for both if the dispute could be settled peacefully through compromise, in other words, if both acted like doves. However, this is no equilibrium, because the willingness to compromise can be exploited by the other player. If the other is a dove, there is no risk in playing a hawk and thus deciding the conflict to one's own advantage. However, if the other plays hawk, it is preferable to play dove to avoid an escalation. What is so perfidious about such a situation is that mutual vielding is not individually rational and hence not an equilibrium. Only the two asymmetrical constellations, in which one refuses to yield and the other gives in, are Nash equilibria. But since both will try to assert the equilibrium that is most beneficial for them individually, they will easily end up with the worst possible outcome. For two hawks, the game will not end well. So in the case of a hawk-dove game, the strategic problem also lies in the costs of coordination failure. This problem becomes all the more urgent, the higher the losses are in the case of an escalation, such as is the case with the nuclear arms race. For such applications, the game is often modeled with high negative payoffs for the uncooperative outcome and qualified as a *chicken game*.

In situations such as the hawk-dove game, another type of strategy is plausible, namely one that neither yields unconditionally nor strictly settles on a hard line, but rather leaves the definite decision open. We introduced this kind of strategy above as the use of *mixed strategies*, that is, a random probabilistic choice between the hawk and the dove. It is interesting to see what difference it makes for the optimal strategy mix, that is, whether the extent of possible losses is rather small or rather large. The nature of the game as such remains unchanged, but the amount of potential damage has an important influence on the probability with which hawk and dove should be played: The greater the potential damage is, the smaller the probability should be that is assigned to playing hawk, up to the point where the safe dove strategy is chosen almost with certainty. So with increasing losses, the equilibrium in mixed strategies converges towards a cooperative solution in the sense of mutual yielding. To avoid disastrous consequences, players will approximate the so-called maximin solution, that is, choose the strategy with the smallest losses in the worst case.

3. Stag hunt

The stag hunt is named after a parable by Rousseau. Two hunters can either hunt a stag together or rabbits alone. Both would benefit more from their share of the stag than from a rabbit. So none of them prefers a rabbit hunt over the stag hunt (this is an important difference to the prisoner's dilemma). But if, for any reason, one hunter abandons the other to go and hunt rabbits, the other is left with nothing, while the first hunter still has the rabbit. Hence, hunting stag carries a risk while hunting rabbits is a safe choice. The matrix of such a game could look as shown in Table 4.13.

In the stag hunt there are two equilibria, namely both hunt a stag together or each hunts rabbits alone. In contrast to the prisoner's dilemma, mutual cooperation also presents an equilibrium in this case. This cooperative equilibrium is associated with the highest payoffs for both players and thus Pareto-optimal. So the stag hunt is a *coordination game without conflicting individual interests* and *without a conflict between individual and collective rationality*.

The strategic problem of the stag hunt game is that the *equilibrium strategies* stag/stag and rabbit/rabbit carry *different risks*. Players hunting rabbits receive a payoff of 2, independently of the other's behavior, and thus bear no risk. A player hunting the stag, on the other hand, is left with nothing if he stays alone. So the problem lies in the risk of suffering a loss if coordinating on the cooperative equilibrium fails. The criteria according to which one should choose between the equilibria with different risks are not clear. In this regard, additional criteria are needed beyond no player having an incentive to deviate unilaterally. Following the so-called *payoff* or *Pareto dominance*, one would choose according to the size of the payoffs, this being the sole criterion, therefore aiming at the Pareto superior stag equilibrium. On the other hand, if one attaches importance to avoiding potential losses in case of a coordination failure, another criterion could be to decide according to the *maximin principle*. Then one would always

<i>Table 4.13</i>	Exampl	e of a	stag	hunt	game
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		B hunts		
		stag	rabbit	
A hunts	stag rabbit	$\uparrow \frac{6, 6}{2, 0} \rightarrow$	$\downarrow 0, \leftarrow 2$ $\underline{2, 2}$	

prefer the safer rabbit equilibrium. A further criterion is the concept of *risk dominance*. It recommends a choice according to expected utilities, based on assumptions about the probability with which the other player will choose his strategies. For example, lacking further information one could assume that the other player is equally likely to play stag or rabbit. If the players are risk-neutral, then the expected utility in the example above lies at 2 for the rabbit strategy and at 3 for the stag strategy.⁴ In this case, the stag is risk-dominant compared to the rabbit. However, if players are risk-averse to a strong enough degree, then the reverse might be true. Risk dominance hence depends on the *risk preferences* of the players.

C. Cooperation

Cooperation games are also among the games with *mixed motives*. They are of particular practical importance. Cooperation games model situations in which *individual and collective rationality contradict one another* because the *equilibria* of the game (deriving from individually rational choices) are *Pareto-inferior*, while the socially desirable (Pareto-optimal) outcomes are not equilibria. Hence, in cooperation games at least one actor has an individual incentive to deviate from socially desirable behavior and bring about a Pareto-inferior outcome. Thus, the term 'cooperation' in game theory is much narrower than the use in everyday language, which includes all possible forms of the common pursuit of goals, but which are also, from a game-theoretic perspective, only in part cooperation games; in part they also present as harmony, conflict, or coordination games.

1. Prisoner's dilemma

The best-known model of a cooperation problem is the *prisoner's dilemma*, which we have already come across in the form of the cartel dilemma. In the prisoner's dilemma and, more generally, in cooperation games, the actions that (would) result in the socially desirable outcome are termed *cooperation*, and the actions that lead to the individually rational outcome are called *defection* or *opportunistic behavior*. In the prisoner's dilemma, defection is the dominant strategy (see Table 4.14).

Prisoner's dilemmas are not limited to two-person games, but can also appear as multiple or n-person games. In those cases, one speaks of problems of *collective action*. But even with many participants, the basic

⁴ E.g., 'stag' gives A a payoff of 6 if B also chooses 'stag', and a payoff of 0 if B chooses 'rabbit'. If both of B's choices are equally likely, A's expected utility for choosing 'stag' is $(\frac{1}{2}*6) + (\frac{1}{2}*0) = 3$.

		В		
		cooperation	defection	
A	cooperation defection	$\begin{array}{c} \downarrow 3, 3 \rightarrow \\ 4, 1 \rightarrow \end{array}$	↓ 1, 4 <u>2, 2</u>	

Table 4.14 Example of a prisoner's dilemma

incentive structure of the prisoner's dilemma does not change, which is why often the two-person game is used as a simplified form of modeling problems of collective action. Negative or positive *externalities* are a major source of cooperation problems. Externality means that the actions of an actor have (positive or negative) consequences for the utility of another. Self-interested actors are assumed to ignore these consequences when making their decisions. In the cartel dilemma, for example, a duopolist who increases his production creates negative (monetary) externalities for the other duopolist in the form of losses from decreasing prices.⁵ Externalities can create a conflict between individual and collective rationality, which is characteristic for cooperation problems.

2. Collective goods

One special case of the externality problem are collective goods, that is, goods that are not private. Private goods are characterized by excludability and the rivalry in their use. *Excludability* means that third parties can be excluded from the use of a good at reasonable costs and thus can be prevented from using the good without the cooperation of the owner or other authorized parties (e.g., you cannot live in a rented apartment without having the key). Excludability provides the factual basis for establishing effective property rights and gives the authorized person the option to demand remuneration in exchange for allowing the use of the good. This creates an incentive to produce and supply the good. *Rivalry* is when the use of a good by one consumer interferes with other consumers' use of the same good (you can only eat a loaf of bread once). Insofar as a good has both characteristics, it creates neither positive nor negative externalities: Producers take the positive effects of their production on the utility of consumers into account, because they count on remuneration from selling it. Consumers, on the other hand, have to pay a price for using a good and

⁵ Lower prices at the same time also create positive (monetary) externalities because they lead, e.g., to welfare gains on the side of consumers. Hence it is for the benefit of society in general if duopolists fail to solve their cooperation problems.

			Rivalry		
		yes	no		
Excludability	yes no	Private goods Common goods	Club goods Public goods		

Table 4.15 Private and collective goods

thus internalize the negative effects of their consumption on the further usage of the good.

For *collective goods*, on the other hand, internalization is problematic. Collective goods lack one or both of these characteristics of private goods. A distinction is made between (pure) public goods, club goods (also toll goods or excludable public goods), and common goods (also commons or common pool resources). They lack the characteristics of excludability and or rivalry in the combination shown in Table 4.15.

A lack of excludability bears the consequence that the user of the good does not have to consider the costs of his use. In common goods, whose use is rivaled, non-excludability creates an incentive for overexploitation. This problem often arises in the common use of natural resources. The exploitation of fish populations in international waters is an example of this phenomenon. If they are overfished, the fish population cannot recover, so that the entire yield decreases. Note that this is more than a simple distribution problem, because overfishing leads to a reduction of social welfare as a whole.

(Pure) public goods and club goods (excludable public goods), on the other hand, lack rivalry. Because of that, their usage has no cost and thus overexploitation is not a problem. Their problem is a problem of underproduction. To achieve efficiency, such goods should be provided as long as the costs of their provision do not surpass the benefits of their use. With (pure) public goods, however, there is no incentive to produce (this efficient amount of) the good due to non-excludability. For this reason, public goods are often provided by the state, which can finance their production through tax revenues. Ensuring external and internal security through the military and the police are examples of this type of public goods. Club goods, in contrast, could in principle be financed through payments and fees because of their excludability. But collecting fees can be inefficient, because it also discourages uses that would be costless because of non-rivalry. Put differently, fees would prevent costless positive externalities. For example, it is possible to finance highways through tolls, but this deters some further usage which, aside from rush hours, would not hamper traffic.

			Country B fishes	
		little	moderately	intensively
Country A fishes	little moderately intensively	$\begin{array}{c} \downarrow 3, 3 \rightarrow \\ 4, 1 \rightarrow \\ \uparrow 3, 0 \rightarrow \end{array}$	$\downarrow 1, 4$ $2, 2$ $\uparrow 1, 1$	$ \begin{array}{c} \downarrow 0, \leftarrow 3 \\ 1, \leftarrow 1 \\ \uparrow 0, \leftarrow 0 \end{array} $

Table 4.16 Example of non-dominance of complete defection

Public goods and common goods are often modeled as prisoner's dilemmas. However, this model implies that *defecting is a dominant strategy*, meaning that everyone always has an incentive to act contrary to the common good. But this is *not always* a realistic assumption. In exploiting fish populations, for example, a point is often reached where it is no longer profitable for fisheries to exploit the common good further, because the low additional yield is not covered by the higher costs of exploitation. Beyond this point, individual and collective interests can run in parallel again, as modeled in the cooperation game (which is not a prisoner's dilemma) shown in Table 4.16.

The payoffs in the four upper left cells (created by the actions 'fishing little' and 'fishing moderately') equal the payoffs of a normal prisoner's dilemma. But the socially even more detrimental possibility of both fishing intensively is not an equilibrium. Hence players have no incentive to defect beyond moderate exploitation. Moreover, there can be cooperation problems even without a dominant strategy or with several equilibria, as long as the socially desirable situation is not an equilibrium. In this regard, the prisoner's dilemma only models an *extreme form* of a cooperation problem.

3. Cooperation with conflict

While the prisoner's dilemma can overstate cooperation problems, because defection is a dominant strategy, it does not cover another aspect of cooperation problems at all, which in reality is of great importance. In real life, there are often not one, but many ways to cooperate, but actors have different preferences over them. This problem appears, for example, when *cooperative gains* or *cooperative burdens* can be *distributed in different ways*. Then actors also have to manage a distribution conflict, in addition to the cooperation problems. This problem can be modeled as a *mixed cooperation and conflict game*. Let us assume that two companies discharge wastewater into a body of water, which interferes with their own production and that of the other company, creating additional costs.

		Company B			
		filter 1 filter 2 no filter			
Company A	filter X filter Y no filter	$\begin{array}{c} \downarrow 5, 5 \rightarrow \\ \downarrow 8, 4 \rightarrow \\ 9, 0 \rightarrow \end{array}$	$\begin{array}{c} \downarrow \textbf{4, 8} \rightarrow \\ \downarrow \textbf{5, 5} \rightarrow \\ \textbf{6, 1} \rightarrow \end{array}$	$\begin{array}{c} \downarrow 0, 9 \\ \downarrow 1, 6 \\ \underline{2, 2} \end{array}$	

 Table 4.17
 Example of a mixed cooperation and conflict game

To clean the wastewater, the companies can install one of two filters or remain passive. Based on the different installation costs and the various outcomes, the payoffs shown in Table 4.17 would obtain for the companies A and B.

This cooperation problem has a single equilibrium in dominant strategies, in which none of the companies (willingly) installs a filter (denoted by an underline). This equilibrium is Pareto-inferior compared to four Pareto-optimal outcomes (in italics). All of these could be the object of potential cooperative efforts. Of these four, two are symmetrical, with payoffs of (5, 5). Compared to these, the other two Pareto-optimal equilibria, with payoffs of (8, 4) and (4, 8), are more efficient in terms of the Kaldor-Hicks criterion (total payoffs of 12 compared to 10), but are very unequally distributed. Game theory does not tell us how this distribution problem, which is innate to many cooperation situations, can be solved. But the existence of this problem presents an additional and often central obstruction, and it should be a fundamental function of the law to help overcome this obstacle to cooperation. Climate protection provides a current example on a global scale. There is widespread agreement that lowering the carbon dioxide emissions would be in the interest of most, if not all, states. But still, negotiations on a follow-up agreement to the Kyoto Protocol are stalled, because the states are unable to agree on the distribution of the reduction obligations and thus on climate protection costs. Not surprisingly, the distribution of reduction costs was and is one of the most contentious political issues in the implementation of the European Emission Trading System.

D. Repeated Games

So far, the unspoken assumption has been that the games depicted in the matrices are *one-shot games*. Some interactions, for example, between neighbors, in business or employment relationships, between political parties, or between states, have a longer duration. Game theory models

such situations as *repeated games*. The assumption in such cases is that the players play the game presented in the matrix, called *stage game* in this context, for *several rounds*, which creates a new game, the *super game*. While all equilibria of the stage game are, as repeated actions, also equilibria of the super game, the repeated game can have a multitude of additional equilibria. If this is the case, it essentially depends on whether the game is repeated an *infinite or indefinite* number of times or if a *predetermined number of rounds* is played.

1. Indefinitely often repeated games and the folk theorem

Let us first consider the case that a game is indefinitely repeated. Then the players do not know in which round the game ends. Of the inhabitants of two adjacent townhouses, for example, one likes to listen to loud music, which disturbs his neighbor, while the neighbor likes to do noisy handicraft work, which bothers the former. Both would prefer their neighbor to be considerate, but still want to indulge in their own penchants. Such a situation, looked at in isolation, can have the structure of a prisoner's dilemma, so that conflict might seem inevitable. However, the neighbors have to get along in the long term, so that they make their decision in the shadow of the future. From a game-theoretic perspective, the payoffs of the stage game are no longer the decisive factor, but the added (and discounted) payoffs of the super game are. Thus, the time frame can change the nature of the game, provided that the *probability of repetition* of the stage game is high enough and players do not devalue future benefits too much, meaning that the so-called discount rates are not too high. In a repeated prisoner's dilemma, mutual defection is still an equilibrium (if one player is never considerate, being considerate is not advisable for the other either). In a long time frame, however, the inevitability of the dilemma structure disappears. If one player cooperates, but only as long as the other cooperates as well, then it is in the self-interest of the other to continue cooperation, because he would otherwise lose the long-term benefits from the continued cooperation, while the gains of a unilateral defection are short-lived, because the other can also be expected to switch to uncooperative behavior. Put differently, in a long time frame players have a credible threat of sanctions. In an indefinite and often repeated prisoner's dilemma, mutual cooperation is therefore a Nash equilibrium. A game with a dominant equilibrium turns into a coordination problem, where one has to choose between the different equilibria. More precisely, the super game of a repeated prisoner's dilemma takes the form of a stag hunt (see section III.B.3), where one can choose, among others, between an equilibrium with low but guaranteed payoffs, and an equilibrium with high but risky payoffs.

More generally, according to the so-called *folk theorem*, in games that are repeated an indefinite number of times (assuming a sufficiently high probability of repetition and sufficiently low discount rates), all payoffs can be realized as long as every player receives on average at least what the other players cannot unilaterally take from him in the stage game (e.g., the payoffs of (defection/defection) in the prisoner's dilemma). Players can bring this about because they have the option to choose their actions in a way that does not maximize their own payoffs, but to minimize the payoffs of the fellow player. This gives them the option to push down the other player to what is called his *maximin payoff*, and this option provides them with a threat of *sanctions* against the other player. With this option of sanctioning available, players in a repeated game can implicitly or explicitly agree to play certain actions of the stage game and to sanction deviations from this plan by inflicting maximin payoffs on the perpetrator. Such a plan is possible for all types of strategies above the maximin payoffs, so that repeated games have an *indefinite number of equilibria*. The problem they pose is mainly a *coordination problem*.

2. Finitely repeated games and backward induction

However, this logic does not apply to games repeated for a *finite number* of times. If a game has only one strategic equilibrium as a one-shot game, it also has only this one (subgame-perfect) equilibrium as a repeated game. This follows from a reasoning called *backward induction*, which demands to solve the super game backwards, beginning from the last stage game: In the last round, the incentives are the same as in the one-shot game, which is why one of the equilibria of the one-shot game should be played. The same reasoning applies to the second to last round, the third to last, and so on, right until the first round. For this reason, in a finitely repeated prisoner's dilemma, cooperation is not a rational solution of the game. Technically, it is not a subgame-perfect equilibrium. To explain subgame perfection, we have to look at games in extensive form.

IV. GAMES IN EXTENSIVE FORM

A. Definition of a Game in Extensive Form

Besides the game in normal form, introduced above, there is another form of representation, the *extensive form*. In the extensive form, the order in which the players move and the information available to them during the game are explicitly shown in a game tree. A game tree consists of *nodes* and *edges*. Nodes denote decision-making situations (*decision nodes*) and



Figure 4.1 Game tree of a sequential standardization game

outcomes (*terminal nodes*). Edges denote the *actions* a player can choose from at the decision nodes. They lead to decision nodes if further decisions are to be made, or to terminal nodes if the game is over. The terminal nodes denote possible outcomes and specify their respective payoffs.

To illustrate this, we can use the issue of standardization again, only this time we do not assume that the companies A and B can decide simultaneously, but first company A and then, knowing A's decision, company B. That game is now a *sequential game with perfect information* (see section IV.C). In its extensive form, it presents as shown in Figure 4.1.

The first decision node (x_1) marks the option to move for A, while the edges leading away from it denote its possibilities to act (standard X and standard Y). Depending on how A decides, B is either at the left (x_2) or the right (x_3) decision node on the second level. B also has the same two options of acting and, depending on how it decides, the game ends at one of the four terminal nodes (z_1, z_2, z_3, z_4) .

The solution for this game is fairly obvious intuitively, if one first considers the situation of company B, when it is its turn to move. Company A has already made its decision at this point. So B knows which standard A has chosen, that is, if it is at x_2 or at x_3 . It will choose the action that is most beneficial, depending on A's choice. If A opted for standard X, B will also choose this standard; and if A has chosen standard Y, B will also follow suit. Company A anticipates this and can thus freely choose its standard. It will thus choose the standard that is more beneficial, that is, standard X. A has the *first-mover advantage* here, which is typical for sequential coordination games.

B. Subgame Perfection

Technically, however, things are not that easy. To determine the Nash equilibria, the game tree can be transformed into a matrix. Compared to the simultaneous game, company A still has the same strategies as in the simultaneous game, that is, its actions. But company B's strategies no longer coincide with its actions. Since strategies are complete plans of action formulated ex ante, B has to select one action for each of its decision nodes (x_2, x_3) in every strategy (or, more precisely, for all its information sets, see section IV.C). Therefore, each of its strategies contains two conditional actions, for example: 'if A chooses standard X, I will also choose standard X; if A chooses standard Y, I will also choose standard Y'; or, in shorter form: $(x_2; X/x_3; Y)$; or, even shorter, (X/Y). Depending on A's choice, only one of these two conditionally specified actions will actually be carried out. In the sequential coordination game, there are therefore four possible strategies for company B: always standard X (X/X), always standard Y (Y/Y), the same standard as company A (X/Y), the opposite standard as company A (Y/X). To determine payoffs, we have to consider which action B chooses according to its conditional strategy, depending on A's choice. This gives us the game matrix shown in Table 4.18.

Now one can see that the game actually has three Nash equilibria. The one printed in bold equals our intuitive outcome: B chooses the strategy of following A's decision. In this equilibrium, A can effectively pick its preferred outcome, standard X. There are two further Nash equilibria, which are marked in italics here. They owe their characteristic as equilibria – no incentive for unilateral deviation – to B's implicit threat. The equilibrium in the lower far right cell (Y, Y/Y) is especially interesting in this context. B's strategy here is to choose its own standard Y, independently of A's behavior (see Figure 4.2).

In this equilibrium, the only reason that there is no incentive for company A to choose its preferred standard X is that company B has

		B chooses			
		X/X	X/Y	Y/X	Y/Y
A chooses	X Y	$\uparrow \frac{3, 2}{1, 1} \rightarrow$	<u>3, 2</u> ↑ 2, 3	$\begin{array}{c} 1, \leftarrow 1 \\ 1, \leftarrow 1 \rightarrow \end{array}$	$\begin{array}{c} \downarrow 1, \leftarrow 1 \\ \underline{2, 3} \end{array}$

 Table 4.18
 Game matrix of a sequential standardization game



Figure 4.2 Equilibrium strategies of equilibrium (Y, Y/Y)

settled beforehand on choosing its own standard Y at x_2 in any event. Thus, if A chose X and B went through with its choice of Y, both would end up at the inferior terminal node z_2 and receive payoffs of only (1,1), instead of the higher payoffs (3,2). Company B's strategy (Y/Y) thus involves an *implicit threat* against company A not to yield to its standard. But the question is whether this threat is *credible*, because B would be shooting itself in the foot if it carried out this threat. Despite being a Nash equilibrium, the strategy profile (Y, Y/Y) is not a convincing solution of the game.

The answer lies in the concept of *subgame perfection* that refines the Nash equilibrium by setting up a further requirement for a rational solution of the game. Subgames are games that do not begin at the initial node, but at one of the following nodes. In our example, there are two subgames (beginning with x_2 and x_3), but only one of them can be actually played, depending on the previous decision of A. In the problematic Nash equilibrium (Y, Y/Y) analyzed above the actions actually carried out would be 'standard Y' at x_1 and 'standard Y' at x_3 . This is the so-called *equilibrium path* on the game tree. It includes subgame x_3 , but not x_2 . Now let us take a look at the implicit threat, which ensures that it is better for A to choose standard Y at x_1 . The threat is contained in B's choice of standard Y in the subgame x_2 . Since x_2 is not on the equilibrium path, B does not have to carry out its threat in the equilibrium. But if it had to, it would be irrational to do so. The concept of subgame perfection addresses this problem



Figure 4.3 Sequential standardization game after tree pruning

by demanding that the equilibrium strategies present a Nash equilibrium in *every* subgame also, even in those that are not on the equilibrium path. This Nash equilibrium (Y, Y/Y) fails this test, because in the subgame x_2 'standard Y' is not the best answer, but 'standard X'. The same is true for the Nash equilibrium (X, X/X). Both equilibria are based on empty threats. Only the equilibrium, in which A chooses the more advantageous standard X and B follows suit, is subgame-perfect.

With the help of the game tree, this solution can also be found by using the method of *backward induction*. In backward induction, an extensive form game is solved for every subgame going backwards from the last decision nodes (x_2 and x_3) to the initial node (x_1). At x_2 , B would choose standard X; at x_3 , B would choose standard Y. Because A anticipates this, in making its decision it can cut the edges to the end nodes which B would not choose (so-called *tree pruning*). The game tree is thus shortened as shown in Figure 4.3.

C. Imperfect Information and Information Levels

So far, we have assumed that company B knows the decision that company A has previously made. In other words, B knows if they are at decision node x_2 or x_3 . If a player knows all the previous moves of his fellow players, this is termed *perfect information*. But one can also imagine situations in which one player might make his move a bit earlier, but the other does not (yet) know of this decision when making his own. This is referred to as *imperfect information*. With regard to the game tree, this would mean for our standardization game that B, when making its decision, would not know if it is at node x_2 or at x_3 . In the terminology of game theory, *decision nodes* that the player cannot keep apart belong to one *information set*. Somewhat counterintuitively, the less a player knows about the moves of



Figure 4.4 Example of a game with imperfect information

his fellow players, the larger his information set is. So if B does not know A's previous decision, x_2 and x_3 belong to the same information set. In the game tree, this is denoted by connecting the decision nodes between which a player cannot decide with a dotted line (see Figure 4.4).

A game like this can no longer be solved by backward induction, because company B does not know at which node it is and thus cannot base its actions on the decision of company A. Its strategies are therefore reduced back to the decision for one of the two standards, and thus to its two actions. The sequential standardization game with imperfect information is thus equivalent to the simultaneous standardization game we had initially analyzed (see Table 4.7).

D. Incomplete Information

Common knowledge refers to characteristics of the game or the players which every player knows and also every player knows that all the other players know of them. Such common knowledge is presumed in game-theoretical solution concepts on various levels. The concept of the Nash equilibrium, for example, presumes that all players behave *rationally* and that this is also common knowledge.

One speaks of *complete information* when the *characteristics of all players* are common knowledge, meaning: when all players know the *payoffs* of all other players and also know which *strategies* and *information*

the others have (while the term 'perfect information' refers not to the knowledge of the characteristics of the players, but to the knowledge of the previous moves). Many strategically very interesting situations are characterized by incomplete information in this sense, for example if an actor is not sure which gains a cooperation partner is actually drawing from their mutual cooperation. One can model such problems of *incomplete information* by introducing into the third game a *move by 'nature'* in which nature chooses some of the player's characteristics in a random draw. So games with *incomplete* information (about some characteristics) are translated into games with *imperfect* information (about nature's previous choice) and can be analyzed using information sets, as discussed above.

This can be illustrated by the example of a market entry game: A market is controlled by monopolist M, who realizes a monopoly profit $(G_M = 100)$. Competitor A considers entering the market as well. If he does so, the monopolist could react with an aggressive defense strategy or by giving way and splitting the market. The effect a market entry would have on the profits of M and A depends on M's cost structure; this cost structure, in turn, depends on whether the monopolist is acting from a weak or from a strong position against the intruder. If the monopolist is weak and gives way, then M and A will realize proportional duopoly profits $(G_D = 40)$ in the case of A's market entry, but its total will still be lower than the monopoly profits (80 < 100). A defensive strategy, on the other hand, would lead to losses for both M and A ($G_A = -10$). If the monopolist is in a strong position and defends his market, he will still be able to realize a profit ($G_{DM} = 30$) even if his position is attacked (e.g., because of high economies of scale), while the intruder will suffer losses upon entering the market ($G_{DA} = -10$). If the market is split, the proportional duopoly profits for M will be lower (e.g., because of decreasing economies of scale) than his profits if he puts up a fight ($G_{TM} = 20$). So a weak monopolist would react to the attack by splitting the market; a strong monopolist, on the other hand, would react with a defensive struggle.

A, however, does not know what M's cost structure is. So the attacker is confronted with two possible games, not knowing which one is going to be played. This can be modeled by providing a move at the beginning of the game tree, by which 'nature' chooses between the two possible games with certain probabilities. The result is the game shown in Figure 4.5, in which subgame x_2 shows the case of the strong monopolist, and subgame x_3 shows the case of the weak monopolist. Since A does not know which subgame he is playing, because he does not know how nature has drawn, the nodes x_2 and x_3 are in one information set. The monopolist, on the other hand, knows his cost structure and therefore knows whether he is in game x_4 or in game x_5 , which is why these nodes are not part of one



Figure 4.5 Example of a market entry game

information set. A's payoffs are denoted on the left-hand side, M's on the right-hand side.

By first solving subgame x_2 using the method of backward induction, one can see that in the case of a market entry (at x_4), a strong monopolist would opt for the defense strategy (preferring 30 at z_2 over 20 at z_3). Anticipating this, the attacker (at x_2) would decide against entering the market (preferring 0 at z_1 over -10 at z_2). In subgame x_3 , on the other hand, in the case of an attack (at x_5), the weak monopolist would decide to split the market (preferring 40 at z_6 over -10 at z_5). Anticipating this, the attacker (at x_3) would choose market entry (preferring 40 at z_6 over 0 at z_4). However, the attacker does not know if he is at x_2 or at x_3 (both belong to the same information set). But we can shorten the game by the moves that M would not play (Figure 4.6).

Now we can see that A's decisions *no longer* depend on *strategic considerations*, because M's choices have been anticipated (and therefore eliminated from the game tree). Rather, A has to consider the expected utilities of his two options based on the probability that the monopolist is weak or strong. If it is equally likely, for example, for the monopolist to be weak or strong, the expected utility for A in the case of market entry is 15 $(-10 \times 0.5 + 40 \times 0.5 = -5 + 20 = 15)$ and in the case of no entry 0. So the

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Figure 4.6 Market entry game after backward induction

competitor should enter the market. The payoffs he then receives (-10 at z_2 or 40 at z_4) depend on whether the monopolist is actually strong or weak.

V. LAW AND INFORMAL INSTITUTIONS

A. Law as Price or as Focal Point

So far, the role of law has not been discussed. However, this should not be taken to mean that game theory only describes legal vacuums. Much as other factual conditions, the law provides factual constraints on actors that can be factored in when modeling a decision-making problem. But game theory does not have a systematic space for legal norms, so that the obligations pronounced in applicable law are, as such, irrelevant. But obligations can be accounted for through the *sanctions* by which they are enforced. From the point of view of self-interested players, legal sanctions may be regarded as a *price* of violating a norm with a specific action. So we can factor in the expected value of the sanction (level of penalties times probability of occurrence) in the payoffs related to that action. Let us take again the example of overfishing, where socially desirable self-restraint is not an equilibrium (see Table 4.16). If moderate and intensive fishing are

			Country B fishes	
		little	moderately	intensively
Country A fishes	little moderately intensively	$\begin{array}{c} \frac{3,3}{2,1} \rightarrow \\ \uparrow 1,0 \end{array}$	1, ←2 ↑ 0, ←0 ↑ −1, ← −1	$0, \leftarrow 1$ $\uparrow -1, \leftarrow -1$ $\uparrow -2, \leftarrow -2$

Table 4.19 Example of payoffs that include sanctions

forbidden and carry a penalty of 8, and the probability of actually being fined is $\frac{1}{4}$, the payoffs of these strategies decrease by -2. The result is the modified game, in which cooperation has become a dominant strategy (altered payoffs in bold), shown in Table 4.19.

In the game matrix above, the law is not explicitly modeled as such, but the changed payoffs take the institutional framework into account. Put differently, introducing legal sanctions alters the nature of the game (from a cooperation game into a harmony game). But there is another way by which the law can influence the game: law can contain *information* on the expected behavior of the other players. This information can serve as a *focal point* for *coordination*.⁶ The decision between right-hand or left-hand traffic as a coordination problem can illustrate this (see section III.A.3). If you travel to Namibia, for example, and would like to drive there, knowledge of the legal situation (left-hand traffic) is usually sufficient to motivate the corresponding behavior. The self-interest in avoiding traffic accidents is incentive enough to choose the equilibrium already established in this repeated game, so that sanctions are not necessary. By providing focal points, the law leaves the nature of the game untouched, but influences which of several equilibria is played.

B. Law and Social Norms

1. Informal institutions as equilibria in repeated interactions

There is a widespread conviction that conflict and chaos would abound were it not for the law. From the perspective of game theory, prospects of order and peaceful cooperation rather depend on the strategic properties of the particular situation, that is, the nature of the game that people play. If people interact in *close-knit communities* where the incentives of an

⁶ See Richard H. McAdams, *A Focal Point Theory of Expressive Law*, 86 VA. L. REV. 1649 *et seq.* (2000); id., *The Expressive Power of Adjudication*, 5 U. ILL. L. REV. 1043 *et seq.* (2005).

indefinitely often repeated game with multiple persons obtain, then, according to the *folk theorem*, they can implement many different equilibria, including cooperative ones, not limited to the equilibria of the isolated individual interactions (of the stage games). Interactions are obviously less dense in modern societies than in rural or village communities. But even in modern times, people take part in a multitude of overlapping groups, which interact fairly often and durably (e.g., in companies and administrations or their departments, within professions such as lawyers or judges, and so on) and are therefore accessible to analysis as repeated games. Social norms and institutions can then emerge, the stability of which, from the perspective of game theory, rests on the stability of the chosen equilibrium. We call such institutions informal institutions. They persist because it would be disadvantageous for the individual to unilaterally deviate from the established equilibrium. This does not imply that other equilibria or institutions cannot be formed; only that many players have to change their behavior for this purpose.

2. Conventions, social norms, and norms of partiality

All informal institutions in our understanding are, as equilibria, 'selfenforcing' by definition. But the stability of some informal institutions is still dependent on information sanctions, whereas others can persist without them. The need for information sanctions depends, among other things, on the nature of the stage game or, more precisely, on whether the behavior that an institution prescribes is also an equilibrium in the stage game or not. For example, if the stage game is a coordination game (such as with right-hand or left-hand traffic), no sanctions are necessary to reach one of the equilibria in the stage game (say, driving on the righthand side). Then, no sanctions are needed either to establish this behavior as an equilibrium in the repeated games. In this regard, one can speak of conventions.⁷ On the other hand, the situation is different if the intended behavior is not an equilibrium in the stage game, such as in cooperation norms in a common good dilemma. Then the stability of the institution rests on credible sanctions with which the members of the group threaten each other (as part of the equilibrium strategy). Largely in line with the legal and sociological terminology, such institutions can be qualified as

⁷ Terminology is not uniform in this sense; cf. Richard H. McAdams and Eric B. Rasmusen, *Norms and the Law* in HANDBOOK OF LAW AND ECONOMICS II 1581 *et seq.* (A. Mitchell Polinsky and Steven Shavell eds, 2007); Robert Sugden, *Spontaneous Order*, 3 J. ECON. PERSPECT. 85 *et seq.* (1989); EDNA ULLMANN-MARGALIT, THE EMERGENCE OF NORMS (1977); H. Peyton Young, *The Evolution of Conventions*, 61 ECONOMETRICA 57 *et seq.* 61 (1993).

social norms. Social norms are informal institutions accompanied by an expectation of sanctions in the case of their violation. In its simple form, the threat of sanctions is decentralized in the sense that players threaten each other with the termination of cooperation. But with increasing complexity of interactions, sanctions are often assigned to specialized authorities who monitor norm compliance and apply sanctions selectively only to the norm violators. Such an institutionalization of sanctioning is an important part of the historical transition from informal social norms to formal law (which does not deny that some forms of law, such as international law, may exist without central sanctioning authorities). Although conventions and social norms are self-enforcing, they do not necessarily equally serve the interests of all concerned. Rather often one encounters 'norms of partiality', that is, informal institutions which perpetuate social inequalities or discrimination.⁸ From a game-theoretical point of view, it seems likely that in such cases the stage game is not a pure cooperation or coordination game, but also a game of conflict in which the payoffs in the equilibria of the stage game are not distributed evenly, like in the battle of the sexes (see section III.B.1). If an institution develops on one of these unequal equilibria, one side might be permanently disadvantaged.

FURTHER READING

- BAIRD, DOUGLAS G., ROBERT H. GERTNER AND RANDAL C. PICKER, GAME THEORY AND THE LAW (Cambridge, MA: Harvard University Press 2000).
- BINMORE, KEN, NATURAL JUSTICE (Oxford: Oxford University Press 2005).
- FUDENBERG, DREW AND JEAN TIROLE, GAME THEORY (Cambridge, MA: MIT Press 1996).
- GOLDSMITH, JACK L. AND ERIC A. POSNER, THE LIMITS OF INTERNATIONAL LAW (Oxford: Oxford University Press 2005).
- GUZMAN, ANDREW T., HOW INTERNATIONAL LAW WORKS: A RATIONAL CHOICE THEORY (Oxford: Oxford University Press 2008).
- KREPS, DAVID M., A COURSE IN MICROECONOMIC THEORY (Princeton: Princeton University Press 1990).
- McAdams, Richard H., A Focal Point Theory of Expressive Law, 86 VA. L. REV. 1649–729 (2000).
- McAdams, Richard H., *The Expressive Power of Adjudication*, 5 U. ILL. L. REV. 1043–122 (2005).
- McAdams, Richard H. and Eric B. Rasmusen, *Norms and the Law*, in HANDBOOK OF LAW AND ECONOMICS II, 1573–618 (A. MITCHELL POLINSKY AND STEVEN SHAVELL eds, Amsterdam: Elsevier 2007).

⁸ Cf. Edna Ullmann-Margalit, The Emergence of Norms 134 *et seq.* (1977).

- MYERSON, ROGER B., GAME THEORY-ANALYSIS OF CONFLICT (Cambridge, MA: Harvard University Press 1997).
- POUNDSTONE, WILLIAM, PRISONER'S DILEMMA (New York: Anchor 1993).
- RASMUSEN, ERIC B., GAMES AND INFORMATION (2nd ed., Malden, MA: Blackwell 1994).
- SCHARPF, FRITZ W., GAMES REAL ACTORS PLAY: ACTOR-CENTERED INSTITUTIONALISM IN POLICY RESEARCH (Boulder: Westview Press 1997).
- SCHELLING, THOMAS C., THE STRATEGY OF CONFLICT (Cambridge, MA: Harvard University Press 1960).
- STRAFFIN, PHILIP D., GAME THEORY AND STRATEGY (5th ed., Washington, DC: The Mathematical Society of America 2004).
- Sugden, Robert, Spontaneous Order, 3 J. ECON. PERSPECT. 85-97 (1989).
- ULLMANN-MARGALIT, EDNA, THE EMERGENCE OF NORMS (Oxford: Oxford University Press 1977).

Young, H. Peyton, The Evolution of Conventions, 61 ECONOMETRICA 57-84 (1993).

5. Contract theory and the economics of contract law

Klaus Ulrich Schmolke

In economics, contract theory deals with questions of how economic actors – as maximizers of their own utility – behave in certain contractual arrangements, and the implications of such behavior in terms of efficiency. Put differently and in more normative terms, contract economics is interested in constructing efficient contract designs given the incentives of the parties. Due to imperfect information and other causes, the parties are sometimes not able to reach the optimal solution, that is, the contract maximizing their joint utility, on their own. Then the question arises whether contract law can help to mitigate the ensuing welfare loss.

I. WHY CONTRACTS?

The core notion of contract economics is – unsurprisingly – the contract. As a legal institution, the contract – defined as a voluntary agreement governing the exchange of goods and services between its parties and being enforced by the courts – is well known to lawyers. As a device that facilitates exchange, the importance of the contract and contract law for a modern market economy is seemingly self-evident. When we recall the microeconomics view on exchange (see Chapter 3), this self-evidence may be doubted. In standard microeconomics, welfare-enhancing exchange is typically thought of as taking place as a series of spot transactions whereby goods, services, and money are simultaneously exchanged at a discrete point in time.

A. Exchange in an Ideal World: The Coase Theorem

When perceiving exchange as a costless spot transaction between two omniscient parties who know all the properties of the intended bargain, allocatively efficient outcomes will be achieved. This is also true when legal entitlements are bargained over. Take the following example from Ronald Coase's seminal article on 'The Problem of Social Cost':¹ A wants to build a factory emitting smoke with harmful effects right next to the residence of B. Regardless of whether we bestow the right to pollute upon A or the entitlement to prohibit pollution upon B, pollution will turn out to be at the same efficient level. As long as an additional unit of pollution is more valuable to A than the harm caused by it is detrimental to B, the additional pollution will take place. If B has the right to prohibit pollution by A, the latter will pay B for allowing the additional pollution and reap the remaining surplus. If A has the right to pollute, B will stop A from adding a further unit of pollution by paying him as soon as the detriment of this further unit to B is larger than its benefit to A.

This is an illustration of the so-called *Coase Theorem*, which in its strong form comprises two hypotheses: first, the *efficiency hypothesis*, which is rather close to the initial statement of this section and in the words of Calabresi goes as follows: 'If people are rational, bargains are costless, and there are no legal impediments to bargains, transactions will . . . occur to the point where bargains can no longer improve the situation; to the point, in short, of optimal resource allocation.'² The second hypothesis, called the *invariance hypothesis*, states that this optimal resource allocation is independent of the initial allocation of legal entitlements.

Thus, while the parties (A and B) will cooperate in the described way to maximize their aggregate surplus without regard to the initial allocation of legal entitlements, the final *distribution* of the maximized surplus between A and B depends on this initial allocation (and on the bargaining power of the actors). However, this distribution is no matter of efficiency.

To do Coase justice, he never believed in the existence of a 'Coasian World' of zero transaction costs. He rather wanted to show the importance of legal rules in the real world, that is, a world with transaction costs, for achieving allocative efficiency. We will come back to that later on.

More important for now is the notion that, in this ideal Coasian World, contracts as economic or legal institutions are needed for reasons of efficiency only insofar as they make the parties of the exchange continue to accept the bargain struck as valid (and do not take back by force what they have traded away). But at least with regard to the exchange of goods this result may arguably also be achieved in the absence of contracts by a mere (but enforceable) ban of the rule of force.

¹ Ronald H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON. 1 (1960).

² Guido Calabresi, Transaction Costs, Resource Allocation, and Liability Rules: A Comment, 11 J. L. & ECON. 67, 68 (1968).

B. Contracts as Commitment and Coordination Devices

The proper value of enforceable contracts to the parties becomes clear when we add two features with regard to the intended exchange: (1) the passage of time, because one party performs in advance or investments have to be made prior to the then simultaneous exchange, and (2) uncer*tainty* about the counterparty's intentions and future actions. Examples are easily given: Suppose A needs a loan. Bank B will not grant one to A as long as B cannot enforce its repayment. Because of the advance payment by B (the grant of the loan) and the uncertainty with respect to A's intentions and future actions (will A repay or not?), B will insist on a credible commitment by A. An enforceable credit contract supplies the necessary commitment device. Such a commitment device may be necessary even if the exchange is performed simultaneously: Imagine A is a tailor specializing in bespoke suits. B wants to buy such a suit, but declines to pay in advance, because A could take the money without manufacturing the suit. Thus, A has to manufacture the suit in advance, but if he does so he has to invest in advance and rely on B to pay the agreed price. A cannot sell the suit to someone else, since it is customized. In other words: B made a specific investment when tailoring the suit. If A has no reason to trust B (i.e., if A is uncertain as to B's intentions and future actions), a credible commitment device is needed: an enforceable contract.

Contracts are also valuable to the parties as a *coordination device*. Suppose A and B want to exploit a gold mine. A has the money, B the expertise. Thus, they agree on a business contract promising each other to provide the money and the expertise, respectively. What they further need to get things going is a miner working in the mine. A will find a good enough miner if he looks for one. B knows the 'mining community'. So he will find a really good miner if he does the search. If both A and B look for a miner independently, they end up with two miners. This would leave the business still profitable, but they would make more profits by hiring only one miner. A and B could coordinate their actions by speaking to each other. B could announce: 'I will hire a miner.' But that may be 'cheap talk'. Assigning the task of hiring a worker to B in the enforceable business contract would therefore be even better. With these economic functions in mind, Shavell defines a contract as 'a specification of the *actions* that named parties are supposed to take at various times, as a function of the *conditions* that then obtain'.³

³ Steven Shavell, *Contracts*, in THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW, Vol. 1, A-D, 436, 436 (Newman ed., London: Palgrave Macmillan 1998).

II. MARKET IMPERFECTIONS AND THE CASE FOR CONTRACT LAW

Given the aforesaid and focusing exclusively on efficiency considerations, one may still wonder why there is more than just one contract law rule stating: 'All contracts entered into by mutual assent of the parties are recognized by law and enforced by the courts.' In the real world, however, there are factors and circumstances at play which often hamper the parties of a contract to strike the optimal bargain (market or bargaining failure, see Chapter 3, section V on market failure in general). Thus, even though both parties seek to maximize their joint utility by contracting, the content of the contract finally agreed upon may fall short of this aim. Worse still, the bargaining situation at hand may be affected by parameters that thwart the conclusion of a contract, so that there will be no contract at all. To illustrate the latter case, think of a consumer C who wants to buy a Blu-ray movie. The electronics retailer R – as all other retailers – only sells her products under the condition that the consumer agrees to her fine print. For C, being a very busy person, it is too onerous and costly to invest his precious time in reading the lengthy fine print for the purchase of a mere Blu-ray disc. But if C skips the reading and concludes the purchase anyway he takes the risk that R has 'hidden' a clause in the fine print that heavily disadvantages C. If C perceives the costs of taking this risk as higher than the benefit of the Blu-ray movie, he will abstain from purchasing the desired Blu-ray movie.

In such cases contract law may provide efficient means to lessen (the impact of) market imperfections, most notably imperfect information and incentive problems.⁴ Even if the law cannot bring about welfaremaximizing contracts (*first-best solution*), it may at least be able to effect a welfare gain (*second-best solution*). But the aforesaid only holds true under one crucial condition that those calling for the 'legal cure', that is, the intervention of the courts or the legislator, tend to forget: Intervention by (contract) law or otherwise is only indicated if the costs of intervention, or – even worse – exceed this gain (see also Chapter 6, section I on government failure). When this insight is neglected by the courts or the legislator, contract law may – in terms of efficiency or welfare maximization (on state intervention by means of contract law in the name of distributive justice,

 $^{^4}$ Cf. with regard to the regulation of 'contractual terms which have not been individually negotiated' ('fine print'), e.g., the European Directive 93/13/EEC on unfair terms in consumer contracts, 1993 O.J. (L 95) 29.

see below, section VI) – in itself become part of the problem instead of being part of the solution. In other words, merely leaving things be may be the best solution achievable!

Against the background of the above, we can easily see that contract theory and the economic analysis of contract law go hand in hand. Contract theory provides the insights to evaluate the legal environment of contractual arrangements: Are the legal constraints of the behavior or decision at hand merely an additional cost factor or a means to overcome market failure, and thus to reap additional welfare gains? As for the causes of market or bargaining failure, economists traditionally distinguish certain categories. Among these are (1) externalities, (2) imperfect or asymmetrically distributed information (information asymmetries), (3) market power, (4) imperfect rationality (limits of cognition), and (5) public goods (see Chapter 3, section V, and on imperfect rationality, Chapter 8). When looking for a 'common denominator' of all or most of these phenomena, Nobel laureate Oliver E. Williamson and like-minded economists found it in the notion of transaction costs (see Chapter 3, section V.C), thus establishing the so-called field of transaction cost economics.⁵ Others, especially those contract theorists inspired by game theory (see Chapter 4), tend to disagree: They see imperfect information of the parties as the main source of their non-optimal contracting. However, this dissension should not be overestimated, since the burden of overcoming imperfect information may be translated into transaction costs.

III. IMPERFECT INFORMATION – A CLOSER LOOK

Therefore, not only those contract theorists focusing on the economics of information, but also most transaction cost economists agree that imperfect information (most notably information asymmetries) is practically the most significant hindrance for efficient contracting. The impact of imperfect information on the efficiency of a contractual bargain becomes clearer if we retrace the following consideration: Pareto optimality of a contractual agreement requires the parties to be able exactly to price each and every parameter constituting the subject matter of the contract,

⁵ OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING 17 (The Free Press: New York 1985): 'This book advances the proposition that the economic institutions of capitalism have the main purpose and effect of economizing on transaction costs.'
including the expected value (see Chapter 2, section I.C.1) of the risks and contingencies attributed to one or the other party by the contract terms. This, in turn, makes it necessary for all parties to the contract to share every piece of information that is relevant to the pricing of these parameters. In reality, however, one party often has *private information* on the contractual subject matter not (initially) shared by the counterparty. The ignorance of this private information may lead to false prices and, in consequence, to inefficient outcomes.

A. The Problem of Adverse Selection

To show the detrimental impact of information asymmetries, George A. Akerlof, in his seminal article on the market for 'lemons', referred to the automobile market by way of example (he himself called it a 'finger exercise'), which shall be explained in the following: Assume that two types of used car are on the market: good cars, which are of good quality, and bad cars (known in the United States as 'lemons'), which are of bad quality. The seller who drove the car for a while knows whether his car is a good or a bad one. The potential buyers do not. What they do know is that it is either a good or a bad car. Without further information potential buyers will attach a probability of 0.5 to the car at hand being a good car (p_g) and – correspondingly – a probability of 0.5 to the car being a bad one ($p_b = 1 - p_g$). Now suppose that the bad car is worth $\epsilon 2,000$, while a good car is worth $\epsilon 4,000$. In this case, the expected value of the car sold is $\epsilon 3,000$ (= $0.5 \times \epsilon 2,000 + 0.5 \times \epsilon 4,000$) if the potential buyer is risk neutral (see Chapter 2, section I.C.1 on risk preferences).

What will happen under these circumstances? The potential buyers will not be willing to pay more than €3,000 for the used car. The sellers of good cars, however, will not sell below €4,000. Thus, they will be driven out of the market. Only the sellers of bad cars will remain. As a result, even though there is demand for used cars of good quality, their sellers will leave the market. This is already bad, but things get even worse: Suppose the remaining bad cars are not of a single bad quality, but their quality is equally distributed within the range of corresponding values from €1,000 (worst cars) to €3,000 (best of the bad cars). In other words, the *expected* value of the bad type is €2,000. After the cars of a quality worth more than €3,000 drop out of the market, the potential buyers will observe this decline in overall quality and hence adapt their value estimations to an expected value of the individual car of €2,000. As a consequence, now even the remaining cars of a quality higher than $\notin 2.000$ leave the market. This game will repeat itself until there are only cars worth €1,000 left in the market (assumed to be of the lowest quality). This 'race to the bottom' is

known as the problem of adverse selection. To sum up, due to the hidden characteristic of the used car's quality, the welfare-maximizing sale of used cars of good quality will not be concluded. State intervention (by law) may be warranted if the market does not come up with a solution of its own.

B. Signaling

What the Akerlof model of the adverse selection dynamic does not take into account is that at least some sellers and buyers may have incentives to provide or acquire more information about the quality of the respective car to close the information gap.

The concept of signaling 1.

In our example of a market for used cars, the sellers of good cars are supposedly eager to convey their private information of the cars' quality to the potential buyers. This can be accomplished by *signaling* the quality of their car by way of the terms of their offer. Since all sellers are likely to advertise their cars as 'good' ones, this signal has to be credible in such a way that the initially uninformed buyers are capable of distinguishing the quality of the car on the basis of the signal. The sellers of good cars will thus try to choose a signal that is too costly for sellers of bad cars.

In our used car example, the issuance of a warranty by the seller would be a signal with such properties. Suppose the seller promises to repair the car free of charge within a certain time period after the conclusion of the contract, in case a defect should occur. Such a warranty is evidently less costly for the seller of a good car, since the probability of a defect occurring is relatively low, while it is relatively high for bad cars. Thus, a seller of good cars can afford this signal, whereas the signaling costs of such a warranty may be too high for sellers of bad cars. In this case, they will only offer their cars without such a warranty.

2. Signaling that is too costly

However, a signal will not be sent if it does not pay off because the costs of signaling are too high, that is, the benefits gained by signaling are lower than the signaling costs themselves. Joseph E. Stiglitz illustrated this mechanism by referring to an employee being assigned to an assembly line.⁶ The employer is not able to determine by herself the productivity of the individual worker. Thus, every worker earns the same wages, whereas

⁶ Joseph E. Stiglitz, *The Theory of 'Screening', Education, and the Distribution* of Income, 65 AM. ECON. REV. 283 (1975).

the employer would be willing to pay more to workers with high productivity. The worker could signal his high productivity by working really hard, which comes with a cost c. This would result in a pay raise of b. As long as $c \ge b$, the signal is not worth the effort. Hence, no signaling will take place.

3. Signaling and state intervention

Signaling is a market mechanism to overcome the problem of adverse selection. One may also think of alternative state intervention to cope with the welfare loss associated with this problem, especially when signaling may be too costly. For example, in the US, several states passed so-called 'Used Car Lemon Laws' which require the dealers of used cars to give consumers a written warranty that depends on the mileage of the car. Sellers of really bad cars then drop out of the market, since for them this warranty obligation is too costly. The main purpose of such laws, however, is not to overcome asymmetric information, but to protect consumers from potentially dangerous cars.

Such laws typically only provide minimum standards as to the quality of a product or the abilities of a service provider. Therefore, informed sellers or service providers may still have incentives to send distinguishing signals showing the superiority of their products or services. For example, Articles 3 and 5 of the European Directive on certain aspects of the sale of consumer goods⁷ provide for a mandatory liability of sellers in case the sold goods are not in conformity with the contract and the lack of conformity becomes apparent within two years as from delivery of the goods. A seller who is convinced of the superior quality of her goods may therefore signal this information by voluntarily prolonging this liability beyond the mandatory two-year period.

C. Screening

1. Screening as a means to gain information about potential counterparties

While Michael Spence contributed the theory of signaling to the analyses of markets affected by information asymmetries,⁸ Joseph Stiglitz was among the first to propose a theory on screening.⁹ *Screening* describes the

⁷ Directive 1999/44/EC, 1999 O.J. (L 171) 12.

⁸ Michael Spence, *Job Market Signaling*, 87 Q. J. ECON. 355 (1973).

⁹ Joseph E. Stiglitz, *The Theory of 'Screening,' Education, and the Distribution of Income*, 65 AM. ECON. REV. 283 (1975). On 10 October 2001, the Nobel Prize in

inverse scenario to signaling: Here it is the uninformed party who adopts costly means to get more information about the abilities of the potential counterparty or the quality of her goods, respectively. The uninformed party 'screens' the potential counterparties.

Rothschild and Stiglitz illustrate this mechanism by referring to the insurance market where insurance companies sell insurance contracts to individuals.¹⁰ These individuals, being risk-averse, purchase insurance to smooth out their expected income losses by accidents occurring with probability *p*. Since their marginal utility of income declines (see Chapter 2, section I.C.1), they are willing to pay an insurance premium that is slightly higher than the expected income loss due to accidents. Now assume there are two types of individuals: those with a low probability of accidents p_l ('good type') and those with a high probability of accidents p_h ('bad type'). From the insurance companies' point of view, the question now arising is which contracts to offer, and to whom, in order to maximize their expected profits.

However, while individuals know to which type they belong, the insurance companies do not know – by assumption – the accident probabilities of the individuals and are therefore not able to discriminate between good and bad types without further information. Thus, they will search for screening devices in order to get this information and, in turn, be able to adjust the contract terms to the individual's propensity to incur accidents.

2. Self-selection by contract

One technique of screening is to force the counterparties, that is, the insurance customers, to reveal private information by the terms of a pricing scheme included in the contract offer. This mechanism is called *self-selection*. In our insurance market example, such a self-selection device may look as follows: The insurance companies offer two different kinds of contract. The first kind offers full coverage and comes at a relatively high price (insurance premium). The second kind provides for retention of a certain amount in case an accident occurs (partial coverage), which is reflected in a lower insurance premium. For customers of the good type, it may be more attractive to choose the contract that only partially covers their losses, since their probability of incurring an accident is low. At the

Economic Sciences was awarded to Akerlof, Spence, and Stiglitz, 'for their analyses of markets with asymmetric information'.

¹⁰ Michael Rothschild and Joseph E. Stiglitz, *Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information*, 90 Q. J. ECON. 629 (1976).

Туре	Probability of accident	Costs of accident	Premium for full coverage	Premium for 80% coverage	Certain loss in the case of full coverage	Expected loss in the case of 80% coverage
Good	10%	100	21	18	21	20
Bad	20%	100	21	18	21	22

 Table 5.1
 Self-selection in the insurance market (separating equilibrium)

same time, the bad-type customers may be better off with full coverage due to their higher propensity to be involved in accidents.

The numerical example in Table 5.1 illustrates the aforesaid: The bad type has a probability p_h of 20 percent to incur an accident at a cost of 100, which translates into an expected loss of 20. Thus, full coverage at a premium of 21 leaves her with a certain loss of 21, that is, the premium payment ($0.2 \times 100 - 0.2 \times 100 - 21$), whereas a partial coverage of 80 percent at a premium of 18 amounts to an expected loss of 22 ($0.8 \times 0.2 \times 100 - 0.2 \times 100 - 18$). She therefore prefers full coverage. On the other hand, the good type having a probability p_1 of 10 percent to incur an accident at a cost of 100 has an expected loss of 20 when choosing only partial coverage ($0.8 \times 0.1 \times 100 - 0.1 \times 100 - 1.1 \times 100 - 2.1$). Thus, she prefers the contract with partial coverage as long as the utility gain achieved by excluding the residual risk is < 1.

Even though both types incur pecuniary losses, they nevertheless conclude an insurance contract as long as they have a utility gain due to their supposed risk aversion. However, compared to a state of perfect information, there is a utility loss to the good type, who prefers to obtain full coverage insurance due to his risk aversion!

It goes without saying that screening by offering self-selecting contracts only works under the assumption that the uninformed party (the insurance company) comes up with a pricing scheme that separates the different customer types because all types are better off with the contract aimed at their respective type (*separating equilibrium*).¹¹ In contrast, a pricing scheme does fail as a screening device, when different types of

¹¹ Michael Rothschild and Joseph E. Stiglitz, *Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information*, 90 Q. J. ECON. 629, 633 (1976) define: 'Equilibrium in a competitive insurance market is a set of contracts such that, when customers choose contracts to maximize expected utility, (i) no contract in the equilibrium set makes negative expected profits; and (ii) there is no contract outside the equilibrium set that, if offered, will make a nonnegative profit.'

Туре	Probability of accident	Costs of accident	Premium for full coverage	Premium for 80% coverage	Certain loss in the case of full coverage	Expected loss in the case of 80% coverage
Good	10%	100	21	19	21	21
Bad	20%	100	21	19	21	23

 Table 5.2
 Self-selection in the insurance market (pooling equilibrium)

counterparties choose the same kind of contract, because it is the utilitymaximizing choice for both (or all) types (*pooling equilibrium*). In consequence, no private information is revealed to the uninformed offeror. To illustrate this, take the numerical example shown in Table 5.2.

The numerical example in Table 5.2 differs from the one given in Table 5.1 only insofar as the premium for partial coverage is 19 instead of 18: For the bad type, nothing changes. The certain loss of 21 when choosing the contract with full coverage is now even more attractive in comparison to the contract with partial coverage, which for her results in an expected loss of 23 ($0.8 \times 0.2 \times 100 - 0.2 \times 100 - 19$). For the good type, however, the situation differs from the former scenario: Choosing the partial coverage now results in an expected loss of 21 ($0.8 \times 0.1 \times 100 - 0.1 \times 100 - 19$), while full coverage at a premium of 21 results in a *certain* loss of 21. Thus, under these conditions, the good type also prefers the contract with full coverage, since he prefers – by assumption – to eliminate the residual risk that is associated with the partial coverage.

When such a pooling equilibrium occurs, the good types pay a rather high price for the respective service or good by which they typically crosssubsidize the bad types who pay too low a price given their risk characteristics. Welfare losses may occur because the pooling contract provides suboptimal incentives for the bad types to avoid the respective risk and, furthermore, because for some good types insurance is too expensive. As a consequence, the latter abstain from buying insurance even though they would prefer to have it.

3. Reduction of screening costs by state intervention

The costs of screening may be (substantially) reduced by state intervention. For example, section 21(1) of the Australian Insurance Contracts Act 1984 (IC Act) states that:

[A]n insured has a duty to disclose to the insurer, before the relevant contract of insurance is entered into, every matter that is known to the insured, being a matter that . . . the insured knows to be a matter relevant to the decision of the

insurer whether to accept the risk and, if so, on what terms; or \ldots a reasonable person in the circumstances could be expected to know to be a matter so relevant.

If the insured fails to comply with this duty of disclosure or makes a misrepresentation in a non-fraudulent manner, the claim of the insured against the insurer is, according to section 28 of the IC Act, reduced 'to the amount that would place the insurer in a position in which the insurer would have been if the failure had not occurred or the misrepresentation had not been made'.

D. Market Power and Asymmetric Information

Monopoly or market power is known as a classic cause of market failure. As has already been shown, a monopolist reduces the supply of his goods to a level below the optimal to maximize his producer surplus, causing a welfare-decreasing 'dead weight loss' (see Chapter 3, section V.A). This concept has been transferred to the realm of contracts in order to explain inefficient contract terms. In a paper from the 1940s pioneering the idea, the German emigré Friedrich Kessler wrote that standard contracts were typically used by enterprises with strong bargaining power. They offered these kinds of contracts to the 'weaker' counterparties who were only left to accept the standard terms or abstain from the bargain. Such standard-ized contracts were therefore 'contracts of adhesion; they are *à prendre ou à laisser*'.¹² Hence, the argument continues, the law has to step in.¹³

Economists will only be bothered by bargaining power as far as it causes a welfare loss. In case it does, the lawyers will ask whether and how the legal environment may reduce this welfare loss. We can only answer this question when we remind ourselves that monopoly power alone is not the cause of the welfare loss, described elsewhere as 'deadweight loss'. If the monopolist were able to discriminate price perfectly, she would reap the maximum surplus without any welfare loss. Thus, the welfare loss occurring in cases of monopoly power is ultimately caused by the imperfect information of the monopolist about the individual reservation prices of her counterparties (see Chapter 3, section V.B).

Drawing on this insight, Richard Craswell rightly pointed out that a

¹² Friedrich Kessler, *Contracts of Adhesion: Some Thoughts about the Freedom of Contracts*, 43 COLUM. L. REV. 629, 632 (1943).

¹³ Cf., for a real-life example, the decision *Macaulay v. Schroeder Publishing Co Ltd*, [1974] 1 W.L.R. 1308 (H.L.); on this decision, see Michael Trebilcock, *The Doctrine of Inequality of Bargaining Power*, 26 U. TORONTO L.J. 359 (1976).

monopolist may have the incentive to charge a high price to reap a high profit. But she will not have an incentive to do this indirectly by demanding inefficient contract terms, when this can be done straightforwardly by raising the monetary price of the good or service offered. This is so, because an *inefficient* contract term by definition does not yield as much profit for the monopolist as it causes costs for the counterparties. If we therefore observe inefficient terms in contracts offered by a monopolist, these terms may be used to discriminate between different groups of counterparties, that is, as a *screening device*. To intervene legally by declaring such terms null and void would only cause the monopolist to demand the same price from all potential counterparties. However, the welfare consequences of such a strategy change are far from clear. Thus, Craswell concludes, 'the focus on monopoly power is really a red herring where contract terms are concerned. If courts and laypeople tend to associate inefficient terms with monopolies, it's probably because monopoly is the only form of market failure that courts and laypeople are familiar with.¹⁴

IV. COGNITIVE LIMITS AND COGNITIVE FAILURES

A. The Limits of Cognition as a Source of Imperfect Information

Like the Coase Theorem, contract theory traditionally assumes rationality of the contracting parties in line with the model of the homo economicus (see Chapter 2, section I.C). The assumption of rationality is crucial to the case for freedom of contract and against state intervention. The parties can only be relied upon to maximize their joint welfare if they are capable of correctly calculating the (subjective) expected utility of their options (see above, section III).

However, there is overwhelming empirical evidence that this assumption of (formal) rationality does not hold. To begin with, it cannot be denied that human decision-makers only have a limited capacity to search for, absorb, and compute information. This *bounded rationality* of human actors is the starting point for a more realistic model of decision-making, which its inventor Herbert Simon dubbed 'satisficing'.¹⁵ At its core

¹⁴ Richard Craswell, *Freedom of Contract*, COASE LECTURE SERIES, 6 *et seq*. (University of Chicago 1995).

¹⁵ See, e.g., Herbert Simon, *Theories of Decision-Making in Economics and Behavioral Science*, 49 AM. ECON. REV. 253, 262–4 (1959).

lies the idea that the human actor does not aim for the optimal, that is, utility-maximizing choice, since this is too costly due to his limited capacities to gather and assess information. Thus, he contents himself with choosing a satisfactory option, thereby saving 'choosing costs'. This is, on balance, the rational course of action for a boundedly rational actor. Even worse, human decision-makers are not only boundedly rational, but also prone to making systematic errors, especially when deciding under uncertainty (see Chapter 8, sections III.B and C for further details on bounded rationality and systematic decision-making errors of human actors). Melvin A. Eisenberg was supposedly the first scholar to perform an indepth analysis on what these findings imply for the freedom of contract and its limitation by contract law.¹⁶ His main argument is that contracting parties misperceive or miscalculate contractually relevant risks as well as the utility of contractual terms allocating these risks. As a consequence, the conclusion of the contract and its terms are incorrectly priced by one or both parties. Therefore, they do not opt for the contract that maximizes their joint utility. The ensuing welfare loss may, in turn, justify state intervention by contract law.

With regard to bounded rationality, contract theorists soon incorporated the insights of Herbert Simon into their analyses without abandoning the traditional rational choice model. They did this by recognizing 'costs of reading' or 'costs of understanding' as a further type of transaction costs. From this perspective, bounded rationality and, more generally, the limits of cognition of one or both parties to a contract may be perceived as a problem of imperfect information. Most economists nowadays, however, especially the proponents of behavioral economics (see Chapter 8 for details) classify cognitive limitations and errors in decision-making caused by biases and the application of heuristics as an independent category of market or bargaining failure (see above, section II).

B. State Intervention by Paternalist Contract Law

The discovery by psychologists and experimental economists of ever new 'anomalies', that is, deviations of human decision-making behavior from the rational choice model, inspired legal scholars to propose a policy of legal paternalism: The erring and rationally deficient human actor shall be protected by the law from his own false decisions. These issues will be discussed in general and at length in Chapter 8. For the purposes of this

¹⁶ Melvin A. Eisenberg, *The Limits of Cognition and the Limits of Contract*, 47 STAN. L. REV. 211 (1995).

chapter, it suffices to give a concluding example of (paternalist) contract law addressing the limits of cognition of the (prospective) parties.

Under Article 18 of the European Directive on mortgage credits,¹⁷ the creditor is not only obliged to assess the creditworthiness of the consumer (debtor). He also has the duty to make the credit available to the consumer only under the condition that 'the result of the creditworthiness assessment indicates that the obligations resulting from the credit agreement are likely to be met in the manner required under that agreement'. Given the typical risk structure of a credit contract and the incentives of the parties to such a contract, this provision seems odd. If the creditor is ready to take the default risk, why should she be obliged to refrain from concluding the credit contract which the consumer obviously wants as well?

For an answer to this question, one has to take into account that the European legislator adopted this provision (among others) 'to prevent household over-indebtedness'. Thus, the European legislator is skeptical when it comes to the ability of consumers to assess correctly their risk of defaulting on a mortgage credit contract. Consumers therefore shall be kept from concluding credit contracts which – unbeknown to themselves – overburden them.

V. INCENTIVE PROBLEMS AND IMPERFECT INFORMATION AFTER CONTRACT CONCLUSION

A. Moral Hazard

1. The phenomenon of moral hazard

Information asymmetries not only occur at the time the contract is concluded, but also thereafter when it is executed. Such information asymmetries may lead to welfare-decreasing incentive problems, the most famous of which is known as *moral hazard*. The term purportedly has its origins in the insurance industry and can be easily depicted in this very context by referring and extending the example given above (see above, section III.C.2 with Table 5.1): Suppose the customer who is more prone to having accidents (bad type) buys insurance with full coverage from an insurance company. Due to his probability of 20 percent of being involved in an accident with costs of 100 *ex ante*, the bad type has to pay an insurance premium of 20 plus administration costs and entrepreneurial profit

¹⁷ Directive 2014/17/EU, 2014 O.J. (L 60) 34.

of the insurance company. The problem now is that, due to the full insurance, the bad type has less than optimal incentives to take precautions for avoiding the risk. In consequence, the probability of an accident actually occurring rises.

The insurer would want to take care of this problem by imposing certain duties of conduct on the insured to restrain the scope of his actions. An insurance company insuring car accidents could, for instance, contractually oblige the insured to take care of the lights and brakes of her car. But this mechanism will not help as far as the actions of the insured cannot be observed by the insurance company (*hidden action*). For example, the insurance company typically does not know whether the insured drives aggressively and inattentively or safely and foresightedly.

2. Agency contracts: The principal-agent conflict

The incentive problems just described may also occur with regard to agency contracts, such as employment or service contracts, or in similar arrangements like the appointment as a corporate director: The agent acts on behalf of his principal, that is, the employer or the corporation (and the shareholders as its owners), and is therefore obliged by contract or appointment to act in the best interest of the principal. The principal, in turn, provides 'payoff rules' or a 'fee schedule' that lay out the pay the agent receives depending on her actions. Therefore, the agent's actions affect both the welfare of the principal as well as the welfare of the agent.

By assumption, though, the agent is as much a maximizer of her *own* utility as the principal. Thus, incentive problems arise under the condition of asymmetric information, that is, uncertainty of the principal about the actions of the agent. Arrow distinguished two main categories of such unequal information distribution.¹⁸ Firstly, information asymmetries occur where the actions of the agent¹⁹ cannot be observed and cannot be precisely inferred from the outcome either (*hidden action*). Secondly, the agent has private information because she made an observation the principal has not made; thus, the principal cannot observe whether the agent uses this information in the best interest of the principal or not (*hidden information*).

To illustrate the problem, think of a managing director of a company doing business on behalf of the shareholders of the company. The managing director of the company is the agent of the shareholders (principal) and

¹⁸ KENNETH J. ARROW, THE ECONOMICS OF AGENCY 3–6 (Institute for Mathematical Studies in the Social Sciences paper, Stanford University 1984).

¹⁹ Id., at 3: 'The most typical <u>hidden action</u> is the effort of the agent.'

therefore obliged to act in the best interest of the company and its owners. Now suppose the managing director runs a company that manufactures and sells beverages (the L-Company, henceforth L). L buys large amounts of Cola syrup from the Coca-Cola Company which is sold at L's stores, but L is investigating a change of supplier due to the high costs of the syrup. The managing director now acquires the information that the National Pepsi-Cola Company, which possesses a secret formula and trademark, is bankrupt. Hence, formula and trademark are offered for sale to the director in his capacity as an agent of L. Instead of buying the formula and trademark for L and thereby seizing the corporate opportunity for his principal, the director captures it for himself without the knowledge of the board of directors of L, sets up a new company wholly owned by him and further on sells the Pepsi syrup to L with a profit.²⁰

3. Solution strategies: Monitoring and alignment of interests by incentive pay

What to do about these incentive problems? Economic theory has put forward mainly two different strategies to address these issues, which may be combined. The first strategy is *monitoring*: The principal may control the actions of the agent by requesting reports, paying her unheralded visits, or assigning a different kind of agent with the task of controlling and supervising the agent. Thus, by monitoring, the principal intends to uncover the formerly hidden action or hidden information. The information gap is thus narrowed. The range of occasions on which the agent may deviate from the best interests of the principal is reduced, as is the range of actions deviating from the principal's best interests, should such an occasion occur.

For example, a company's board of directors regularly consists not only of managing directors who run the company, but also of independent directors supervising and controlling the actions of the former. In German stock corporation law, there are actually two boards: A managing board (*Vorstand*), which is controlled and monitored by a supervisory board (*Aufsichtsrat*).

The second strategy to address the incentive problems of an agent acting on behalf of a principal is the *alignment of interests*. Here, the agent is not 'forced' to comply with the interests of the principal by uncovering (potential) hidden actions and thereby reducing the information gap between principal and agent. Instead, the agent is 'induced' to act in the best

 $^{^{20}}$ Cf. the Delaware case *Guth v. Loft, Inc.*, 5 A.2d 503 (Del. 1939), the facts of which have been simplified here.

interest of her principal by making it in her own best interest to do so. The most common measure to achieve this goal is incentive pay. Think again of a company's managing director. Typically, his remuneration not only consists of a fixed salary, but also of a proportion of variable pay. This variable pay is typically tied to the company's performance. At first, stock options were deemed to be the ideal tool to align the interests of executives with the best interests of their firm. Nowadays, too large a proportion of variable pay and especially the provision of stock options are considered harmful by many since this induces risk-seeking behavior. In the aftermath of the 2008 financial crisis, a lively debate has been going on as to how bankers and managers should be properly incentivized in order to induce them to act in the long-term interest of their firms.

However, implementing these strategies comes at a cost. Such costs are called *agency costs*, which also comprise the original welfare loss caused by using suboptimally incentivized agents.

4. State intervention by law

The state tries to lower agency costs through legal intervention. Company law, for example, provides monitoring structures, which experience has shown to be useful in restraining the management from acting to the detriment of the principal. One such device is the mandatory supervisory board that German stock corporation law stipulates. A means of interest alignment would be to hold the agent liable for not acting in the best interest of her principal. Recall the managing director of the L-Company (see section V.A.2): US corporation law recognizes the so-called 'corporate opportunities doctrine', whereby directors and officers of a company are held accountable for misappropriating the business opportunities of their company. The idea is that due to these liability rules it is no longer worthwhile for a director or officer to diverge from the company's, that is, the shareholders', best interest ex ante. Finally, it seems noteworthy that after the financial crisis of 2008 many company laws stipulated rules for executive remuneration to prevent a compensation scheme from setting perverse incentives to the detriment of the company and its shareholders.

B. Long-Term Contracts, Opportunism, and the Cost Trade-Off of the Parties

1. The limits – transaction costs and bounded rationality

The aforementioned problems are typically exacerbated when the parties enter long-term contracts, sometimes also called 'relational contracts'. As their name already indicates, they are intended to govern the conduct of the parties for a longer, sometimes indeterminate duration. Such contracts are concluded when their subjects require considerable specific investments and consecutive transactions. The subject matter covered by such contracts is typically complex. This complexity, as well as the need to project the contractual relationship into the contingent future, leads to a high level of uncertainty. In short, relational contracts are concluded 'where transactions (1) are recurrent, (2) entail idiosyncratic investment, and (3) are executed under greater uncertainty'.²¹

Due to the bounded rationality of the parties, that is, their bounded capacity to absorb and compute information (see above, section IV.A.), those contracts are necessarily incomplete to a considerable extent: Even though the parties recognize the need to modify and specify their contractual relationship in the future, they do not negotiate the respective terms *ex ante* due to the prohibitive costs of such negotiations. As a consequence, even important aspects of the contractual arrangement may not be governed by a precise and substantiated program of duties.

Against this background of a necessarily incomplete contract, the parties expect to renegotiate and adapt the original allocation of risks when future events so demand. The termination of the contract is typically no feasible alternative path of action since it would devalue the specific investments already made by the parties. This is true at least as long as those investments have not been redeemed. Hence, the parties are 'locked in' the contractual relationship.

2. The threat – opportunism ex post

These features of a long-term contractual relationship would be less of a problem if the parties agreed upon a rule whereby they commit themselves to filling the gaps in their contract sequentially in a way that maximizes their joint utility.²² However, this efficient path of mutual cooperation is threatened by the parties' opportunism. Williamson defines such *opportunism* as 'self-interest seeking with guile'.²³ It may cause the parties to act in ways that further their own advantage, but frustrate outcomes

²¹ Oliver E. Williamson, *Transaction-Cost Economics: The Governance of Contractual Relations*, 22 J. L. & ECON. 233, 259 (1979).

²² Cf. OLIVER E. WILLIAMSON, THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING 48 (New York: The Free Press 1985): '[P]roblems during contract execution could be avoided by *ex ante* insistence upon a general clause of the following kind: I agree candidly to disclose all relevant information and thereafter to propose and cooperate in joint profit-maximizing courses of action during the contract execution interval, the benefits of which gains will be divided without dispute according to the sharing ration herein provided.'

²³ Id., at 47.

that are superior from a welfare perspective. Since cooperation during the contract execution period is generally for the mutual benefit of both parties, opportunistic behavior only emerges where the expected short-term gains of defection are higher than the expected long-term gains of cooperation. The occurrence of such 'high-value opportunism'²⁴ obviously depends on the discount rate the parties apply to future gains.

3. The trade-off - transaction costs versus governance costs

Given the aforesaid, the parties of a long-term contract have to accomplish a twofold task: On the one hand, they aim to minimize the transaction costs *ex ante*, not least due to their bounded rationality. On the other hand, the parties strive to implement safeguards against *ex post* opportunism. Both goals have to be traded off, however, since the reduction of transaction costs *ex ante* typically increases the hazard of opportunism or, alternatively, the governance costs necessary to hold opportunism at bay *ex post*.

4. The law – part of the solution or part of the problem?

What part does the law have to play in this long-term contract scenario? At its best, the law can be an effective means to lower the sum of the costs of opportunism and the costs to avoid opportunism, which comprise the transaction costs *ex ante* as well as the governance costs *ex post*. Legal default rules may help to further this aim (at least) in three different ways: Firstly, they inform the parties about the issues and aspects which are of significance to their contractual arrangement. Secondly, they relieve the parties of the burden to negotiate each and every aspect of their contractual relationship, thus allowing them to focus on the important issues. Thirdly, default rules fill the gaps the parties left after concluding their negotiations.

Donald J. Smythe distinguishes (at least) five beneficial effects that contract law, as a means of reducing the likelihood of *ex post* opportunism, may have on long-term contractual relations: Such a law 'will (1) increase the longevity of relational contracts, (2) improve the cooperativeness of relational contracts, (3) increase the size of investments under relational contracts, (4) decrease expenditures on special arbitration procedures, and (5) decrease the volume of the transactions conducted under less efficient governance structures ...²⁵

²⁴ See E. Posner, A Theory of Contract Law under Conditions of Radical Judicial Error, 94 Nw. U. L. REV. 749, 761 (2000).

²⁵ Donald J. Smythe, *Bounded Rationality, the Doctrine of Impracticability, and the Governance of Relational Contracts,* 13 S. CAL. INTERDISC. L.J. 227, 267 (2004).

So far, legal intervention in long-term contractual arrangements sounds like a success story. But the law can also become part of the problem: For example, it is well known that legal rules and arrangements that are intended to protect one party from opportunistic behavior of the other party may under unfortunate circumstances be misused by the protected party for a different kind of opportunism. This can be perceived as a manifestation of moral hazard: The protective legal rule may work like an insurance insulating the protected party from the adverse consequences of defection. This, in turn, may stifle his incentives to uphold the cooperative equilibrium of the contractual arrangement. Furthermore, when contractual partners take their quarrels to court, there is always the possibility that the judge – being an outsider to the parties' relationship – may misinterpret a certain course of action. What he thinks of as opportunistic behavior may actually be an appropriate means of retaliation that pushes the defecting counterparty back on the path of cooperation and vice versa.

Because of these dangers of dysfunctional or misapplied law, some legal scholars argue for restraining the role of law (in favor of social norms) as a means of stabilizing a welfare-enhancing cooperative equilibrium in long-term contractual relations. The law should – so the argument goes – only be employed for a 'large strike', that is to impose strict sanctions in the case of 'large scale opportunism'.

5. Application – minority protection in the close corporation

A prominent field where legal rules are applied to abate ex post opportunism in long-term contractual arrangements is the protection of minority shareholders of close corporations. These rules address the following problem: close corporations own the features of long-term contracts, as described above. To smooth the decision-making process with regard to the conduct of the underlying business, the majority principle is generally the legal default rule. This may become dangerous for a shareholder who finds himself in the minority faction later on. The majority might be tempted to abandon the course of cooperation that maximizes the joint profits of the shareholders in favor of a more opportunistic course of action that disproportionately benefits the majority faction. Since there is no liquid market for memberships in a close corporation, the exit by sale of shares is no realistic option for the aggrieved minority. Hence, the minority shareholder is 'locked in'. Company law provides certain protective measures to help the minority in distress: In UK company law, for example, according to section 994 of the Companies Act 2006, a member of a company may apply to the court by petition for an order on the grounds 'that the company's affairs are being or have been conducted in a manner that is unfairly prejudicial to the interests ... of some part

of its members (including at least himself)'. To take another example, in German close corporation law a shareholder is entitled to leave the company 'for good cause', which also captures cases of a severe disruption of the members' relationship. In this case, the departing shareholder is entitled to 'full compensation' for the loss of his membership. More problematically, this right to 'full compensation' is also granted to departing members who have been expelled by the company, that is, the majority of the shareholders, for good cause. However, this statutory default provision may backfire, since it insures the shareholder even when he himself is defecting (moral hazard). Therefore, the parties often provide for a deduction from the full compensation in the articles of association to incentivize cooperative behavior.

VI. THE UNEASY CASE FOR 'DISTRIBUTIVE JUSTICE' IN CONTRACT LAW

The economic approach to contracts and contract law aims at maximizing social welfare, which in the context of contracts often means maximizing the welfare of the (prospective) parties to the contract. Hence, contract theorists are typically unconcerned about how the welfare gains reaped by the conclusion and execution of a contract are distributed among the parties. From a legal perspective, this seems odd at first glance, since the notion of 'distributive justice' plays a rather prominent role in contract law debates among legal scholars, especially when the law of consumer contracts is concerned. This raises the question: Is common ignorance with regard to distributive issues a serious flaw in the economic approach to contract design and contract law, or is there a convincing justification for focusing on issues of welfare maximization?

While economists are not oblivious to the necessity of redistributing resources by state intervention (see Chapter 1, section IV.D.1 with regard to the constitutional boundaries of exclusively pursuing welfare maximization in terms of efficiency gains), most of them agree that private law is a comparatively clumsy, unreliable, and inefficient means to redistribute resources. With regard to contract law in particular, economists further some noteworthy arguments for this viewpoint, which should at least be known by a contract lawyer, even if she dissents from their conclusion: The party burdened by the law with the costs of disadvantageous contract terms, for example, the entrepreneur or professional vis-à-vis consumers, regularly reacts to such intervention by raising the price for her product or service. As a result, the consumer who is supposed to benefit from the legal intervention bears its costs in the end. The distributive effect

between professional and consumer parties is naught. To illustrate this mechanism, let us draw again on the European Directive on the sale of consumer goods, which provides for a mandatory liability of sellers in the case where the sold goods are not in conformity with the contract and the lack of conformity becomes apparent within two years as from delivery of the goods (see above, section III.B.3). This liability comes at a cost for the seller, who therefore calculates the expected costs for each good sold and raises the price of the good accordingly. The consumer is now insured, which she appreciates under the assumption of risk aversion, but pays the price for this insurance.

Now let us assume that the party burdened by mandatory contract terms cannot pass on the whole costs of such terms, but only part of the costs. In this case, the intentionally burdened party has indeed to bear the costs, or part of the costs, associated with the legal rule. But does it benefit the counterparty? It has rightly been remarked that the unwillingness of the counterparty to bear the whole costs of such mandatory contract terms indicates that he does not appreciate the terms that much, at least not enough to pay for them. Craswell generalized this insight with regard to consumer contracts: 'Paradoxical as it may seem, the rules whose costs are most heavily passed on are also the rules that will benefit consumers the most.'²⁶

Some scholars believe that the unwillingness of contractual parties to pay for certain terms is the very reason why the social planner (the legislator) makes them compulsory. However, those who try to justify interventions that cause such effects (solely) by reference to the notion of 'distributive justice' have a hard time. The crucial point seems to be that the social planner assumes that the unwillingness to pay for the term is based on a flawed decision-making process, that is, because it is caused by limits of cognition (see above, section IV): If the consumer correctly understood the impact of the mandatory term, he would pay for it.

Mandatory contract terms may have distributive effects of a different kind: Suppose the preferences of the demand side (consumers) are heterogeneous with regard to the mandatory contract term. As a consequence, some consumers profit from the term in question, while others incur losses. In this scenario, the redistribution does not take place between the consumers and their professional counterparties, but among different subgroups of consumers. To illustrate this, let us draw again on the mandatory liability of sellers provided for in the European Directive on

²⁶ Richard Craswell, *Passing On the Costs of Legal Rules: Efficiency and Distribution in Buyer–Seller Relationships*, 43 STAN. L. REV. 361, 372 (1991).

the sale of consumer goods (see above, section III.B.3). This mandatory liability functions as an insurance against the risk that the good does not conform to the contract, the specifications of which are uniform and establish a minimum standard that cannot be waived. The seller is thus compelled to offer a pooling contract with regard to this liability. This, in turn, may lead to a cross-subsidization of high-risk consumers by low-risk consumers (redistribution). Some low-risk consumers may even drop out of the market and thereby cause a welfare loss (see above, section III.C.2).

VII. CONCLUSION

Contract theory provides an analytic apparatus to identify the welfare implications of various bargaining scenarios and contractual arrangements. It has been especially successful in detecting sources and conditions of market failure where the parties fail to conclude the optimal, that is, welfare-maximizing, contract. The most important source of such market failures is imperfect information of the parties and consequent incentive problems. Whenever a market failure occurs, the law, most notably contract law, may be used to lessen the ensuing welfare loss (second-best solution). However, legal intervention is only warranted if the costs of intervention are lower than the welfare gain accomplished by the intervention.

The concepts of contract theory can be applied to very different bargaining settings. The examples given in this chapter covered the sale of goods, insurance contracts, labor contracts, and the governance of companies. But the scope of contract theory is much greater. Thus, its insights may, for example, also help to conceptualize and solve issues of public choice (see Chapter 6, section III.C) or (public) international law.²⁷

FURTHER READING

Akerlof, George A., The Market for 'Lemons': Quality Uncertainty and the Market Mechanism, 84 Q. J. ECON. 488–500 (1970).

ARROW, KENNETH J., THE ECONOMICS OF AGENCY (Institute for Mathematical Studies in the Social Sciences paper, Stanford University 1984).

²⁷ See, e.g., ROBERT E. SCOTT AND PAUL B. STEPHAN, THE LIMITS OF LEVIATHAN: CONTRACT THEORY AND THE ENFORCEMENT OF INTERNATIONAL LAW (Cambridge: CUP 2006).

- CALABRESI, GUIDO, THE COSTS OF ACCIDENTS (New Haven: Yale University Press 1970).
- Calabresi, Guido, Transaction Costs, Resource Allocation, and Liability Rules: A Comment, 11 J. L. & ECON. 67–73 (1968).
- Coase, Ronald H., The Problem of Social Cost, 3 J. L. & ECON. 1-44 (1960).
- Craswell, Richard, Passing On the Costs of Legal Rules: Efficiency and Distribution in Buyer–Seller Relationships, 43 STAN. L. REV. 361–98 (1991).
- Eisenberg, Melvin A., *The Limits of Cognition and the Limits of Contract*, 47 STAN. L. REV. 211–59 (1995).
- Hermalin, Benjamin E., Avery W. Katz and Richard Craswell, *Contract Law*, in HANDBOOK OF LAW AND ECONOMICS, Vol. I, Ch. 1 (A. Mitchell Polinsky and Steven Shavell eds, Amsterdam: North-Holland 2007).
- Medema, Steven G. and Richard O. Zerbe, *The Coase Theorem*, in ENCYCLOPEDIA OF LAW AND ECONOMICS, Vol. I, 836–92 (Boudewijn Bouckaert and Gerrit de Geest eds, Cheltenham, UK and Northampton, MA, USA: Edward Elgar and the University of Ghent 2000).
- Rothschild, Michael and Joseph E. Stiglitz, Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information, 90 Q. J. ECON. 629–49 (1976).
- Scott, Robert E., Conflict and Cooperation in Long-Term Contracts, 75 CAL. L. REV. 2005–54 (1987).
- Shavell, Steven, *Contracts*, in THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW, Vol. 1, A-D, 436–45 (Peter Newman ed., London: Palgrave Macmillan 1998).
- Spence, Michael, Job Market Signaling, 87 Q. J. ECON. 355-74 (1973).
- Stiglitz, Joseph E., The Theory of 'Screening', Education, and the Distribution of Income, 65 AM. ECON. REV. 283–300 (1975).
- Stiglitz, Joseph E. and Andrew Weiss, Credit Rationing in the Markets with Imperfect Information, 71 AM. ECON. REV. 393–410 (1981).
- Williamson, Oliver E., Transaction-Cost Economics: The Governance of Contractual Relations, 22 J. L. & ECON. 233–61 (1979).
- WILLIAMSON, OLIVER E., THE ECONOMIC INSTITUTIONS OF CAPITALISM: FIRMS, MARKETS, RELATIONAL CONTRACTING (New York: The Free Press 1985).

6. Public and social choice theory Emanuel V. Towfigh and Niels Petersen

I. ECONOMICS AND THE EXPLANATION OF GOVERNMENT

Economists often perceive themselves not merely as experts on the economy, but as social scientists who deal with the explanation of many areas of social life. It is thus not astonishing that economic theory has not refrained from trying to explain politics. The economic theory of politics is often called the 'New Political Economy' and has found its way into legal scholarship, especially in the United States. The New Political Economy focuses on conflicts between individual and collective rationality of political actors - which comprises voters, politicians, bureaucrats, public administration, parties or lobbyists. It principally applies an empirical or analytical perspective. Rational choice theory thus has to be understood as a specific perspective to think about politics and public administration. It rejects a 'romantic', idealist understanding of politics,¹ which was dominant in political science until the 1950s. The idealist perspective treated politicians differently than market actors. While it is commonly assumed that market participants maximize their utility under incomplete information, politicians were thought to be guided by the public interest. Furthermore, it was assumed that they take perfectly informed decisions.

One of the fundamental questions of political theory is the justification of government and the definition of its functions. One influential approach of the traditional political economy believed that it was the main function of government to correct market failure. This concerned, in particular, providing public goods, internalizing external effects (see above Chapter 3, section V.C) and ensuring the macro-

¹ In the early days of Public Choice Theory, its protagonists referred to the classical view of political actors (especially 'voters', 'politicians' and 'bureaucrats') as being 'romantic'; cf. G. TULLOCK, THE POLITICS OF BUREAUCRACY (Washington D.C.: Public Affairs Press 1965).

economic equilibrium.² Public goods are usually not provided by the market because people have individual incentives not to contribute to a public good and to free-ride on the contributions of others, although it would be efficient to contribute from a collective perspective (see above Chapter 3, section V.D). Furthermore, the government is asked to correct positive or negative external effects that lead to an over- or undersupply of specific goods (see above Chapter 3, section V.C), to protect markets against anticompetitive conduct, or to remediate informational asymmetries.³ A more controversially discussed function of government is the correction of the income and wealth distribution that is achieved by the market through the institutions of the welfare state. Finally, some economists argue that government has to ensure an equilibrium between demand and supply in order to prevent recessions and unemployment and thus to guarantee financial and economic stability, as the market often fails in this respect.

Although theoretically plausible, these justifications of government functions have one common weakness: even if welfare economics has highlighted certain inefficiencies of markets, this does not automatically mean that government is the right actor to correct these market failures. The depicted conception is incoherent if it contrasts imperfect markets to a perfect government. If there is market failure, it cannot be excluded that there is also government failure. State interventions are therefore only justified if they produce less harm than market inefficiencies.

This insight is the foundation of the New Political Economy. Proponents of this approach use economics and rational choice theory to develop a conceptual framework that can be applied to the political process. Two theoretical strands can be distinguished. On the one hand, researchers try to analyze how decisions of the actors in the public sphere affect the public good, to explain the occurrence of negative consequences and to design mechanisms to ensure positive outcomes of the political process (public choice theory). On the other hand, there is research on the optimal aggregation of preferences into collective decisions (social choice theory).

 $^{^2\,\,}$ R.A. Musgrave, The Theory of Public Finance (New York: McGraw-Hill 1959).

³ A good overview is given by A. HINDMOOR, RATIONAL CHOICE 132–3 (Houndmills: Palgrave Macmillan 2006).

II. BASIC ASSUMPTIONS OF PUBLIC CHOICE THEORY

Public choice theory has three basic assumptions:

- 1. The allocation of resources is determined by the political process, not by a benevolent and omniscient dictator.
- 2. The political process can best be explained as a strategic interaction between the participating groups; these are, in particular, the voters, the politicians and the public administration.
- 3. Every actor seeks to maximize his individual utility; it is assumed that voters try to maximize their utility in accordance with standard rational choice theory, while politicians usually try to maximize votes in electoral ballots, and bureaucrats try to maximize their budget.

On the basis of these assumptions, public choice theory draws some conclusions on the rational conduct of the three principal types of actors (politicians, voters and bureaucrats).

A. Politicians

The category of politicians comprises elected representatives as well as candidates who run for office. According to public choice theory, it can be assumed that it is the main motivation of politicians to maximize their individual utility - it does not seem to be convincing to perceive the same person as a utility maximizer as long as he acts as a market participant (e.g. in his personal life), but to consider him as a benevolent optimizer of the public good while being a politician. This does not mean that politicians only seek to maximize their material welfare. They may also have other motivations: some people draw a lot of satisfaction from helping to make the world a better place, while others are principally motivated by gaining power. However, independent of the content of the basic preferences, politicians share one important motivation: they have to stay in office in order to attain their goals. Therefore, politicians principally seek to maximize the votes they get in general elections. According to public choice theory, they try to capture votes by promising benefits to the voters that outweigh the perceived costs of their election. However, besides votes, many politicians also want to maximize their material welfare, their prestige or their power. This dimension is primarily analyzed by the 'rent-seeking' literature.⁴

⁴ See, in particular, D.C. MUELLER, PUBLIC CHOICE III ch 15 (Cambridge: Cambridge University Press 2003).

B. Voters

According to the traditional models of public choice theory, the citizens can only influence the political process through their votes in general elections. Like politicians, voters are also assumed to try to maximize their individual utility.⁵ Consequently, voters usually support the candidate from whom they expect to receive the greatest individual benefit. The acquisition of information about the candidates and their programs involves some costs (transaction costs, see Chapter 3, section V.C). Consequently, a rational voter will not be indifferent to the effect of his vote as he incurs certain costs for voting, for example for the acquisition of information, but also for going to the polling station. He votes in order to contribute to the victory of 'his' candidate. His benefit thus results from the expected utility from his vote causing the victory of his candidate minus the costs of voting.

However, the likelihood that one single vote will decide an election is minuscule: the own vote will only be decisive if all other votes are divided equally or if the preferred candidate is down by one vote. The economic literature thus points out that the odds of the own vote deciding an election are about the same as the odds of losing one's life in a car accident on the way to the polling station.⁶ This observation has two consequences: on the one hand, the costs of information gathering will, in general, exceed the benefit of voting. Therefore, the voter acts rationally if he does not inform himself about the programs of the candidates (rational ignorance). Consequently, voters will usually not be informed comprehensively when deciding for whom to vote.

On the other hand, it would be rational not to vote at all, as the costs incurred through voting are higher than the expected benefit.⁷ Furthermore, the voter cannot be sure that he is voting for the right candidate if he has only spent minimal effort on gathering information about the candidates, which should further decrease his incentives to vote. However, this prediction does not match reality. Instead, we can observe that a significant number of citizens do vote – the so-called 'voting paradox'. Prominent proponents of the New Political Economy

⁵ Seminally A. DOWNS, AN ECONOMIC THEORY OF DEMOCRACY ch 11-14 (New York: Harper 1957).

⁶ See MUELLER (n 4) 305.

⁷ An oversimplifying, but well-done illustration of this paradox can be found on YouTube, accessed 20 July 2015 at http://www.youtube.com/ watch?v=21uJUZuIcEo (C. Metzler and J. Kurz, *Tullock: Voting Schmoting*).

believe this behavior to be irrational.⁸ Others try to come up with rational explanations. Some assume that voters have a specific taste for voting, that is, that the mere act of voting bestows some utility upon them.⁹ Other authors believe that the social benefit of voting has to be taken into account.¹⁰ A further approach proposes that people do maximize other factors than their utility as traditionally understood (e.g. they minimize their potentially maximal regret: minimax-regret strategy – this could also be perceived as an extreme form of risk aversion). There are even more attempts to explain *why* people vote – the question has not been answered yet.¹¹ However, there is some empirical evidence that citizens indeed follow rational considerations with regard to the *content* of their voting decision.¹² We will get back to this question when we discuss the median voter theorem (see below, section III.A).

C. Bureaucrats

In the previous two sections, we have become acquainted with the politician and the voter – or, more precisely, the rational choice models of these two archetypes. However, there is also a third category of actors – those who are asked to execute the policies, which were desired by the voters and enacted by the politicians, designated with the unflattering expression 'bureaucrats'. While the general use of the term *bureaucrat* implies some negative connotation, which early proponents of public choice theory may well have intended, the word is now used as a *terminus technicus* for a specific concept in this theoretical framework and no longer carries a pejorative meaning.

¹¹ See J.H. Aldrich, *When Is it Rational to Vote?* in D.C. MUELLER (ed.), PERSPECTIVES ON PUBLIC CHOICE (Cambridge: Cambridge University Press 1997) on some empirical evidence.

¹² S. MERRILL AND B. GROFMAN, A UNIFIED THEORY OF VOTING (Cambridge: Cambridge University Press 1999). Cf. also M.P. Fiorina, *Voting Behaviour* in MUELLER (n 11).

⁸ Cf. G. TULLOCK, TOWARD A MATHEMATICS OF POLITICS (Ann Arbor: University of Michigan Press 1967).

⁹ Id. 110.

¹⁰ J.O. Ledyard, *The Paradox of Voting and Candidate Competition: A General Equilibrium Analysis* in G. HORNWICH AND J.P. QUIRK (eds), ESSAYS IN CONTEMPORARY FIELDS OF ECONOMICS (West Lafayette: Purdue University Press 1981); J.O. Ledyard, *The Pure Theory of Large Two-Candidate Elections*, 44 PUB. CHOICE 7 (1984); T.R. Palfrey and H. Rosenthal, *A Strategic Calculus of Voting*, 43 PUB. CHOICE 7 (1983); T.R. Palfrey and H. Rosenthal, *Voter Participation and Strategic Uncertainty*, 79 AM. POLIT. SCI. REV. 62 (1985). Cf. also J.A. Ferejohn and M.P. Fiorina, *The Paradox of Not Voting: A Decision Theoretic Analysis*, 68 AM. POLIT. SCI. REV. 525 (1974).

New Political Economy assumes that the bureaucrats' principal motivation is to maximize their utility. According to public choice theory, public administrations are usually modelled as organizations that offer goods and services to citizens, without being exposed to market mechanisms. For this task, they are assigned a budget by the politicians. The models do not consider the public administration to be a monolithic entity, but focus on the individual actors within these entities. The most important characteristics of the public administration are their hierarchical organization and their non-profit orientation. From these two characteristics follow some crucial differences to firms, which act in the market: on the one hand, all information is reported centrally to and thus runs together at one place – most often the 'senior bureaucrat'. On the other hand, it is hardly possible to commit all actors to the same goal, as opposed to the market, where making profit is, in theory, a common and measurable objective. Rather, the interests of the different bureaucrats may diverge, which leads to conflicts of interest and thus to inefficiencies.

What is the principal goal of bureaucrats? As the public administration is not profit-oriented, they are not primarily interested in maximizing the wealth of the organization. The preferences of the bureaucrats often diverge, depending on the function that they exercise within the organization: they may be interested in job security, a higher salary, more attractive terms, an increase in power and influence, public appreciation and status, or in decreasing their workload.¹³ Most of these goals can be promoted by maximizing the budget of the administrative entity. Public choice theory thus assumes that bureaucrats are mainly motivated by maximizing their budget (see below, section III.C).

III. MISGUIDED INCENTIVES IN REPRESENTATIVE SYSTEMS

Public choice theory is primarily an instrument to highlight and to explain the malfunctioning of public institutions. Its main attraction is the intuitively plausible, incentive-based explanations of frequently observed failures and problems in representative democracies. This section seeks to exhibit three prominent models of rational choice theory and to analyze them in more detail. These are the median voter theorem, the issue of

¹³ A. DOWNS, INSIDE BUREAUCRACY 81 (Boston: Little, Brown and Company 1967); W.A. NISKANEN, BUREAUCRACY AND REPRESENTATIVE GOVERNMENT 38 (Chicago: Aldine 1971).

small, but powerful, interest groups, and the budget-maximizing problem of public administrations.

A. The Median Voter Theorem

Today, it is a self-evident truth of politics that elections are won in the centre of the political spectrum. A party cannot win elections by merely attracting a specific clientele. Rather, it has to court the median voter, that is, the citizen who has as many people left as right of him in the political spectrum. The theoretical explanation of this phenomenon was developed by Anthony Downs,¹⁴ who was inspired by a contribution of the American economist Harold Hotelling.¹⁵ Hotelling dealt with competition in a one-dimensional space. Let us assume a village that extends along one main street. In this village, two petrol stations want to settle. Where do these two place themselves if distance is the main factor for the villagers to use one or the other? One could imagine that they divide the village into two imaginary halves and that each of them settles in the centre of one of these halves. In reality, however, both petrol stations will often be found close to each other in the centre of the village. Why? Let us assume that, if one of the two petrol stations settled in the centre of the eastern part of the village, then it would be rational for the second station to place itself just west of the first one. For it would attract all customers living west of the second petrol station, that is, three-quarters of all inhabitants, which would be a significant competitive advantage. In order to avoid this scenario, both petrol stations will usually move to the centre of the village.

1. The model

Can these considerations be transferred to the political sphere? Downs argues that this is possible (Figure 6.1). In his basic theory of democracy, he follows the conception of Joseph Schumpeter. Schumpeter assumes that the political process in a representative democracy does not differ significantly from competition in markets.¹⁶ Instead of competing for market shares, political parties compete for vote shares in the elections. They thus design their programs to attract as many voters as possible. This is also the crucial assumption in Downs' theory. But it is not the only one. Furthermore, Downs assumes that parties compete in a one-dimensional

¹⁴ Downs (n 5).

¹⁵ H. Hotelling, *Stability in Competition*, 39 ECON. J. 41 (1929).

¹⁶ J. SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY (New York: Harper 1942).



Figure 6.2 The position of the median voter depending on the distribution of the political spectrum

space, that they can occupy any position in the political spectrum, that there are only two parties, that voters always vote for the party that is closest to their political preferences, that information is complete and that voter preferences are constant.

On the basis of these assumptions, political parties will always align their position with the policy preferences of the median voter. If one party shifted only slightly to the left or the right of the political spectrum, the other party would follow immediately and attract all voters close to the centre that have been 'abandoned' by the other party. For the theory to work, it is irrelevant what the exact shape of the voter distribution looks like. If they are distributed normally (on the normal distribution, see Chapter 7, section II.B), the parties indeed meet in the centre of the political spectrum. However, if the distribution is skewed, the median voter shifts to the left or the right so that the parties do so as well in order to compete for this voter (Figure 6.2).

The median voter theorem seems to offer many reasons for critique, which refer to the assumptions as well as to the results. The assumptions seem to be unrealistic. The political spectrum is, in reality, not just onedimensional. Two voters who agree on economic policy may have totally diverging views on immigration or abortion. Moreover, it seems likely that some politicians have certain basic political convictions that they would not compromise for trying to maximize votes. With its focus on two parties, the model also seems to have a limited applicability. It may fit the Anglo-American context, but it is doubtful whether it can be transferred to the representative systems that we find in most of continental Europe. Concerning the empirical results, the evaluation does not look much brighter. It is true that one can observe that the programs of the principal parties in many European countries have converged in the last decades. However, there are still significant differences. The policies are not interchangeable. Rather, many policy propositions follow patterns that are rooted in party traditions.

However, some of these points are probably due to overly strict standards of evaluation. The model does not claim to be an exact representation of reality. A model necessarily has to simplify. It concentrates on specific factors and is thus not totally accurate in its predictions. As a starting point for explanations, however, it may be of considerable value. In order to illustrate this, we will relax some of the assumptions of the model in the following section in order to see how this affects the predictions.

2. Relaxing the assumptions of the model

The central premise of the theory of competitive democracy, upon which Downs' model is based, is that politicians seek to maximize the votes they get. Is this assumption realistic? If we assume that politicians only want to maximize votes and have no other motivations, we probably do our elected representatives an injustice. Most politicians probably have certain political convictions or ideals they would not trade with a surplus in votes. This explains why, in reality, the political parties do not meet exactly at the position of the median voter, but have diverging positions. But does this mean that the assumption is unrealistic? If we try to relax it and assume that politicians *also* seek to maximize votes, we seem to come closer to reality. We can observe that political programs are not necessarily constant. Instead, they may be aligned with changing societal realities if a party is unsuccessful. In the UK, Tony Blair's New Labour Party, which brought Labour back to government after 18 years in opposition, is a good example. This change of direction was probably not only motivated by changing political convictions within the party. Rather, the intention to regain power played a crucial role.

Let us turn to the second premise – the assumption that parties can choose their position in the political spectrum without restraints. Certainly, parties have certain flexibility. But this flexibility is limited. This has several reasons. First, credibility is an important asset for a party to be successful. If a party has an intimate relationship with the suppliers of nuclear energy for years, it will not be credible if it suddenly changes its position in the wake of an abrupt shift in public opinion. Second, parties are dependent on the support of their grassroots activists. These party members often join a party because they assume that the party represents their basic convictions. If the party does not want to lose the support of these members, which is often crucial for electoral campaigns, it cannot arbitrarily change its position in the political spectrum. This may also explain why parties usually do not meet exactly at the position of the median voter.

The assumption that the political spectrum is one-dimensional is a very classical assumption. Traditionally, political positions are divided into 'left' and 'right'. This division is of a gradual nature. Every individual can take any position from the extreme left to the extreme right of the spectrum. However, it is difficult to assign an exact position to every party on a one-dimensional left/right-scale. There may be voters to the left of the political spectrum who believe that the preferred societal order can best be implemented through an authoritarian government; others may find an anarchic form of state more attractive. In a similar way, we can also differentiate people preferring an authoritarian or more liberal government at the right end of the political spectrum.

Consequently, it seems plausible to consider the political spectrum to be a multidimensional space. For instance, if we assume that the political space is two-dimensional, we could differentiate between left and right on the *x*-axis, and between authoritarian and liberal on the *y*-axis. In such a two-dimensional space, we can also draw indifference curves (see Chapter 3, section II.A.2) and try to determine the optimal position of every party.¹⁷ However, in all multidimensional spaces, it is impossible to find a stable equilibrium. For every position P₁ in the political space, we can find a position P₂ that is supported by a greater number of voters. Yet, there is always a position P₃ that is better than P₂, but worse than P₁. That means that P₃> P₂> P₁> P₃, that is, we have a typical cycle. For this reason, it is impossible to identify a stable equilibrium.

However, we can identify a so-called uncovered set: the political space in which the likelihood of finding a majority is greatest. This uncovered set will often be close to the intersection of the dimension medians. Consequently, the addition of a new dimension does not fundamentally change the results of the median voter theorem. Rather, the modification gives an additional explanatory dimension for multi-party systems – as they are commonly found in electoral systems with proportional representation. In such systems, the small parties take on positions that are not covered by the major parties. The Green Party in Germany, for instance,

¹⁷ For a more detailed explanation, see HINDMOOR (n 3) 34–9.

is not just one more party in the left/right-spectrum. Instead, it addresses certain political issues, such as environmental protection, which had not been adequately accounted for by the established parties.

The assumption that voters only vote for the party that is closest to their political preferences does not always fit reality either. Voters act rationally if they only acquire limited information about the party programs. One simple voting heuristic is thus to vote for the party you have always voted for. But this inertia is limited, as there is an increasing number of mobile voters. Therefore, this restriction does not cast doubt on the basic results of the model either. If parties move towards the median voter, they cannot ensure their election. But they at least increase the likelihood of being elected.

The certainty assumption also only holds in the model world. Voting decisions are not only decisions about past conduct of politicians, but also involve a prognosis of how political actors will behave in the future. Consequently, voters are uncertain about the exact consequences of their voting decision. In order to reduce this uncertainty, credibility is an important asset for parties. As we have already seen, the need to build up credibility prevents parties from changing their position radically and thus taking any position in the political spectrum.

Finally, the assumption of constant preferences is one of the basic assumptions of rational choice theory in general (see Chapter 2, section I.B.1). The preference formation of individuals is one of the great mysteries of social science research. Psychological research suggests that individual preferences are neither constant nor transitive, but that they may be incoherent and change over time.¹⁸ What consequences does this have for our model? Basically, it means that political parties have a bigger room for manoeuvre. They are not merely marionettes that blindly have to follow the voters' preferences. Instead, they may seek to shape the preferences of the latter. This is probably the most severe objection to the median voter theorem. However, the shaping of citizens' preferences is a long and complex process, whose success is much less certain than the short-term orientation at the perceived preferences of the median voter. As politics is often short-term-oriented, parties will at least mix (see Chapter 4, section II.B.3) their strategies. The believed political preferences of the median voter will thus remain of crucial influence on the political process and the alignment of party programs.

¹⁸ See P. Slovic, *The Construction of Preference*, 50 AM. PSYCHOLOGIST 364 (1995).

3. Conclusion

The median voter theorem is an excellent example for the attraction of sophisticated economic modelling. Economic models usually do not claim to represent reality in all possible facets and aspects. Instead, they are based on certain assumptions, which are necessarily stylized. Models are often compared to maps, which are also not intended to reproduce every single detail of the shape of a depicted region. But we do not have to understand these assumptions as restrictions. Instead, it may be interesting to relax or vary the assumptions and observe how this affects the results of the model. Consequently, the median voter theorem does not claim to make point predictions about the functioning of the political process. However, it may explain some phenomena that we observe in today's political process. The explanatory power is certainly higher for two-party systems than for the proportional multi-party systems of continental Europe. However, it also contains some important insights for the latter.

B. Rent-Seeking: The Special Interest Effect

A further problem of representative democracies that has been identified by rational choice theory is mechanisms to promote special interests of a particular group – often referred to as lobbying. The basic phenomenon is easy to explain: in every society, there are small groups of people who have strong interests in certain policy fields and who exploit the rational ignorance of voters in many areas that do not directly affect them. Some political decisions have a strong positive outcome for one particular group, while the negative effects are divided among the great majority of citizens, so that each individual is only marginally affected. Giving state aid to a particular industry will make a huge difference for the beneficiaries, while the average costs for each individual citizen are, as such, negligible. Therefore, the small group has strong incentives to lobby for the benefit, while the general voter acts rationally if he does not invest into a contrary lobbying campaign because of his small share in the costs.

Politicians thus try to gain the support of the small group because they are unlikely to lose any voters of the general population over this issue. Consequently, they have incentives to promote special interests even if this is harmful to the public good. Issues where politicians can provide a benefit to a specific group, to the detriment of a third group that does not have votes, are even more attractive. Such a third group may be the future generation, whose members are still too young to vote and which is affected by a debt-oriented fiscal policy or lax environmental standards, or people living in neighboring countries or regions. The position of nuclear power plants in Europe may serve as an example: they are astonishingly

Constituency	New bridge in A (€)	Port renovation in B (€)	Shopping centre in C (€)	Total (€)
A	+ 10	- 3	- 3	+ 4
В	- 3	+ 8	- 3	+ 2
С	- 3	- 3	+ 6	± 0
D	- 3	- 3	- 3	- 9
E	- 3	- 3	- 3	- 9
Total (€)	- 2	- 4	- 6	- 12

Table 6.1 Costs or benefits per voter in electoral districts

often placed close to national borders – of course, the citizens of the neighboring country had neither a vote nor influence in the placement decision.

External effects for people in neighboring regions may also occur if representatives are elected in their constituencies and if they are not accountable to the whole citizenry of the country. Let us assume a country with five constituencies and a party that only competes in three of them. The party may win these elections promising benefits for these three regions, while the country as a whole may expect a net loss from these campaign gifts. Table 6.1 may illustrate this example.

Presumably, we have already had an intuition about these misguided incentives just by observing day-to-day politics. However, rational choice theory gives us a theoretical framework to show why these developments are not surprising.

C. Budget Maximization of Bureaucrats

We have already seen that bureaucrats usually tend to maximize their utility by maximizing the budget over which they dispose. Moreover, a larger budget is also in the interest of the citizens for which a particular administrative unit is responsible. If the budget of a public university is extended, this is generally also in the interest of the faculty, the students and the staff of this university. Consequently, the interests of the bureaucrats and the special groups they serve usually run parallel. They may thus often form an alliance against politicians.

1. The model

But how do bureaucrats manage to maximize their budget and to receive excessive funds? The theory assumes that politicians and bureaucrats negotiate about the budget of the public administration. In these negotiations, the bureaucrats have an advantage because there is an information asymmetry in their favour. This information asymmetry exists because bureaucrats usually have a much clearer picture of the minimal costs of a desired output. Furthermore, politicians often lack clear standards for the evaluation of the output of the administration because there are usually no other suppliers that the administration competes with and can be compared against. Instead, the administration usually is only obliged to offer a specific level of activity. Therefore, politicians have a monitoring problem. Because of this monitoring problem, it is usually assumed that the administration has the opportunity to make 'take it or leave it' offers, which strengthens its bargaining power.

Politicians only have limited possibilities to control and monitor the administration. In particular, they have four monitoring instruments:

- (1) They can determine the total level of the administrative output. Therefore, they can prevent bureaucrats from inflating their budget by offering an arbitrarily high amount of activity.
- (2) Even if politicians do not know the relationship between the level of output and the administrative costs, they can estimate the value of the output. Therefore, they will not agree to budgets that are more expensive than the value that is offered to the citizens in return.
- (3) Moreover, they will not accept a budget if the marginal utility of the output is negative.
- (4) Finally, the politicians can ensure that the bureaucrats keep their promises and offer the agreed level of activity.

If there were a market for administrative activity and if the politicians had full information, the optimal budget could be determined in the way shown in Figure 6.3.

The administration would offer the quantity Q to the price P because the marginal utility is higher than the marginal costs up to this point (see Chapter 3). The indicated point B thus forms a market equilibrium. The necessary budget for realizing this point is represented by the quadrangle 0-C-B-Q. This would produce a welfare surplus, which can be identified by the triangle A-B-C.

However, if we assume that there is an information asymmetry in the budget negotiations, the equilibrium will not be reached because the politicians do not know the exact cost function of the administration. The main point of orientation for the politicians is that they will not agree to a budget, whose welfare benefit is lower than its costs. At the same time, this means that the bureaucrats will try to extend their budget until every welfare benefit is depleted (Figure 6.4).



Figure 6.3 The welfare optimal budget



Figure 6.4 Welfare losses because of budget maximization tendencies of the public administration

In the example illustrated above, the waste triangle B-D-E may not be larger than the utility triangle A-B-C. However, if bureaucrats seek to maximize their budget, it will also rarely be smaller. Instead of offering the optimal level of activity Q, they will offer – take it or leave it! – the level Q_1 . Thus, they double the costs of their output and maximize their budget, which is now described by the quadrangle 0-C-D-Q₁. Because they lack the necessary monitoring devices, politicians will agree to this budget, although it does not constitute a welfare-optimizing equilibrium.

2. Influence and critique

The theory of the budget-maximizing bureaucrats has received a lot of attention. Critics have pointed out the weaknesses of the model and proposed alternatives. The critique focused on the 'take it or leave it' proposition in particular. Many scholars also tried to test the hypotheses of the model empirically.¹⁹ However, despite all criticism, the theory has had a strong influence on law and politics. New scholarly tendencies like the 'New Public Management' and many approaches of modern public administration research have their roots in these insights.

IV. COLLECTIVE DECISION-MAKING THROUGH VOTES AND ELECTIONS: SOCIAL CHOICE

The arithmetic of collective decision-making still remains one of the principal unsolved issues of political theory and political philosophy. If we assume that every individual has an *a priori* right to freedom, every collective decision that interferes with individual freedom needs to be justified. The conceptions of justification vary under different constitutions. The basic problem that every democracy faces is that it needs a mechanism to aggregate individual preferences into a decision that is attributable to the citizenry as a whole, even if certain individuals may be diametrically opposed to specific outcomes of the collective decision-making process. The most common way in which preferences are aggregated are votes and elections. There is a controversial debate in political theory about whether direct or indirect democracy is the superior form of state. The vast majority of democracies today have established a representative system. The idea of indirect democracy is that executive or parliamentary decisions represent the aggregated preferences of all citizens. However, rational choice theory is skeptical with regard to the extent of the representation. In this section, we want to deal with problems of preference transformation in votes and elections and take a closer look at two important theorems - Arrow's theorem and the Ostrogorski Paradox.

A. Problems of Votes and Elections

Social choice theory studies problems of group decision-making: how can we transform diverging individual convictions, values and preferences into a rational and coherent collective decision? The assumptions of social

¹⁹ See MUELLER (n 4) 374–9.
choice theory follow, to a large extent, the general assumptions of rational choice: it is assumed that individual preferences are complete, transitive, ordinal and constant, and that no inter-personal comparison of preferences is possible (see Chapter 2, section I.B.1). Furthermore, it is assumed that voters honestly reveal their preferences and that they do not vote strategically. Decisions are generally taken by majority vote: if the majority prefers one option to another, the result is binding for all members of the group.

1. Simple majority vote

If we only have two options, majority decision-making is simple. The option that gets more votes prevails. However, if we only add a single, third option, life becomes much more complicated. In elections, we often have to choose between at least three candidates or parties – for example in elections to the British House of Commons or the German *Bundestag*. To illustrate the problem, let us turn to an example. Assume that there are three policy options (a, b and c) and 21 voters. The voters have the following preferences:

5 voters:	A > B > C
6 voters:	B > A > C
10 voters:	C > B > A

In a simple majority vote, C would be the 'social choice'. However, a majority of the voters prefers both A and B to C (maybe because of a general joint feature that A and B share), which gives us a first intuition for the inherent conflicts of simple majority votes.

2. Agenda procedure

An alternative to majority voting would be to form pairs of choices and always to choose between just two options. Because this procedure reminds us of some sports events, it is often called 'tournament procedure'. A more common name is agenda procedure, which already hints at the most glaring weakness of the mechanism – the dependence of the result on the agenda, that is, the order in which the options are voted on. To illustrate the problem, we will slightly modify our example from above.

5 voters:	A > C > B
6 voters:	B > A > C
10 voters:	C > B > A

If we vote in pairs on the different options, we will get the picture shown in Figure 6.5. The result is astonishing: Depending on the order in which we vote on the different options the result of our collective decision differs.



Figure 6.5 Dependence of the result of a vote on the voting agenda

If A first competes with C and then with B, B wins it all. However, if B starts against C, it loses, while A wins the final against C. Now, if A first competes with B, B wins – only to lose in the following round against C. Thus, we have three different ways of structuring the decision-making process and we get three different results – even though the underlying preferences have not changed! The results of the agenda procedure can sometimes be even more absurd. Let us consider the following example with three voters and four choices:

Voter 1:	a > x > y > b
Voter 2:	x > y > b > a
Voter 3:	b > a > x > y

A talented agenda setter can now structure the decision-making process in a way, in which option y is chosen although x is preferred to y by all three voters (Figure 6.6).

3. Condorcet procedure

In order to avoid the agenda-setting problem, we can compare all options by recurring to the full order of preferences. This voting procedure has been developed by Nicolas de Condorcet (1743–4). Consequently, it is called Condorcet procedure. In order to illustrate it, let us turn back to our initial example:

5 voters:	A > B > C
6 voters:	B > A > C
10 voters:	C > B > A

Here, the Condorcet procedure yields a satisfactory result: B wins because this option is preferred by 16 voters compared to A, and by 11 voters

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Figure 6.6 Agenda paradox: y wins although all voters prefer x to y



Figure 6.7 The Condorcet Paradox

compared to C. However, the Condorcet procedure does not always lead to one consistent choice because the order of preferences may produce voting cycles (also called Condorcet Paradox). In order to illustrate this situation, we can assume the following choice with three voters and three options:

Voter 1:	a > b > c
Voter 2:	b > c > a
Voter 3:	c > a > b

The Condorcet procedure does not yield a coherent result. Instead, we observe a voting cycle (Figure 6.7).

4. The Borda procedure

In order to solve the problems of the Condorcet procedure, Jean-Charles de Borda (1733–99) developed a procedure that was named after him. In this procedure, every vote contains a ranking of choices. On the basis

of this ranking, we calculate the Borda value that consists of the sum of the ranks of every option. The following example may illustrate the procedure:

A > B > C	\Rightarrow	Borda value of	$A = 2^*1 + 1^*2 = 4$
A > C > B	\Rightarrow	Borda value of	$\mathbf{B} = 1^*2 + 2^*3 = 8$
C > A > B	\Rightarrow	Borda value of	C = 1*1 + 1*2 + 1*3 = 6

The option of choice is the one that has the lowest Borda value. The procedure is simple, and it always produces a result. The 'result' may be a tie between two or more options that needs to be broken; by contrast, the Condorcet procedure does not provide a clear stopping rule but may produce the aforementioned cycles.

However, the Borda procedure, too, has some disadvantages because, in some situations, it produces counter-intuitive results. The following example may illustrate this. Let us assume we have three voters, which have the following preferences:

2 voters:	A > C > B > D
1 voter:	C > B > D > A

According to Condorcet, A is the preferred choice in this example because the majority of voters absolutely prefer A to all other tastes (and thus the option A wins three pairwise comparisons, C wins two, B wins one and D none). However, Borda would make C the winner because the Borda value of C (5) is lower than the one of A (6).

However, Borda has even more weaknesses. On the one hand, it sometimes leads to an inverted order paradox. If we have seven voters and four choices and if the preferences of the voters are distributed as illustrated in Figure 6.8, x has the lowest Borda value and is thus the option of choice. However, if we eliminate x and calculate the Borda values of the remaining three options, their order is inverted.

On the other hand, the result is sometimes influenced by irrelevant alternatives. This influence occurs if the comparison between two choices not only depends on their relationship in the preference orders of the voters, but also on their rank within these preference orders. To illustrate this problem, let us again turn to our – slightly modified – initial example:

5 voters:	A > C > B
8 voters:	B > A > C
10 voters:	C > B > A

~

$$\begin{array}{c} x > c > b > a \\ a > x > c > b \\ b > a > x > c \\ x > c > b > a \\ a > x > c > b > a \\ a > x > c > b \\ b > a > x > c > b \\ b > a > x > c > b \\ x = 13 \\ a = 18 \\ b = 19 \\ c = 20 \\ c = 20 \\ c = 13 \\ b = 14 \\ c = 15 \\ c = 15 \\ c = 15 \\ c = 15 \\ c = 10 \\$$



If we calculate the Borda values, C has a value of 44, B of 43 and A of 51. B thus wins, while A loses. If we only compare B and C, it should be irrelevant whether there is also a choice of A. However, if we delete A from our example and calculate the Borda values for the remaining two choices, C has a value of 31 and B of 38. Suddenly, C is our option of choice. This result seems weird. Let us assume we are standing in an ice cream shop and have just decided to buy a cone with chocolate ice cream. That very moment, the vendor puts up a sign that says 'For today, we are out of vanilla ice cream!' Because of this sign, we change our choice and choose strawberry instead! Such behavior does not seem to be rational. Because of these weaknesses, the Borda procedure is rarely used in political procedures. However, a modified form of this procedure is used in the Eurovision Song Contest.

B. Arrow's Impossibility Theorem

The deficiencies of voting procedures were also noticed by the future Nobel laureate Kenneth Arrow. In his dissertation, Arrow analyzed whether it is possible to have a voting procedure that is universally applicable and that fulfills certain predetermined criteria.²⁰ Arrow sets up four requirements for voting procedures:

- 1. He required collective preferences to be transitive, that is, if a > b and b > c, then also a > c.
- 2. The preferences have to be independent of irrelevant alternatives.
- 3. The collective decision should reflect the preferences of the group members; thus, if all group members prefer one option to another, this should also be reflected in the collective decision.

²⁰ K. ARROW, SOCIAL CHOICE AND INDIVIDUAL VALUES (New Haven: Yale University Press 1951).

4. There should be no dictator, that is, no individual whose preferences automatically determine the collective decision.

	Preference 1	Preference 2	Preference 3		
Voter 1	А	В	С		
Voter 2	В	С	А		
Voter 3	С	Α	В		

Table 6.2 Voting cycle

On the basis of these four assumptions, Arrow showed that, if two or more voters have to choose between three or more options, it is always possible to find an order of preferences, for which it is not possible to identify a consistent collective decision. Every possible voting procedure violates at least one of the four requirements or produces an inconsistent order.²¹ It is, for example, not possible to find a decision-making procedure which does not violate one of the preconditions if the preferences look as they do in Table 6.2.

One may ask how likely it is that such voting cycles appear in reality and whether they have a practical relevance.²² Stochastically, the probability is quite high. However, critics object that voting decisions are usually more structured and often lie on a continuum, which makes cycles improbable. A voter with leftist tendencies will probably rather vote for a centrist than for a right-wing party. This objection has a certain plausibility if we consider one-dimensional political spaces. However, if we conceive the political space to be multidimensional (see section III.A), voting decisions do not necessarily rest on a continuum. A citizen who has preferences for an authoritarian government may generally vote for a communist party. At the same time, he may prefer the extreme right to a liberal party. Moreover, the preference of a voter for a specific party is most often a compromise (see section IV.C). A voter may prefer the position of Party A in matters of economic policy, while being closer to Party B with regard to immigration issues. Therefore, the occurrence of voting cycles may be more likely than it seemed at first sight.

How do we then deal with this dilemma? The economic literature has tried to come up with some solutions by relaxing some of the four

²¹ K. Arrow, A Difficulty in the Concept of Social Welfare, 58 J. POL. ECON. 328 (1950).

²² See HINDMOOR (n 3) 93ff.

requirements.²³ The dictator and the Pareto criterion are not seriously discussed. We might agree on compromises regarding the transitivity requirement (it may be sufficient to determine the winner of an election). However, extensions of Arrow's theorem have shown that this does not resolve all difficulties. Perhaps we do not need the requirement that the result should be independent of irrelevant alternatives, but the odd results that are produced if collective preferences change just because we delete some irrelevant options from the menu of choice are difficult to justify. Finally, there is some research on relaxing the universality requirement: it may already be significant progress to have procedures that help us in specific situations even if they may fail in others.

C. The Ostrogorski Paradox

While Arrow's theorem has shown that the formation of collective preferences is, in some situations, impossible, regardless of whether we look at direct or indirect democracies, the Ostrogorski Paradox particularly focuses on representative systems of democracy. It shows that representation may distort collective preferences under certain conditions.²⁴ The theorem assumes that two parties have a program comprising three different issues. Furthermore, there are four voter groups that have different orders of preferences on the three mentioned issues. Some voters prefer Party X for one issue, but go with Party Y for another issue – a common situation in representative democracies. It will rarely happen that we agree with all positions of a particular party we vote for. Therefore, voting choices are always compromises. Citizens vote for the party they feel closest to in most of the issues that are important to them.

The Ostrogorski Paradox shows that, in cases where citizens vote en bloc on a specific issue (or vote for a party that represents them on these issues), the results may often be different than if they had voted directly on each individual issue. In the example illustrated in Table 6.3, Party X wins although Party Y would have had the majority on the individual issues. The Ostrogorski Paradox thus also highlights problems of translating individual preferences into collective decisions in representative democracies.

²³ A. Sen, *The Possibility of Social Choice*, 89 AM. ECON. REV. 349 (1999).

²⁴ D.W. Rae and H. Daudt, *The Ostrogorski Paradox: A Peculiarity of Compound Majority Decision*, 4 EUR. J. POL. RES. 391 (1976).

Groups of	Share	Issue-	related prefe	Elected	Election	
voters (%)		Issue 1 Issue 2 Issue 3		party	result	
A	20	Х	Х	Y	X	Party X wins
В	20	Х	Y	Х	X	with 60% of
С	20	Y	Х	Х	X	the votes
D	40	Y	Y	Y	Y	
Issue-related majority for Party Y (%)		60	60	60		

Table 6.3 The Ostrogorski Paradox

D. Evaluation and Legal Implications

We have seen in this section that individual preferences cannot always be consistently translated into collective decisions. This has also important consequences for the legal realm. In particular, it is an invitation to rethink some of the ideas of democracy discussed in legal scholarship. Legal concepts of democracy often play a crucial role in evaluating decision-making procedures in international or supranational contexts. Many American legal scholars meet international decision-making processes with great skepticism.²⁵ Equally, the reluctance of the German Constitutional Court to embrace European integration in the recent Lisbon judgment has been based on considerations derived from democracy theory.²⁶ These critiques often contrast the deficient decision-making procedures in the international realm with an idealist perception of decision-making within the nation state.

However, the rational choice literature raises serious doubts with regard to this idealist position. In his famous Gettysburg address, Abraham Lincoln claimed that democracy is 'government of the people by the

²⁵ See, for example, C.A. Bradley and J.L. Goldsmith, *The Current Illegitimacy of International Human Rights Litigation*, 66 FORDHAM L. REV. 319 (1997); P.B. Stephan, *International Governance and American Democracy*, 1 CHICAGO J. INT'L L. 237 (2000); R.P. Alford, *Misusing International Sources to Interpret the Constitution*, 98 AM. J. INT'L L. 57 (2004).

²⁶ Case 2 BvE 2/08, *Lisbon Treaty* [2009] 123 Entscheidungen des Bundesverfassungsgerichts 267 (German Federal Constitutional Court, 30 June 2009). English translation accessed 19 July 2015 at https://www.bundesverfassungsgericht.de/entscheidungen/es20090630_2bve000208en.html. See also the critique of this judgment voiced by D. Halberstam and C. Möllers, *The German Constitutional Court says 'Ja zu Deutschland!'*, 10 GERMAN L.J. 1241 (2009).

people for the people'.²⁷ But what does 'by the people' mean in representative democracies? There is no such thing as a consistent 'will of the people'; any such reference must remain fictitious. As has been shown in this chapter, and especially by the described paradoxes, collective preferences must not be considered a static or even tangible construct. Rather, they are dynamic which renders their representation a difficult endeavour. It certainly depends on whether voting cycles or distortions of collective preferences are frequent in reality or whether they appear only rarely. This is an empirical question that awaits thorough investigation. Yet, it seems plausible to say that these problems are severe, and not just an intellectual pastime. If this is the case, the impact of these insights on the theory of democracy – and ultimately on legal scholarship – needs to be seriously considered.

FURTHER READING

- ARROW, KENNETH, SOCIAL CHOICE AND INDIVIDUAL VALUES (New Haven: Yale University Press 1951).
- Downs, Anthony, An Economic Theory of Democracy (New York: Harper 1957).
- HINDMOOR, ANDREW, RATIONAL CHOICE (Houndmills: Palgrave Macmillan 2006).
- MUELLER, DENNIS C., PUBLIC CHOICE III (Cambridge: Cambridge University Press 2003).
- NURMI, HANNU, VOTING PARADOXES AND HOW TO DEAL WITH THEM (Berlin: Springer 1999).
- Petersen, Niels, *The German Constitutional Court and legislative capture*, 12 INTERNATIONAL JOURNAL OF CONSTITUTIONAL LAW 650 (2014).
- Rae, Douglas W. and Hans Daudt, *The Ostrogorski Paradox: A Peculiarity of Compound Majority Decision*, 4 EUR. J. POL. Res. 391 (1976).
- RIKER, WILLIAM H., LIBERALISM AGAINST POPULISM: A CONFRONTATION BETWEEN THE THEORY OF DEMOCRACY AND THE THEORY OF SOCIAL CHOICE (San Francisco: Freeman 1982).
- SCHUMPETER, JOSEPH, CAPITALISM, SOCIALISM AND DEMOCRACY (New York: Harper 1942).

Sen, Amartya, The Possibility of Social Choice, 89 AM. ECON. REV. 349 (1999).

- Sunstein, Cass R., Interest Groups in American Public Law, 38 STANFORD LAW REVIEW 29 (1985).
- TULLOCK, GORDON, THE POLITICS OF BUREAUCRACY (Washington D.C.: Public Affairs Press 1965).

²⁷ Address delivered at the Dedication of the Cemetery at Gettysburg (19 November 1863), reprinted in R.P. BASLER (ed.), THE COLLECTED WORKS OF ABRAHAM LINCOLN, Vol. 7 22–3 (New Brunswick: Rutgers University Press 1953).

7. Empirical research and statistics Sebastian J. Goerg and Niels Petersen

I. INTRODUCTION AND RESEARCH DESIGN

In Chapter 1, we have seen that findings of empirical research can become relevant for legal reasoning at several levels. This chapter will give a short introduction into *empirical research methods*. The aim of the chapter is to give lawyers a better understanding of the structure of empirical research. It will not enable anybody to conduct his or her own study. However, readers of this chapter should be better able to understand empirical studies that have been conducted by others, and to evaluate the relevancy and the limits of the findings. There are several kinds of empirical research. Some studies try to interpret social practices, while others attempt to *describe social phenomena*, and still others try to *explain causal relationships*. In this chapter, we will focus on the latter two strands of research, in particular on the *statistical analysis* that is a central part of such studies.

An example of descriptive research is a comparative study on the development of university dropouts in Organisation for Economic Cooperation and Development (OECD) countries. We need to perform a statistical analysis for such a descriptive study because it is impossible to observe every case that occurs in reality. Instead, such a study is usually based on a *representative sample*. However, samples are never a perfect representation of the whole population, that is, all possible cases that occur in reality. Therefore, the toolbox of descriptive statistics provides us with tools to analyse the extent to which the conclusions we can draw from our sample also apply to the *population as a whole*.

However, the field of statistics not only has tools to describe social phenomena. Most empirical studies focus on the *identification of causal mechanisms*. We might, for instance, wish to analyse whether economic development enhances the level and the stability of democracy, or whether people with a good education have, on average, a higher income than people with a lower level of education. Such research also depends on a thorough statistical analysis. Statistical tests are designed to tell us whether

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a *statistically significant correlation* between two social phenomena exists. In social science research, the analysed factors are called variables. The *dependent variable* designates the social phenomenon that is supposed to be explained. In an example, of the effect of economic development on the level of democracy, the democracy level would be the dependent variable. The *independent* (or *explanatory*) variables designate the phenomena that are supposed to explain the occurrence of the dependent phenomenon. In our example, the independent variable is the level of economic development.

In the following, we will analyse three questions more closely. First, we will have a closer look at the *concept of causality*. If we find a statistically significant correlation between the independent and the dependent variables, it does not automatically mean that there is also a causal connection between the two analysed phenomena. There is no statistical test which can directly tell us whether a relationship is causal or not. Instead, we have to come up with a good *research design* that allows us to identify whether the relationship between two variables is indeed causal. The first subsection will explain some rules that have to be observed in this respect. In the second subsection, we will have a look at how to operationalize and measure the variables of our study. Finally, we will discuss to what extent the results of a social science study can be generalized.

A. Research Design and Causality

1. Causality in studies with two variables

Let us first consider a scenario in which there are only two variables that are totally independent of any external factors. Let us call these variables X and Y. Even if we observe a correlation between X and Y, we cannot automatically conclude that Y was caused by X. Instead, it may be that causality runs in the opposite direction, that is, that X was caused by Y, or that it runs in both directions. In our above example of whether the level of economic development influences the level of democracy in a country, studies usually observe a correlation between both factors, that is, an increase in economic development coincides with an increase in the level of democracy. However, we cannot draw the conclusion from this observation that a higher level of economic development increases the likelihood of a country becoming or staying democratic. It is possible that causality runs in the opposite direction: Democracy is not stable because of the high level of economic development, but economic development is due to the democratic organization of the state. Finally, it is possible that both factors are interdependent, that is, economic development leads to an increase in the level of democracy, and this in turn strengthens the economic performance of the country.

The direction of causality is not pure guesswork. For certain cases, there are rules that allow us to estimate the direction of causality. This is always the case if causality can only run in one direction according to our understanding of the world. If *two variables succeed each other in time*, a correlation has to be due to a causal effect of the first, not the second variable. The education of the parents usually influences the level of education of their children, while it is highly unlikely for the latter to influence the former. Furthermore, we can make causal conclusions if *one of the variables cannot be changed*. If we observe a correlation between the fact that a country is landlocked and its economic development, causality can only run in one direction. Access to the sea can influence economic performance, but a strong economic performance cannot give a country access to the sea.

Finally, there are cases in which one variable can change in principle, but such a *change is slow and sticky*, while the other observed variable is much more flexible and changes more easily. In such a constellation, we can usually also conclude that the correlation was caused by the sticky variable. Let us, for example, assume that there is a correlation between the predominant religion of a state and its form of government. The majority religion in a society is not a constant. However, the variable is significantly stickier than the form of government. For this reason, a change in the form of state may rather have been influenced by the majority religion than the religion by the form of state. In the political sciences, for example, some scholars once developed a theory that Protestant states are more open to democracy than Catholic states. If we had indeed observed a negative correlation between Catholicism and democracy, this would have been confirmation of the theory. We would not have to worry about reverse causality, that is, that democracy might have caused the population to turn Protestant.

2. Causality in studies with multiple variables

In reality, we never have only two factors that interact in isolation from any external influences. The form of government of a country will never depend only on the economic performance, but also on the level of education or the ethnic, religious and cultural homogeneity. These factors do not have to interest us if they only affect the dependent variable that we want to explain. Under such circumstances, they can be considered as *random effects*, which occur in every specification of the dependent variable with the same probability. If the number of observations is sufficiently large, these *random effects do not bias the result* of the statistical analysis. Instead, there are statistical tests that can filter out such random effects and tell us the probability of the result also holding if there were no exogenous influences.

However, often these factors not only influence the dependent, but also the independent variable. In such a case, the effect is not random anymore. Instead, the external factors may cause *spurious relationships*. There is, for example, a strong correlation between the body height of siblings. However, the height of the older sibling is not causally related to the height of the younger sibling. Instead, the height of both depends on a third factor – the height of the parents. Similarly, if we look at the relationship between storks and babies born in 17 European countries, we find a highly significant correlation between both.¹ Again, this does not tell us whether storks actually bring the babies or babies help to increase the population of storks. Both directions of causality seem to be absurd. But why are storks and the number of births correlated? In our example, the correlation can be explained because both factors are caused by a third variable: the size of the country. The larger the country, the more people live there, and the more space is available for storks. Therefore, we will find more people giving birth and more storks at the same time. We will return to this example at the end of this chapter (see section III.B.2.b).

There are, in principle, two possibilities to take the influence of such external factors into account. We can try to control for external influences either through the research design of the study or through the statistical analysis. The most effective form to exclude external influences is the experiment. In an experiment, spurious effects are ideally excluded through the research design. Experimenters usually divide the subjects of the experiment into two or more *treatment groups*. These treatment groups should only differ in one factor. If the results of the treatment groups differ in a statistically significant way, we can conclude that this difference is due to the difference between the groups. In an experimental setting, it is crucial that the subjects of the experiment are randomly assigned to one of the different treatment groups in order to exclude selection effects. Furthermore, all external factors have to be constant so that we can guarantee that there is no exogenous variable that influences both the independent and the dependent variable. Even in an experiment, there are factors that we cannot control. However, these factors affect the different treatment groups in the same way – they are thus mere random effects.

Let us assume that we want to know whether prisoners reintegrate more

¹ R. Matthews, *Storks Deliver Babies* (p = 0.008), 22(2) TEACHING STATISTICS 36 (2000).

easily into society after their release from prison if they receive some financial support.² If we want to perform an experiment, we have to *divide the prisoners randomly into two groups of the same size*. One group of prisoners receive financial support, the others do not. Now we can observe whether one group of prisoners is less likely to commit a crime after their release. If the group that receives financial support commits less crime, we can assume that the financial support has a causal effect on the likelihood of recidivism. Certainly, there are other factors that influence the success of reintegration into society: the personality of each prisoner, the crime originally committed, the length of the prison sentence, the prisoner's social network and many other factors. However, these are all random effects. If the prisoners have been selected randomly, the likelihood of a certain type of prisoner being in one group or the other is the same. Consequently, the mentioned factors do not bias the result. If the number of observations is large enough, these random effects can thus be filtered out in the statistical analysis.

Unfortunately, it is not always possible to conduct an experiment. Sometimes, it is *impossible to randomize the observed subjects* because of ethical concerns or factual limitations. If one wishes to analyse the effect of the level of economic development on the form of government, it is impossible to attribute a specific level of economic development randomly to different states. Instead, these are factors that cannot be manipulated by the researcher. In such a case, it is only possible to control for potential spurious effects in the statistical analysis.

In some cases, it is also possible to make a compromise between experimental and econometric designs. It may happen that *conditions* in reality are *very similar* to each other and that there is only a fundamental difference in the main explanatory variable. Such a case is often called a *quasi-experiment*. One example is a study from John Henry Sloan and colleagues.³ The study tried to analyse the effect of small-arms regulation on the crime rate. The researchers compared two cities that are geographically close to each other and have very similar demographic characteristics – Seattle and Vancouver. There is just one decisive difference between the two. Seattle is an American city and thus lacks any small-arms regulation, while Vancouver is in Canada, where the purchase

² C.D. Mallar and C.V.D. Thornton, *Transitional Aid for Released Prisoners: Evidence from the Life Experiment*, 13(2) JOURNAL OF HUMAN RESOURCES 208 (1978).

³ J.H. Sloan, A.L. Kellermann, D.T. Reay, J.A. Ferris, T. Koepsell, F.P. Rivara, C. Rice, L. Gray, J. LoGerfo, *Handgun Regulations, Crime, Assaults, and Homicide: A Tale of Two Cities*, 319(19) New ENGLAND JOURNAL OF MEDICINE 1256 (1988).



Figure 7.1 Path diagram on causality in an empirical model



Figure 7.2 Suppression effect

of small arms is regulated by the state. This comparison is not a perfect experiment because we cannot exclude with certainty that both cities differ in an important respect that we cannot observe. However, the situation is as close to an experiment as real-life situations can be.

If we cannot perform a quasi-experiment, we can *control for potential spurious effects* in the *statistical analysis*. For such a control, we have to take all factors into account which might *influence the dependent variable* as well as the independent variables in our regression analysis (see section III.B.2.b for more details). If we want to analyse the relationship between economic development and the form of government, it is not sufficient to measure these two factors and to examine whether they are correlated. Instead, we also have to control for potential disturbing factors, such as the cultural and religious background of the society, the colonial past, the social capital or the level of education. Before we start to measure and run a statistical test, we should thus always sit down with a pen and paper and try to map out the relevant factors and their influence on the independent and the dependent variable (see Figure 7.1).

We only have to include those variables which influence both the independent (X) and the dependent (Y) variable in our regression analysis. Sometimes, there are also factors (Z) that are related to both variables of our analysis, but only have a causal effect on the dependent variable. This is the case if X has a causal effect on Z and Z has a causal effect on Y (see Figure 7.2). For an unbiased result, it is not necessary to include Z in our model. However, it may be interesting for other reasons to differentiate between the direct effect of X on Y and the indirect effect of X on Y via Z.

For example, we might want to analyse how the level of education of an individual shapes his or her environmental awareness. Between both factors, there is possibly a *direct and an indirect effect*. The level of education also has an effect on the level of income of an individual. The higher her education, the higher her income usually is, and the latter might shape the beliefs with regard to the environment. Let us assume that a rising level of education has a positive effect on both environmental awareness and the level of income. At the same time, it is not implausible for a rising income to lead to a decrease in environmental awareness. If we have money to buy expensive cars or tickets for air travel, ecological conduct may be considered as too costly. While the direct effect of education on environmental awareness is thus positive, the indirect one is negative. If both effects cancel each other out, we would call this a suppression effect. In such a constellation, our regression would show that education has no effect on environmental awareness if we do not control for the level of income in our regression. However, while correct, this result would only tell half of the story.

B. Measuring Data

1. Some preliminary thoughts

After we have identified all variables that are relevant for our study, we have to measure them. However, before we can measure, we have to *specify* and define the concepts behind each of the variables. We define a variable by identifying the relevant characteristics of the concept. Let us return to the example on the relationship between economic development and the level of democracy. Both concepts, economic development and democracy, are not self-explanatory. Does economic development refer to economic growth, the gross domestic product or to the per-capita income? Can a state already be considered as a democracy if its government is elected, or does democracy also require the guarantee of certain civil and political rights? Under which conditions can elections be considered democratic? Social scientists have to choose definitions according to their research interests. This may be an obstacle for the reception of social science studies in legal contexts. The definition of a concept in a social science study may differ significantly from the legal definition. In such a case, the insights of a social science study cannot easily be deployed in the legal context.⁴

Finally, the concepts have to be operationalized. This means that we

⁴ On this problem, see N. Petersen, *Avoiding the Common Wisdom Fallacy: The Role of Social Sciences in Constitutional Adjudication*, 11 INT'L J. CONST. L. 294, 316–17 (2013).

have to find *indicators* that allow us to *measure the concepts* according to their definition. Let us assume that we have opted in our example for a broad definition of democracy, which also includes the guarantee of civil and political rights as a necessary characteristic. Then, we would have to find indicators that measure the effectiveness of human rights guarantees. These could be reports of non-governmental organizations or international organizations on the human rights situations in the analysed countries. If we want to analyse the relationship statistically, we would have to translate the qualitative into quantitative data by coding the qualitative information in the reports.

2. Implementation

After having made some theoretical considerations regarding the data that we need, we have to collect the data. There are several ways to collect data. We can either use *field data or experimental data*. In both cases, we can either collect the data ourselves or recur to data collected by third persons. In particular for field studies, researchers usually rely on already existing data. Such data can be economic indicators, information about the composition of the population, geographic data, and so on. Often, field data is collected by national statistics agencies or international organizations, such as the World Bank or the OECD. Sometimes, however, it can make sense for researchers to collect their own data. They can send questionnaires to a number of subjects or code qualitative data that they observe. In the United States, there are several studies on whether the political ideology of Supreme Court judges influences their decision-making. For such a study, the researchers have to collect their own data on the political ideology of the judges and their decision-making practice. They can code public speeches or newspaper articles of the judges to identify their political ideology and code their votes in order to determine their decisionmaking practice according to a previously determined scheme.

Experimental data is almost exclusively collected by the researchers performing the study.⁵ Experiments observe, measure and analyse the conduct of the experimental subjects. Most of these experiments are laboratory studies. The subjects are asked to perform specific tasks. As we have seen, the experimental subjects are usually put into different treatment groups. If the conduct of the subjects in the different treatment groups differs significantly, we can assume that this difference is causally related

⁵ Sometimes, authors make meta-studies, in which they compare the results of several experimental studies on a specific topic. In such a case, the author will usually recur to already existing experimental data.

to the difference between the groups. Even though most experiments take place in the *controlled environment of a laboratory*, this is not a necessary requirement. As we have seen, experiments can also be performed as *field experiments* – an example is the study on the social reintegration of released prisoners that we have considered earlier.

C. The Validity of Results

Once we have measured our data, we hope to be able to draw conclusions about the extent to which our observations are evidence for a general theory. Not every observation is an expression of a general theory. Rather, we have to examine the validity of the results of our study. There are *three types of validity* – statistical validity, internal validity and external validity.⁶ A number of observations are *statistically valid* if we can assume with a certain probability that the observations were not made randomly, but that they are based on an existing regularity. If a correlation is *statistically significant*, we can assume with a certain probability (usually 95 percent) that the observed effect is not due to chance. However, the opposite conclusion is not possible. If a correlation is statistically insignificant, we cannot conclude that the observed effect is only a random effect. We can only *not exclude* that it might be a random effect.

If we want to draw the conclusion that specific observations are based on general empirical relationships, we need a certain number of observations. According to the law of large numbers, the relative frequency of a random event is usually closer to the actual probability of this event the more often it is observed. To clarify the logic behind the law of large numbers, let us consider an urn like the one that is represented in Figure 7.3. Let us assume that the urn contains 6,000 balls that are either black or grey. In order to determine the percentage of grey balls, we start to draw balls randomly from the urn. Let us assume that the first ball is grey. If this ball represented the relationship of balls in the urn, 100 percent of all balls would be grey. If the second ball is black, the relationship changes radically. Now, 50 percent of the balls would have one and 50 percent would have the other color. If the third ball were also black, the percentage of grey balls would decrease to 33.3 percent. The more balls we draw, the more precisely our result will represent the actual distribution on average. In our example, 1,500 of the balls are grey, that is, 25 percent. The example highlights the importance of the number of observations for the

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⁶ See T.D. COOK AND D.T. CAMPBELL, QUASI-EXPERIMENTATION 37–94 (Boston: Houghton Mifflin Company 1979).



Figure 7.3 Example of an urn with black and grey balls (left); number of grey balls drawn in a simulation (right)

accuracy of empirical research. We do not need to draw all balls from the urn in order to take an accurate guess of the relationship between grey and black balls. However, we need a *significant number of observations* (in this case about 250). If we only want to know whether there are more black or more grey balls in the urn, we need considerably less observations (in our example, 20 would already be sufficient). Statistical tests rely on this insight. The higher the number of observations, or the larger the observed difference, the more likely it is that our result is statistically significant.

The *internal validity* tells us whether a result that we observe is coherent. A result lacks internal validity if we have not controlled for variables that are correlated with the dependent as well as the independent variable. The lack of internal validity may be caused by a deficient research design. If we have not identified all relevant variables before the conduct of our study or if we have not attributed the subjects in our experiment randomly to their treatment groups, the result will be biased. Sometimes, internal invalidity may also be caused by practical difficulties: It may be impossible to observe or measure all relevant variables.

Finally, the results only justify conclusions with regard to general laws if they are also *externally valid*, that is, if they are also valid *in other contexts*. A sample can only be externally valid for the population from which it is drawn. Let us assume we conduct an experiment with male employees from the US. If these employees were randomly selected, the results of this experiment will be valid also for other American male employees even if they did not participate in the study. However, we will not be able to draw conclusions for the behavior of female employees or Chinese entrepreneurs. If we want to test whether our results are also valid for women or Chinese, we have to replicate the study with random samples of the respective populations.

II. DESCRIPTIVE STATISTICS

Descriptive statistics are used to depict empirical data. The easiest way to present empirical data is through tables, in which all the measured or calculated values are given. The financial market sections in daily newspapers used to give stock prices from the previous day in such tables.⁷ These tables were usually several pages long and – if you were not interested in a particular company, but in the general stock market – made rather uninteresting and confusing reading. Therefore, newspapers report stock market indices that summarize information to measure the value of a market – for example, the S&P 500. Since these indices vary over time (day, week, year), they are often represented by graphs reflecting the variation over time.

Just as stock market data can be presented differently, different forms of presentation are used for other types of empirical data. Descriptive statistics allows such a representation in the form of tables, graphs and summary measures. Unlike inferential statistics, which we shall cover later in this chapter, descriptive statistics does not allow identification of consequences of social phenomena or correlations between empirical factors.

A. Statistical Variable

In empirical research, we often compare attributes of persons, firms, countries or other objects of interest. Those attributes are called statistical variables. Investigated attributes of persons could be age, gender or income; attributes of firms could be size, profits or industry areas; and attributes of countries could be size, unemployment or crime rates. For example, the statistical variable (i.e., the attribute) reported property crimes in 2012 would have the value of 1129 for University of California Berkeley, 271 for Cornell University and 550 for Harvard University.⁸ We

⁷ Nowadays, with real-time stock prices available on the Internet, most daily newspapers have dropped these tables.

⁸ Source: FEDERAL BUREAU OF INVESTIGATION, CRIME IN THE UNITED STATES (2012) accessed 20 July 2015 at https://www.fbi.gov/about-us/cjis/ucr/ucr.

differentiate between populations and samples. A population includes all elements of possible observations; for example, the population could be all universities in the United States. The sample consists only of observations drawn from the population. Thus, the above sample (Berkeley, Cornell and Harvard) is a subset of the population of the universities in the United States.

A common classification of variables is the distinction between qualitative variables and quantitative variables. *Quantitative variables* are numeric and can be divided into continuous and discrete variables. Continuous variables take arbitrary values and are measured on a ratio scale. Examples are temperature, time and sizes. Discrete variables can only take on certain values and have intermediate jumps. When measuring the variable number of children in a family, we can measure zero, one, two, three or any other integer number of children, but not 1.5 children. Thus, the variable reporting property crimes in 2012 from the previous example is also a discrete variable. A *qualitative variable* has unique categories. Examples of qualitative variables are *gender* with the values female and male, or marital status with the values single, married, widowed and divorced. The value of a qualitative variable belongs always to exactly one category. Therefore, it is also called a categorical variable.

B. Histograms and Distributions

To present quantitative data, *histograms* are frequently used. Figure 7.4 gives two histograms, which describe weekly earnings of British households in pounds.

As in a bar graph, the data in a histogram is divided into categories. These categories are intervals and their size is not fixed. In Figure 7.4, the intervals are intervals of weekly incomes. Unlike with qualitative variables, computational comparisons are possible with quantitative variables. Someone in the \pounds 0–400 interval has less weekly income than someone in the \pounds 400–800 interval. A histogram gives the number of observations per interval by the height of the bars. Figure 7.4 shows the same data with two different interval sizes. On the left the interval size is \pounds 400, and on the right it is \pounds 50. Through the choice of intervals, additional information can be displayed. The histogram on the right reveals that many more people earned between \pounds 100–199 per week than \pounds 0–99. On the left this information is concealed. It is important to note that the interval sizes in the two histograms differ, but in both histograms the sum of households in the interval from £0 to \pounds 400 is the same.

Histograms help to identify incomes that occur quite frequently in the sample and others that occur only rarely. However, the main reason why



Source: British Household Panel Survey, 2009

Figure 7.4 Histograms with different interval sizes for the weekly income in pounds (f)

histograms are a very popular way to present data is that they depict its distribution. Of particular interest is the type of distribution. Two distribution types that data is usually compared with are the uniform distribution and the normal distribution (see Figure 7.5). If the incomes in Figure 7.4 were uniformly distributed, every income would be earned by the same number of people. Thus, in a histogram, all bars would have the same height. A normal distribution has the form of a bell curve in which the highest frequency is the center. If the incomes in Figure 7.4 were normally distributed, the income in the middle of the distribution would be earned by the highest number of people. Furthermore, the same number of people would earn both more and less than the income in the middle of the distribution. Of course, these distributions are idealized and can only be approximated with histograms. Furthermore, distributions can take many different forms. Figure 7.6 shows distributions with different properties. If the tail on the right-hand side is longer or fatter than on the left-hand side, the distribution is *right-skewed*. Conversely, if the tail on the left-hand side is longer than on the right-hand side, the distribution is *left-skewed*. If a distribution has two peaks, it is called bimodal.



Figure 7.5 Sketch of a uniform distribution (left) and a normal distribution (right)



Figure 7.6 A right-skewed distribution (left), a left-skewed distribution (center) and a bimodal distribution (right)

C. Summary Statistic

Using histograms, quantitative data can be presented in a very informative way. However, this can be inconvenient as we are often not interested in the full distribution, but only in single characteristics. If we describe the characteristics of a population, we call them a *parameter*, but if we describe the characteristics of a sample, we call it a *statistic*. *Summary statistics* describe a single characteristic of samples numerically. The most common summary statistics describe location and dispersion.

Measures of location are statistics on the *central tendency*. The most common measures of location are means, such as the mode, the arithmetic mean and the median. The *mode* is the value that appears most often in the sample, for example the most frequent income in a sample. The *arithmetic mean*, or simply the *mean*, is calculated by summing up all observed values and dividing the sum by N, the number of observations in the sample:

$$\overline{x} = \frac{x_1 + x_2 + x_3 + \ldots + x_N}{N}$$
(7.1)

Sebastian J. Goerg and Niels Petersen - 9781783471676 Downloaded from Elgar Online at 09/19/2021 09:38:16PM via free access *Example:* Five drivers have to pay \$15, \$15, \$25, \$35 and \$80 for speeding, respectively. What is the arithmetic mean?

$$\overline{x} = \frac{15 + 15 + 25 + 35 + 80}{5} = \frac{170}{5} = 34$$
 (7.2)

The mean value of the fine is \$34. If all five drivers had to pay \$34, this would result in the same amount as the sum of the actual fines. So on average all drivers have paid 34 dollars. Therefore, we often refer to the mean as the average.

The *median* cuts a sorted sample into two halves. Fifty percent of all observations have a value lower than (or equal to) the median and 50 percent of all observations have a value greater than (or equal to) the median. Formally, the median is calculated as follows:

$$\widetilde{x} = \begin{cases} x_{\frac{N+1}{2}} & \text{if odd number of observations } N\\ \frac{x_{N/2} + x_{(N+1)/2}}{2} & \text{if even number of observations } N \end{cases}$$
(7.3)

With an odd number of observations, the median is simply the value in the middle of the sorted observations. This position can be calculated by adding one to the number of observations and dividing this number by two. For an even number of observations, the median has the (fictitious) value of the number between the sorted observation in the middle (N/2) and the middle plus one (N/2 + 1).

Example: The Florida Department of Highway Safety and Motor Vehicles assigns points to drivers for traffic offenses and revokes their licenses if a certain amount is cumulated. Seven drivers received points for speeding. The points are: 3, 3, 3, 3, 4, 4, 4. As the number of observations is an odd one, the median is located at position (7 + 1)/2 = 8/2 = 4. The median is therefore located at the fourth position and thus it is 3 points. Now we take a look at an even number of observations. Six drivers have received the following points: 3, 3, 3, 4, 4, 4. The median is thus between the value at the third position (6 divided by 2) and at the fourth position (6 divided by 2 plus 1). The values at the third and the fourth position are 3 and 4 points, thus the median is 3.5 points ((3 + 4)/2).

Usually, the median is more robust against outliers and skewed distributions than the mean. As an example, take a look at the distribution of the monthly gross income in Germany given in Figure 7.7. The distribution is skewed to the right because of very high incomes earned by only a few persons.



Source: German Socio-Economic Panel (2009)

Figure 7.7 Estimated distribution of gross incomes in euros (ϵ)

The mode is given by the left vertical line, the median by the central vertical line and the mean by the right vertical line. The mean income indicates how much everyone would earn if everyone had the same income. The median is the income that divides the distribution in half. At the median, 50 percent of the people in the sample earn a lower income (or the same) and 50 percent earn a higher income (or the same). The median income is $\pounds 2,636$, while the mean income is much higher at $\pounds 3,178$. However, a few persons with very large incomes lead to this higher mean. This illustrates the need to be cautious when selecting a statistic for the central tendency.

However, distributions have additional properties that are not captured by measures of location. Figure 7.8 gives two distributions. Both distributions have approximately the same median, mean and mode. Nevertheless, the two distributions look very different as they have different dispersions.

The simplest *measure of dispersion* is the *range*. The range is the smallest interval containing all data in a sample. In a sorted sample, this is the difference between the largest and smallest values. A more sophisticated measure of dispersion is the variance. The *sample variance* is calculated



Figure 7.8 Two distributions with low dispersion (left) and high dispersion (right)

using the squared distances of the individual observations to the mean of the sample. The greater the dispersion of the sample is, the greater the sample variance. Formally the variance is defined as:

$$s^{2} = \frac{1}{N-1} \sum_{i=1}^{N} (x_{i} - \overline{x})^{2}$$
(7.4)

In the calculation, we subtract the sample mean from each value and square the difference. These squares are added and divided by the sum of observations minus 1.

Example: Consider the fines of five drivers for speeding. The fines amount to \$15, \$15, \$25, \$35 and \$80. In this chapter, we already calculated the mean as \$34. Thus, the variance is obtained as follows:

$$s^{2} = \frac{(15 - 34)^{2} + (15 - 34)^{2} + (25 - 34)^{2} + (35 - 34)^{2} + (80 - 34)^{2}}{5 - 1} = 730$$
(7.5)

Thus, the variance is $\2730 . The variance is always specified as the square of the respective unit. The measure of dispersion, the *standard deviation*, is directly related to the variance. It is defined as the square root of the variance:

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$$s = \sqrt[2]{\frac{1}{N-1} \sum_{i=1}^{N} (x_i - \overline{x})^2}$$
(7.6)

For the above example, this results in a standard deviation of \$27.02. The unit of the standard deviation corresponds to the unit of the sample. Both variance and standard deviation convey the same information.

In addition to the variance and standard deviation, there is the *standard error of the mean*. The standard error⁹ indicates the quality of an estimate. With the mean of a sample you usually want to predict the (fixed) mean of a population. However, the mean of a sample can differ from the population mean due to random factors and measurement errors of this value. The smaller the standard error of the mean, the higher is its accuracy. The standard error is defined as the standard deviation divided by the square root of the number of observations:

$$SE = \frac{s}{\sqrt[2]{N}}$$
(7.7)

Therefore, the standard error gets smaller with decreased standard deviation or with increased sample size. If the sample size is extremely large, the standard error is very small. In contrast, the standard deviation is not directly affected by the sample size. The measured dispersion remains the same regardless of accuracy and sample size.

III. INFERENTIAL STATISTICS

Descriptive statistics gives us different possibilities to present data. However, often we would like to draw conclusions beyond pure description. Using samples, we would like to make statements on the significance and reliability of differences between samples, or about the possible relationship between two or more variables. *Inferential statistics* allows us to draw such conclusions from data. In the following, the basic concepts of statistical tests are explained, before the different areas of application are illustrated with the help of simple examples.

⁹ In general, the standard error is a quality measure for an estimate of an unknown parameter. This may be the mean of a population, but also a regression coefficient. Here we discuss only the standard error of the mean value, but other standard errors are interpreted analogously.

A. Basic Concepts of Statistical Testing

Most statistical tests are used to qualify differences between samples or statistical variables. Here, we call a difference between two samples or variables *statistically significant* if the probability that this difference has arisen by chance is very low. The term 'statistically significant' does not imply that the relation or the difference is important. Rather it just means that the finding is unlikely to be the result of a random event; in other words, there is a high probability for a systematic deviation or relationship. Please keep in mind that this is not the same as being economically relevant, important or even meaningful.

Starting points of each statistical test are the *null hypothesis* H_0 and the *alternative hypothesis* H_1 . The null hypothesis usually states that there exists no difference, or there is no relation between two factors. The alternative hypothesis, however, states that there exists a difference, or a relationship between two factors. H_1 is usually the research hypothesis and should be either confirmed or rejected. We always test H_0 against H_1 and hypotheses must be formulated in such a way that only one can be true.

If, for example, you want to compare the average body size of men and women, the null hypothesis would state that there is no difference, and the alternative hypothesis would state that they differ. In this example, the alternative hypothesis does not state a direction for the difference. Such a test is called a *two-sided test*. If the alternative hypothesis states a direction for the difference, for example, that men are on average taller than women, the applied test is a *one-sided test*.

However, one has to be cautious with the interpretation of test results. A statistical test will never confirm with absolute certainty whether the null or the alternative hypothesis is true. Rather, they are probability statements. The desired probability for qualifying an effect as not being due to pure chance is called the *significance level* α . The significance level indicates how likely it is that we incorrectly reject the null hypothesis although it is true. We refer to this error as a *type 1 error* or *false positive*.

On the other side, finding a non-significant result is assigned with an error probability, too. If we wrongly confirm the null hypothesis and reject the alternative hypothesis, we speak of a *type 2 error* or *false negative*. Unlike with type 1 errors, there are situations when we cannot calculate the probability of a type 2 error. Table 7.1 summarizes the discussed errors.

The significance level is used as a threshold representing the highest acceptable probability of a type 1 error. However, the smaller α is, the higher the probability of a type 2 error. In the social sciences, we usually work with significance levels of 5 percent. In addition, results at the

	H ₀ is true	H_1 is true
H ₀ is not rejected	correct result true negative	type 2 error false negative
H ₀ is rejected	type 1 error false positive	correct outcome true positive

 Table 7.1
 Possible errors with hypothesis testing

10 percent level are often referred to as weakly significant. Results at the 1 percent level are referred to as highly significant. However, once we work with larger datasets (thousands of observations), we tend to use higher levels of significance (i.e., smaller probabilities). Usually statistical programs do not return the significance level, but the *p*-value of a test. The p-value is the actual calculated probability of a type 1 error. If the p-value is below the significance level, we consider the test result as statistically significant.

B. Selection of Statistical Tests

There exist a vast number of statistical tests. They have been developed for different research questions, different types of variables and different relationships between variables. In the following, we will discuss some typical applications, without a claim for completeness. These examples are only intended to illustrate tests as valuable tools; they are not suitable to teach the reader the application of these tools. If you are interested in more detailed insights, you should take a look at the selected reading list at the end of this chapter and perhaps acquaint yourself with a statistical software package.

After choosing hypotheses and significance level, one turns to the *selection of the test method*. The test must be suitable for the research question and the available data. The selection of the test is already narrowed down by the research hypothesis. Given the hypothesis, we either *test differences* between variables or we *test dependence* or relationships between variables. An example for testing differences would be the comparison of the average height of men and women. An example for testing dependence would be whether body size and shoe size are correlated.

1. Testing differences

When testing for differences it is necessary to specify the nature of the difference first. In this category, the most common tests are tests for differences in the central tendency (mean or median), the dispersion (standard

deviation or variance) or the shape of the whole distribution. In addition, one must take into account whether *dependent samples* or *independent samples* are tested. We deal with dependent samples if, for example, observations from one person can be found in both samples. Such samples are often used in medical trials to determine the effects of drugs. In such cases, the first sample consists of values (e.g., blood pressure) before taking the drug and the second sample of measures after the intake.

However, it is often impractical or simply not possible to work with dependent samples. For instance, if we wanted to examine differences in the hair volumes of 18-year-old and 50-year-old men, it would be highly inefficient to collect the first survey when subjects are 18 years old and then wait for 32 years to collect the second survey. Instead, one would use two random samples: one sample of 18-year-old men and a second sample of 50-year-old men. Since these two samples are not directly related, they are considered independent.

(a) Central tendency In this section, we will first illustrate the testing of dependent samples, and later the testing of independent samples. Up to now, using hand-held mobile phones while driving has not been forbidden in most US states. Suppose you were interested in the effect of mobile phone usage on reaction times while driving. In an experimental study, one could test the reaction times of ten participants while driving a simulator. First one would measure the reaction times of the participants while fully concentrating on the road. Thereafter, the same participants would perform the same task again while using their mobile phones. Because we are gathering data for the same participants, we are working with two dependent samples. As the null hypothesis we formulate that reaction times while using a phone are at least as fast as the reaction times without a phone. Therefore, the alternative hypothesis is that reaction times are faster without phones. Since the hypotheses are directed, we can apply a onesided test and as a significance level we choose 1 percent. Table 7.2 gives the measured times (in milliseconds) of the participants in the experiment.

The table shows that, on average, response times are faster without mobile phone usage than those with (mean reaction time without 407.5ms, mean reaction time with 464.7ms). However, there are two participants with faster reaction times while using the phone. Can we conclude that there is a systematic difference in response times? A simple test¹⁰ returns a

¹⁰ In this example, the Wilcoxon signed rank test for dependent samples was applied. Alternatives are the t-test for dependent and the Fisher-Pitman permutation test for dependent samples.

Without mobile phone	391	368	427	402	372	409	438	408	402	458
With mobile phone	446	498	496	487	426	403	523	440	474	454

Table 7.2 Reaction times of participants in milliseconds

Table 7.3 Wages of 16 randomly selected employees in dollars (\$)

Women	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Men	2,405	2,405	2,405	2,405	2,405	2,405	2,405	2,405

p-value of p = 0.006. Thus, we can conclude that, on average, talking on mobile phones decreases reaction times significantly.

One example for an independent sample is the wages of randomly selected women and men. Let us assume that a company is sued for allegedly discriminating against women by paying them lower wages. Table 7.3 gives the wages of 16 randomly selected female and male employees.

The table reveals that, on average, women earn less (\$2,400) than men at this company (\$2,405). Can we conclude that there is a significant difference between the two samples, or is the result just driven by chance? The null hypothesis would state that no difference exists in average wages, while the alternative hypothesis states that there is a difference. The null hypothesis should be rejected with a significance level of 1 percent. A simple test¹¹ returns a p-value of p < 0.001 and we can reject the null hypothesis.

Let us take another look at the table. In this example, all women received a wage of \$2,400 and all the men received \$2,405. Thus, all male employees received \$5 more than the female employees. Our test only confirms that it is quite unlikely for this difference to arise by chance. However, the test does not answer the question whether a difference of \$5 is substantial or important. This interpretation is left to the researcher who carries out a study or, in this example, the judge.

(b) Dispersion In addition to testing the differences in the central tendency of variables, comparing the standard deviations might be an

¹¹ In this example, the Mann-Whitney U-test was applied. Alternatives are the t-test for independent samples and the Fisher-Pitman permutation test for independent samples.

Course A	100	80	70	60	40	30	20	0
Course B	60	55	55	50	50	45	45	40

Table 7.4 Test scores of 16 students in two different courses

interesting question. Testing the standard deviations is often used to analyse the differences in quality and precision.

Table 7.4, for example, gives the exam results of 16 students for two courses on the same material. Both courses have the same mean and median of 50 points. However, the standard deviations are different; in course A, it is 33.38 points, and in course B it is 6.56 points. We test the null hypothesis that there is no difference between the standard deviations with a threshold for the significance level of 5 percent. The calculated p-value is p < 0.001 and, thus, the null hypothesis is rejected. Although the average performance of the students in courses A and B is exactly the same, it shows us that the performance of students in course B is much more homogenous than the performance of students in course A.

(c) Distributions A question regularly asked when working with empirical data is how the data is distributed. If there are enough observations, for example, if one has a large representative sample, one can plot the distribution and compare it to other distributions. As already discussed in this chapter, the gross income in Germany is skewed to the right (see section II.C). Figure 7.9 shows the distribution of gross incomes and what a normal distribution would look like. It is quite obvious that these two distributions differ.

For large samples, differences between distributions can often be identified at first glance. In smaller samples, random outliers have a bigger influence on the data and thus the comparison is harder and we use statistical tests. With these tests,¹² we can either test whether the distribution of a sample differs significantly from a theoretical distribution (i.e., uniform or normal distributions) or whether the distribution of two samples differs. A typical question would be whether the wage distribution for women differs from the one for men.

When testing the differences of distribution, it is important to note that it is only possible to conclude if the distributions differ significantly or not.

¹² For testing a sample against a theoretical distribution, one could use the Shapiro-Wilk test or the Kolmogorov-Smirnov test. For testing two samples, one could use the Kolmogorov-Smirnov test, the Pearson Chi² test or the Epps-Singelton Omnibus test.



Source: German Socio-Economic Panel (2009)



A statement about the nature of the difference, that is, different mean, variance or distribution type, is not possible.

2. Testing dependencies

When testing dependencies between two variables, we distinguish between non-causal and causal dependencies. Non-directional relationships are investigated with *correlations*, while statements of causality are investigated with *regressions*. Before moving on, you might want to recall our earlier discussion of causality (see section I.A).

(a) Correlations In empirical studies, we are regularly interested in the relationship between two measured variables (e.g., height and shoe size). If there is a positive or a negative relationship between two variables, we call this relationship a correlation. Correlations can often be identified with the help of *scatter plots*, such as the ones in Figure 7.10.

An accurate measure of a relationship between two variables is the *correlation coefficient r*, which reflects the (linear) dependency between two variables. A correlation coefficient can take any value between -1



Figure 7.10 Scatter plots of variables without correlation (left), positive correlation (center) and negative correlation (right)

and 1 (including -1 and 1). If the coefficient is larger than zero (r > 0), we have a *positive correlation*. If the coefficient is smaller than zero (r < 0), we have a *negative correlation*. If the correlation coefficient is zero (r = 0), we conclude that the two variables are uncorrelated and there is no (linear) relationship between them. The closer the correlation coefficient is to either -1 or 1, the more are the observations on one line. In Figure 7.10, for example, the coefficient for the correlation on the left is r = -0.016; in the middle, it is r = 0.98; and on the right, it is r = -0.97.

In addition to correlation coefficients, statistical programs provide a significance level. As with the tests discussed in the previous section, the significance level gives the probability of wrongly identifying a non-existing (linear) relationship. Simplified, the higher the significance level, the more robust the result.

Let us take a look at an example for the correlation between two measured variables. Figure 7.11 gives the unemployment rate and the rate of robbery crimes for each US state in 2012. Each dot represents one US state. The graph already reveals a likely positive relationship: more robberies occur with higher unemployment, or vice versa, and unemployment is higher the more robberies there are. And indeed, testing the correlation returns a positive correlation coefficient of r = 0.6136 and a highly significant p-value of p = 0.0001.

In our example, there is a highly significant and strongly positive correlation between unemployment and robberies. However, it is important to note again that correlation does not imply causality (see section I.A).



Source: Federal Bureau of Investigation and Bureau of Labor Statistics

Figure 7.11 Scatter plot of unemployment rate and robbery rates for the 50 US states

Therefore we cannot conclude whether more committed robberies lead to more unemployment or whether unemployment is the reason for committing robberies. The only valid conclusion, given the applied analysis, is that increased unemployment and robberies tend to occur jointly.

(b) Regressions Econometrics combines economic theory (model) with reality (observed data). Regression analysis is one of its most important tools. In econometrics, regression models are used to analyse causal relationships and to test economic models.

In regression, we have one *dependent variable* (the variable to be explained), and one or several *independent variables* (also known as explanatory variables). The dependent variable is explained by the explanatory variables and thus depends on these. With the help of regressions we can determine whether an explanatory variable has any influence on a dependent variable, how much a change of an independent variable influences the dependent variable, and how a dependent variable changes over time. Typical questions that are investigated with the help of regression models are:

- How much does the demand of a product change with an increase of \$1?
- How does the crime rate change if more police officers are hired?
- How does the income of an employee depend on educational background, age and gender?

In the following, we will discuss the prices of used cars as an example. A regression is always based on a model. A model always specifies the dependent variable, the independent variables, error terms, as well as the functional form. Let us assume that the price of a used car depends only on the mileage of the car. Furthermore, the relationship between mileage and price is linear, that is, the price of the car decreases by the same amount for each mile driven. In this case, our econometrical model is as follows:

$$Price_{x} = \alpha + \beta_{I} Miles_{x} + \gamma_{x}$$
(7.8)

On the left-hand side of the equation, we see the variable to be explained – in our example, the price of car X. On the right-hand side of the equation, we see the variable that should explain the price – in our example, the number of miles of car X. Beta is the coefficient we want to estimate with the regression. It reflects the influence of the explanatory variable, that is, it shows how much the price of a car changes with each mile driven. Alpha is a constant. It reproduces the estimated value of a car with zero miles driven. Gamma is the error term, it is random and it reflects, for example, prices asked by the seller that are too high or too low. We assume that these errors are on average balanced, thus gamma is on average zero. An important assumption here is that alpha and beta are the same for all vehicles. There is only a difference concerning the number of miles driven and the error.¹³

A linear regression with a single explanatory variable can be very easily illustrated with a graph. The scatter plot in Figure 7.12 gives the prices and mileages of used cars. The above regression model estimates the straight line, which best describes the scatter plot, given as the dashed line in Figure 7.12. The slope of the dashed line is the estimated coefficient beta, and the intercept of the *y*-axis is the constant alpha.

Statistical programs normally provide some additional information, apart from the coefficients and the constant. These are diagnostics for the

¹³ Further assumptions are: no correlations between explanatory variables and error terms; error terms are normally distributed with a constant standard deviation.


Figure 7.12 Scatter plot of prices for a used car and mileage

whole estimation and p-values for the individual coefficients. The diagnostics measure the quality of the estimation. The most common ones are the *coefficient of determination* (R^2) and the *F-statistic*. The R^2 measures how well the estimated regression function maps the empirical data. Thus, it assesses how well the regression describes the data on which the estimates are based. In the above example, the R^2 describes how much of the dispersion in prices is explained by the dispersion in number of miles. The value of the R^2 is always between 0 and 1. The higher the value, the more of the price dispersion is explained by the model. If the regression explains all of the dispersion, R^2 becomes equal to one ($R^2 = 1$) and the data is fully explained by the constant and the coefficients. If the explanatory variables do not explain anything of the existing dispersion, R^2 becomes equal to zero ($R^2 = 0$). If the regression model is used not only to describe the current data, but also to predict future data, R^2 should be fairly large.

The *F*-statistic or *F*-test informs us whether the explanatory variables of the estimated model actually influence the dependent variable. However, if the F-test is significant, this does not mean that all coefficients are statistically significant, that is, all explanatory variables have a significant influence on the dependent variable. In order to check the influence of each independent variable, the individual regression coefficients are tested with the t-statistic. The *t*-test checks for each independent variable whether it has

Variable	Model 1	Model 2	Model 3
Miles	-0.2045 **	-0.1630 **	-0.0984 *
	(0.0402)	(0.0349)	(0.0406)
Horsepower		56.198 **	48.973 **
		(16.4937)	(15.001)
Doors			659.05 *
			(266.17)
Constant	15364.61	8809.97	4465.852
	(1504.15)	(2281.19)	(2686.88)
F-test	p < 0.0001	p < 0.0001	p < 0.0001
\mathbb{R}^2	0.5525	0.7169	0.7860

Table 7.5 Linear regressions explaining the price of used cars

Note: ** $p \le 0.01$; * $p \le 0.05$.

a significant relationship with the dependent variable or not. A significant t-test means that the probability of the coefficient of the independent variable actually influencing the dependent variable is sufficiently high. Again, all caveats of significance testing apply here, too (see above, section III.A).

The regression results are usually presented in tables. Table 7.5 gives the estimates of three regression models explaining the price of used cars: Model 1 is the model from the above example, model 2 complements the first by the number of horsepower and model 3 adds the number of doors (3 or 5 doors). Formally, these models are defined as:

Model 1: $Price_x = \alpha + \beta_1 Miles + \gamma_x$ Model 2: $Price_x = \alpha + \beta_1 Miles + \beta_2$ Horsepower $+ \gamma_x$ Model 3: $Price_x = \alpha + \beta_1 Miles + \beta_2$ Horsepower $+ \beta_3 Doors + \gamma_x$

Although such tables may look complicated, they are nothing to be scared of. First we will look at the p-value of the F-test. The F-statistic checks whether there are regression coefficients that are significantly different from zero. Generally speaking, if the F-test is significant, there exists a statistically robust relationship between at least one of the explanatory variables and the dependent variable. Here, it is highly significant for all three models. This tells us that in each model at least one of the coefficients has a significant influence on the price. The next step is to look at the significance levels of the single coefficients in the models. The statistical program usually gives the p-value for each coefficient; in tables, we usually prefer to give the significance levels with the help of stars. The levels are usually explained in the legend. The more stars there are, the more certain we can be that the explanatory variable influences the value of the used car. The applied test for the single coefficients is the t-test.

We now turn our attention to the signs of the coefficients. In the third model, the coefficient for miles is negative, while the coefficients for doors and horsepower are positive. Thus, the price of a used car decreases with the number of miles driven, but it increases with the number of doors and the amount of horsepower. Since all the coefficients are significant, we can be pretty sure that these three factors (miles, horsepower and doors) actually influence the price of the car. Here the coefficients are in dollars: with each mile driven, the value decreases by 0.0984 dollars; with each additional horsepower, it increases by 48.973 dollars. In addition, the table gives the standard errors of the regression coefficients in brackets. The standard errors depend on the standard deviation of the estimated coefficients and the number of observations, and they are important for the p-values of the t-tests. Put simply, the higher the standard error is, the less likely it is that the independent variable has a significant influence on the dependent variable.

As you can see in the table, the coefficient for mileage becomes smaller when additional variables are added. The reason for this is that a part of the price is better explained by the additional variables. The third model is best suited to estimate the price of a used car as it has the most significant coefficients and the highest coefficient of determination R^2 .

However, as any other statistical tool, regressions are not immune to errors. Just as spurious correlations can lead to problematic results, omitted variables are a problem for regression models. Let us turn to the example of the spurious correlation between storks and births discussed earlier (see section I.A.2). Table 7.6 gives the estimation of two linear regression models, based on the data from the study comparing the number of storks and birth rates in 17 European countries. The first model assumes that only the number of storks explains the number of births in a country; the second model assumes that the number of storks and the size of the country (in square kilometers) explain the number of births in a country.

Model 1 confirms our previous correlation and indicates a significant relationship between the number of storks and births per year. However, as model 2 demonstrates, this is only a spurious correlation and the result of an omitted variable. After including the omitted variable (country size) in the model, the number of storks actually has no significant impact on the number of births. Furthermore, the accuracy of model 2 is higher than the accuracy of model 1, as can be seen by the improved p-value of the F-test.

Variable	Model 1	Model 2
Number of storks	0.029 *	-0.006
	(0.009)	(0.006)
Size in km ²		0.0015 *
		(0.0002)
Constant	225.03	-7.411
	(93.56)	(56.70)
F-test	p < 0.01	p < 0.0001
\mathbb{R}^2	0.3847	0.8922

Table 7.6 Linear regressions explaining the birth rates

Note: $* p \le 0.01$.

Of course, there are many more applications for regressions and thus further challenges arise. For example, the relationship between variables is not necessarily a linear one, variables can have a limited range of values or they represent probabilities. Further challenges are, among others, multicollinearity (high correlations between independent variables) and heteroskedasticity (different standard deviations in the dataset). The biggest challenge, however, is to establish causality. Due to this complexity, econometrics has become an enormously important field within economics.

FURTHER READING

- COOK, THOMAS D. AND DONALD T. CAMPBELL, QUASI-EXPERIMENTATION (Boston: Houghton Mifflin Company 1979).
- COPE, DAVID, FUNDAMENTALS OF STATISTICAL ANALYSIS (New York: Foundation Press 2005).
- DAVIS, JAMES A., THE LOGIC OF CAUSAL ORDER (Beverly Hills: Sage 1985).
- JACKSON, HOWELL E., LOUIS KAPLOW, STEVEN M. SHAVELL, W. KIP VISCUSI AND DAVID COPE, ANALYTICAL METHODS FOR LAWYERS (2nd ed., New York: Foundation Press 2010).
- KENNEDY, PETER, A GUIDE TO ECONOMETRICS, (6th ed., Boston: Wiley-Blackwell 2010).
- Kish, Leslie, *Representation, Randomization, and Realism*, in: STATISTICAL DESIGN FOR RESEARCH 1–26 (Leslie Kish ed., Hoboken: Wiley 1987).
- LAWLESS, ROBERT M., JENNIFER K. ROBENNOLT AND THOMAS S. ULEN, EMPIRICAL METHODS IN LAW (New York: Aspen Publishers 2009).
- SIEGEL, SIDNEY AND N. JOHN CASTELLAN, NONPARAMETRIC STATISTICS FOR THE BEHAVIORAL SCIENCES (New York: McGraw-Hill, 1988).
- SINGLETON, ROYCE A. AND BRUCE C. STRAITS, APPROACHES TO SOCIAL RESEARCH (5th ed., New York: Oxford University Press 2009).

8. Behavioral law and economics Markus Englerth

I. BEHAVIORAL THEORY IN ECONOMICS

The rational investor, as we encounter him in most traditional economics textbooks, is a rather prudent fellow. He knows the financial markets inside out, dispassionately pursuing his well-understood self-interest by weighing the potential and risk of each product he buys or sells. Most observers of the latest financial crisis, however, will find it hard to square this image with the revelations following the great meltdown. What they were confronted with in the daily newscasts of that time were reckless types driven by excessive greed, exuberance and sometimes fear, who frantically traded complex financial products they often barely understood. It has been said that the crisis of 2007–08 not only shook the worldwide financial system; it also rattled the science of economics. Reality suddenly seemed to fly in the face of some of its most fundamental assumptions, leading to an outright crisis of the discipline itself. Yet every crisis generates some profiteers. Accordingly, the slump for conventional economic wisdom created a 'bull market' for a group of economists who had long doubted some tenets of their discipline – most importantly, the theory of rational choice.

The critique focused primarily on the behavioral model underlying conventional economics. Such critique is, in particular, voiced by a relatively new movement in legal studies, most often referred to as *behavioral law and economics*. Proponents of this movement strive to present an alternative to the traditional rational choice approach. Instead of simply accepting the latter's assumptions (see Chapter 2 on the assumptions of traditional economic theory), this new movement attempts to test them empirically and to modify and enhance them with insights from behavioral science. The result is less than complete rationality, but more than random irrationality: Richard Thaler coined the term '*quasi-rationality*' to describe this.¹ Others use a term that is perhaps even more incisive: 'predictable

¹ RICHARD THALER, QUASI-RATIONAL ECONOMICS (New York: Russell Sage Foundation 1991).

irrationality'.² The potential as well as the possible weaknesses of this alternative behavioral model for legal economics will be discussed on the following pages.

II. METHODOLOGICAL AND CONCEPTUAL BASICS

The term 'behavioral law and economics' alone contains three linguistic components: the behavioral, the economic and the legal one. The following pages intend to examine what these terms represent and how they relate to each other.

A. The Behavioral Component

The behavioral element distinguishes the new approach from the traditional economic analysis of law. The dominant behavioral science, for open-minded economists, was cognitive psychology. Cognitive psychology usually offers results that can be seen as valid for all human beings. The fundamental set-up of our brains is the same for everyone. Hence, it does not come as a surprise that most deviations from the rational model documented by cognitive psychology can be found in the vast majority of people in exactly the same way. Such deviations are therefore systematic and, to a degree, predictable. This systematic character provides the foundation for a relatively universal 'quasi-rational' behavioral model. However, the term 'behavioral science' is increasingly understood expansively. Some authors, for instance, are beginning to include the field of neuroscience. Departing from an improved understanding of our brain's diagram, they hope to gain deeper insights into the effects discovered by psychology, and into the way they are associated. Others are trying to make sociology fruitful terrain for economic issues, endowing homo economicus with a social dimension beyond game-theoretic and strategic interaction.³ It remains to be seen just how significant the usefulness of such expansions will prove to be.

² DAN ARIELY, PREDICTABLY IRRATIONAL: THE HIDDEN FORCES THAT SHAPE OUR DECISIONS (New York: HarperCollins 2008).

³ Cf., e.g., Dan M. Kahan, *The Logic of Reciprocity: Trust, Collective Action, and Law*, 95 MICHIGAN L. REV. 2477–97 (1997).

B. The Economic Component

Behavioral law and economics is not the same as 'law and psychology', just as behavioral economics is not 'merely' psychology. In fact, the new approach also contains a great deal of economics. First of all, behavioral economists have all but given up their search for equilibria and efficient solutions, although they may indeed come to different results. The same applies for economic *methods*: methodological individualism (see Chapter 2, section I.A), mathematical formalization of assumptions, and logical deduction of results – the value of these methods is hardly questioned.

It is beyond doubt that the traditionally most popular methodology of behavioral economics lies in conducting experiments; in the decision lab, participants are presented with a problem they must solve without being embedded in their usual socio-cultural context. However, all other methods used in economics are just as valid: field data maintain their relevance, just as field experiments and computer simulations do. Moreover, in most papers, the rationality assumption of the standard approach apparently still continues to be the benchmark necessary to detect 'anomalies'.

C. The Legal Component

Cognitive psychology, which empirically underpins behavioral economics, is *not a normative discipline*. It is all about understanding how the human brain works. Whether the result is good or bad is not of interest to this discipline. The findings of behavioral economics should be accommodated in every normative analysis. On their own, however, they do not have a normative character.

A discipline that regularly deals with normative judgments is law. Lawyers play an important role in applying the insights gained from behavioral economics to real-world problems. Indeed, the scope for a normative review is wider, as we shall see, compared to traditional economic analysis. For the latter, to some extent, constitutes a closed system: autonomous market behavior and efficient results are, in a sense, two sides of the same coin. State intervention is only necessary once high transaction costs impede free market exchange (see Chapter 3). In actual fact, however, many cognitive phenomena can have a very similar effect as transaction costs, as behavioral economists point out. It is neither desirable nor practical to neutralize them all through state regulation. The legal scholar, in consequence, faces a problem of selection: Which effects are so detrimental that they need paternalistic regulation? Which ones are neutral, and which are even positive? And how should we proceed when an effect is ambivalent, that is, when it can have positive and negative effects on one individual or several? Legal scholars have to use a normative axe, as it were, in this new thicket of complex judgments.

In the following, some prominent insights from the rich behavioral (law and) economics literature are outlined and legal applications discussed. Most of these examples stem from the domain of criminal law. However, the relevance of behavioral law and economics is not limited to this. The literature is abundant with applications pertaining to private and public law as well.⁴

III. INSIGHTS OF BEHAVIORAL ECONOMICS

In their seminal essay on the methodology of behavioral law and economics, Jolls, Sunstein and Thaler speak of the '*three bounds*' that distinguish the psychologically informed behavioral model from the traditional rationality model. They call them (1) bounded self-interest, (2) bounded rationality and (3) bounded willpower.⁵ Other authors have taken up this threefold (and obviously not imperative) categorization, and the following illustration will also be oriented along these lines.

A. Bounded Self-interest

In a famous quotation, the economist Francis Edgeworth elevated selfinterest to the 'first principle of economics'. What he means is that homo economicus searches to maximize his utility given existing restrictions (see Chapter 2, section I.C on the model of the homo economicus). However, this does not answer the question of just how this utility is to be defined. Economists quite consciously refrain from making tangible statements on this. Even though they often concentrate on the material or monetary utility, this restriction is by no means imperative. Nobody can seriously dispute that people may also be interested in gaining respect or esteem, or in avoiding disapproval. The thief robs because he values the loot more than a clear conscience, and the nun prays because a good relationship with God is worth more to her than anything else. Both maximize what

⁴ A general overview can be found in Christine Jolls, Cass R. Sunstein and Richard H. Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1508 (1998); Russel B. Korobkin and Thomas S. Ulen, *Law* and Behavioral Science: Removing the Rationality Assumption from Law and Economics, 88 CAL. L. REV. 1053 (2000).

⁵ Jolls, Sunstein and Thaler, *A Behavioral Approach to Law and Economics*, 50 STAN. L. REV. 1471, 1476 (1998).

economists call their *expected utility* according to the formula commonly applied in decision theory:

$$EU = p_1 U(x_1) + p_2 U(x_2) + \ldots + p_n U(x_n).$$
(8.1)

Here, $U(x_1)$ to $U(x_n)$ define the individual utility of particular uncertain events that can occur with probabilities p_1 to p_n . This utility is not determined objectively, but rather subjectively, in other words according to the individual utility function U of the decision-maker, which also expresses the latter's attitude towards risk. The same result x can therefore be evaluated quite differently by two people.

Is not every observed behavior then in accord with expected utility theory? Two things ensure that it avoids the pitfall of circularity and lacking falsifiability, which could easily result from such arbitrariness. First, a series of so-called rationality axioms determines a strict framework for possible preferences. Each decision has to be interpretable as a rational choice not only standing by itself, but it must not be at odds with the preferences stated in other decisions either. Second, economists conventionally make a further restriction, according to which homo economicus indeed only seeks his own advantage. The utility of others hence has no influence on the utility of homo economicus. Social preferences, though they do not usually disrupt the framework of rational theory, are as a rule implicitly excluded. Homo economicus is, hence, neither altruistic nor begrudging. He is barely interested in his fellow human beings. Now, our everyday experience shows us that most people are not quite as detached as this. Both psychologists and economists have tried to define this experience more precisely in a series of experiments (see Chapter 4, section III.C).

The best-known of these is the *ultimatum game*.⁶ The rules of the game are very straightforward. Player 1 is given the task of dividing a certain sum of money between himself and a second player. Player 2 can accept or refuse this offer. If Player 2 accepts, the money is divided as Player 1 proposed. If Player 2 refuses, both players end up empty-handed. The prediction of rational choice theory for such a situation is just as straightforward. A rational Player 1 would offer the lowest possible sum, 1 cent, in order to keep the maximum for himself. A rational Player 2 would have to accept this offer, because after all 1 cent is better than nothing. However, the behavior predicted by rational choice for the ultimatum

⁶ Essential reading on this is Werner Güth, Rolf Schmittberger and Bernd Schwarze, *An Experimental Analysis of Ultimatum Bargaining*, 3 J. ECON. BEHAV. ORGAN. 367 (1982).

game is almost never observed. Offers of less than one-third of the total sum are regularly refused by Player 2. Most participants who play the role of Player 1 appear to anticipate Player 2's reluctance to be fobbed off with only very little. In consequence, the average offer in the initial experiment was a 63:37 distribution. A 50:50 distribution was the one offered most frequently.

Even if the sums played for are comparable to a month's salary, the players' behavior remains unchanged. Apparently, the vast majority of participants in the role of Player 2 feel a need to punish an ungenerous opponent, even if this puts them at a disadvantage. Note that it is Player 2's behavior which appears to breach the self-interest postulate. Player 1, by contrast, anticipating this, behaves rationally by making a generous offer, so as to keep at least a piece of the 'pie'.

Contrary to this, in the so-called *dictator game*, the player whose turn it is first behaves in contradiction to rational theory. In this game, the opponent does not have the option of refusing the offer made to him. However, here also we do not often see an offer of merely the minimum sum. Instead of reserving the highest possible share for themselves, most players in the offering role give a substantial part to Player 2 (even if we do observe that the offers are slightly inferior to those made in the ultimatum game).

What both experiments demonstrate is that people are very often not only motivated by their narrowly defined self-interest, but also by *fairness norms*. Such norms may have different roots. Some, such as the *principle of mutuality*, might well have been evolutionarily adaptive.⁷ The findings resulting from a tournament organized by Robert Axelrod support this: in a computer simulation, the researchers had programs compete against each other, each program embodying a different strategy in competition with the other strategies. In the end, only a four-line program developed by the mathematician Anatol Rapaport prevailed by pursuing a strict tit-for-tat strategy.⁸ Note that this strategy is very similar to the behavior displayed by real people when playing the ultimatum game. Other fairness norms may be culturally determined. Among other aspects, the manipulability of the results of the dictator game and the ultimatum game support this thesis. For instance, if one suggests to Player 1 that he achieved his offering role through merit (for instance, by correctly answering a difficult

⁷ For a short overview on this topic, cf. Samuel Bowles and Herbert Gintis, *Homo Reciprocans*, 415 NATURE 125 (2002); for a longer treatment, cf. SAMUEL BOWLES AND HERBERT GINTIS, A COOPERATIVE SPECIES: HUMAN RECIPROCITY AND ITS EVOLUTION (Princeton NJ: Princeton University Press 2011). ⁸ Cf. ROBERT AXELROD, THE EVOLUTION OF COOPERATION (New York: Basic

^o CI. KOBERT AXELROD, THE EVOLUTION OF COOPERATION (New York: Basic Books 1984).

question before the game), then his offers are significantly lower than they would be without such a suggestion.

The above does not imply that the standard assumption of selfinterested behavior *always* falls short. The games mentioned above were, for the most part, one-shot games that were played under the prerequisite of total anonymity. In real life, however, such conditions are relatively rare. Folk wisdom has it that 'you always meet twice in life'.

Notwithstanding this, the impact of fairness norms does not seem limited to a few artificial situations. There are economically relevant behavioral patterns that are hard to explain by assuming pure self-interest. For instance, people generally leave tips in motorway service areas they are unlikely ever to visit again. The relevance of the concept of fairness for legal analysis is not to be underestimated either. Two brief examples illustrate this.

Many lawyers and criminologists take it as given that people obey the law not only out of a fear of punishment. They also emphasize the role of social norms and internalized values in maintaining order.⁹ Experimental research on fairness preferences - in particular the concept of mutuality supports this assumption. It suggests that, as long as people believe that most of their fellow human beings will adhere to existing norms, they will themselves be prepared to do the same. This makes intuitive sense; if every possible opportunity were used to commit a crime, the upholding of public order could scarcely be guaranteed. However, this logic does not function in one direction only. The visible erosion of norms in a community may also lead to the feeling that it is foolish to be law-abiding. Self-interest will then come back with a vengeance, and the process of social breakdown will be accelerated by the fact that more and more people who might normally cooperate without reservation now denounce cooperation. The concept of 'conditional cooperation' is reminiscent of the theoretical starting point of the so-called broken windows theory, which claims that minor but visible transgressions (like an unfixed broken window or litter in the streets) should not be tolerated on the grounds that they invite further (and more severe) transgressions by signaling a weakening of the social order.¹⁰

At times, the law itself prohibits efficient transactions, without economic theory being able to give plausible reasons for this (see on this

⁹ Cf. ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES (Cambridge, Mass.: Harvard University Press 1991).

¹⁰ George L. Kelling and James Q. Wilson, *Broken Windows: The Police and Neighborhood Safety*, ATLANTIC MONTHLY 29 (March 1982); cf. Kees Keizer, Siegwart Lindenberg and Linda Steg, *The Spreading of Disorder*, 322 SCIENCE 1681 (2008).

Chapter 2, section II). For instance, some interpret the *prohibition of black-market trading* by resorting to certain fairness norms.¹¹ Black-market trading, as they see it, ultimately corresponds to an auction and is therefore highly efficient, for auctions guarantee that a good goes to those who value it most, and this is precisely the result that is recommended by traditional welfare economics. Despite its efficiency, most people reject this kind of allocation for some goods. Instead, they favor a mechanism by which a coveted concert ticket should go to the person who has queued longest for it. In such cases, fairness norms ensure that exchange deals that are by nature efficient are prohibited and an alternative and less efficient mechanism prevails.

B. Bounded Rationality

People are not computers: their cognitive skills are just as limited as their memory is. This rather trivial observation is one that not even rational choice economists would deny. However, they view the knowledge of our *cognitive limitations* as insignificant; people may not be computers, but we are able to create simplified models of their behavior as though their brain acted as efficiently as a high-performance computer. In addition, many view rational utility maximization as evolutionarily adaptive. If anyone were to perform a gross violation against the rationality postulates, they would soon be driven out of the market by more rational actors.

Behavioral economists do not find any of these arguments convincing. Basing their point on various empirical findings, they argue that, in the case of the rationality postulates, unrealistic assumptions actually lead to incorrect predictions and that rational choice theory hence fails because of its own benchmarks. Even in the case of companies and corporate actors, irrationality has been shown not to lead to instant insolvency. Rather, the market is constantly replete with firms that work inefficiently. This objection is even more valid for individuals. Those who make irrational consumer decisions may end up living at sub-standard level, but they can still be around for a very long time.

Behavioral economists therefore demand that the behavioral assumptions of economic theory be revised. Instead of presuming unlimited rationality, economists should learn from psychology and explicitly incorporate certain systematic deviations from their postulates into their models. In a number of experiments, behavioral economists have already

¹¹ Jolls, Sunstein and Thaler, A Behavioral Approach to Law and Economics, STANFORD L. REV. 50, 1471, 1510 et seq. (1998).

indicated such deviations. These can broadly be divided into the two categories 'judgment' and 'choice', as established in empirical decision theory.¹² The first category concerns cognitive processes that help shape our idea of probabilities, while the second category concerns the choice between different options on this basis.

1. Judgment

Standard economic theory elevates human beings to intuitive statisticians. Homo economicus initially collects the optimal amount of information. Once new information arrives, the probability judgment is updated, in accordance with *Baves' theorem*, that is, the homo economicus translates an existing *a priori* probability into *a posteriori* distributions, while always adhering to certain statistical principles. This theory certainly leaves enough room for a psychological lining, since it does not say how the a priori probabilities are determined in the first place. However, in standard economics, this room is usually left empty. In addition, several assumptions are connected with Bayes' theorem, and their empirical validity is minor. And this is where behavioral economics can contribute corrective measures. It should be added that, as in the case of fairness norms, this does not necessarily mean abandoning a mathematically formalized model in favor of a purely verbal ad-hoc approach. Rather, so-called 'quasi-Bayesian' models seem to be gaining the upper hand, which seek to integrate several of the effects described below into the standard framework.

(a) Heuristics Probably the best-known example from the field of judgment is heuristics, numerous cognitive rules of thumb that have been documented by psychologists for a long time and that help us to find our way around a highly complex world, despite our own limited cognitive capacities. The downside of these mental shortcuts is that they predictably lead to misjudgments in certain situations.

A prominent example of this is the availability heuristic.¹³ Daniel Kahneman and Amos Tversky had asked participants in an experiment to estimate how many of the words in a text passage ended in the syllable '-ing'. They regularly got much higher estimates than when they asked for the number of times that words had the letter 'n' as their second-last letter. This is paradoxical, as the second case is a sub-category of the first

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¹² Daniel Kahneman, A Perspective on Judgment and Choice: Mapping Bounded Rationality, 58 THE AMERICAN PSYCHOLOGIST 697 (2003).

A seminal contribution is Daniel Kahneman and Amos Tversky. Subjective Probability: A Judgment of Representativeness, 3 COGNITIVE PSYCHOLOGY 430 (1972).

and must therefore logically be more likely. The reason why most participants judged this differently is explained by the availability heuristic. Most English-speaking people are aware of a rule that determines when a word ends in '-ing' (usually the present participle and the gerund). A comparable rule for words that have an 'n' as their second-last letter was not available to them. Hence, generally speaking, the availability heuristic leads to people overestimating information that is readily available – to the detriment of the a priori probability.

A similar distortion is caused by the *representativeness heuristic*, which was also documented by Kahneman and Tversky.¹⁴ It is founded on the observation that people frequently categorize events. When forming a probability judgment, they are led in no small measure by a similarity to a category they know, but they neglect the probability with which the category itself occurs. To give an example: participants in an experiment were given information about a woman called Linda, and this information could be associated with a stereotypical feminist. Then, they were asked what was more probable: (1) Linda is a bank employee, or (2) Linda is a bank employee who is active in the women's rights movement. Most participants chose (2), although once again this answer was merely a logical sub-category of (1) and therefore cannot be more likely.

Why should legal scholars bother with heuristics? There are several answers to this, and two should serve as examples.

Standard economic theory of criminal law acts on the assumption that lawbreakers are deterred not only by the severity of the penalty, but also by an increased *likelihood of detection*. Obviously, this presupposes that they reach a realistic judgment of the likelihood of being caught. However, apparently their probability judgment depends not only on the actual probability, but it is also influenced by the availability heuristic. If criminals know someone who was imprisoned, or if they are aware of such a case through the media, this will have a disproportionately strong effect on their judgment. A visible type of enforcement thus has some advantages over an inconspicuous one. The police are therefore well advised to make successes in certain areas known to the media. This would explain why the media coverage of the imprisonment of a well-known public figure for tax fraud regularly entails many voluntary disclosures of tax liabilities.

Judges are also prone to thinking in terms of representativeness. This can lead to dangerous miscarriages of justice, as any criminal defense

¹⁴ Cf. DANIEL KAHNEMAN, PAUL SLOVIC AND AMOS TVERSKY, JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 23 *et seq.* (Cambridge/New York: Cambridge University Press 1982).

lawyer will confirm. A vivid example of this occurs in the context of sexual offenses. When a child shows typical symptoms of abuse, judges tend to conclude that this child actually was abused. However, such conclusions ignore the *a priori* probability of these symptoms. Just because something is typical, it does not have to be conclusive. Rather, we need to know additionally how often the symptoms in question occur in the case of children who have *not* been abused. If that is not known, the typicality of certain symptoms is not only a bad form of proof – it is no proof at all. Experts in the area of child abuse naturally encounter abused children disproportionately often. Their judgment therefore needs to be complemented by knowledge from uninfluenced sources.

(b) Hindsight bias Just as the availability heuristic leads to overestimating the likelihood of current events, hindsight bias can lead people to deem events that have already occurred to have been more probable than any alternative courses of events ('They should have seen that coming'). In a study by Baruch Fischhoff, for instance, five groups of participants received different versions of a text on the 19th-century conflict between the Nepalese Ghurkas and the British.¹⁵ The texts resembled each other with regard to the telling of the background, but they had four different endings. The fifth group was not told the ending at all. After reading the texts, the participants were asked which course of events they thought to be most probable. They turned out to be systematically biased towards the turn of events that had just been presented to them as the actual one. Only in the control group could such bias not be ascertained. Hindsight bias may be closely linked to the availability heuristic. Events that are presented to us as true are more easily imaginable and their probability is therefore overestimated.

Judges are well advised to bear this phenomenon in mind. Whenever they are called to determine whether someone has acted negligently, they do this with hindsight. Hence, they know that something has gone awry: capital has been lost, a patient has died or a chemical plant has blown up. The court is now confronted with the question whether the tragic event could have been foreseen. In fact, this question is rarely answered with a no. Numerous empirical studies from the areas of criminal and tort law show that jury members and judges are prone to hindsight bias. This leads not only to unjustifiable convictions, but provides incentives for inefficient

¹⁵ Baruch Fischhoff, *Hindsight* \neq *Foresight: The Effect of Outcome Knowledge* on Judgment under Uncertainty, 1 J. EXP. PSYCHOL. HUM. PERCEPTION & PERFORMANCE 288 (1975).

overregulation in the future. It is therefore self-evident that hindsight bias should be neutralized as far as possible. There is much evidence that an increased use of group deliberation can contribute to this, as is the case with a bench of judges or among jury members. Also, an *ex ante* formulation, as precise as possible, of codes and standards of care can be of great use. Finally, we should consider whether, in certain areas, strict liability might not lead to more just results than fault-based liability.

(c) Excessive optimism and overconfidence bias Bayes' theorem presupposes that people can separate the likelihood of an event occurring from the utility associated with this event. In actual fact, however, most people are not capable of being consistent here. Instead, they succumb to many different forms of wishful thinking. Even if they can correctly estimate, at an abstract level, the statistical likelihood of certain events occurring, they do not relate this estimate to themselves. To give a classic example: most people would probably be able to estimate that the statistical rate of divorce in the United States is well above 40 percent. However, if we ask those who are on the verge of getting married what they think about the likelihood of their own marriage failing, their answer is likely to be 'zero'. What seems at first sight to be a trivial example is transferable to many areas. In a study by Neil Weinstein, most of the students questioned were convinced that positive events would occur more often in their lives than in the average lives of their fellow students, and that they would be spared tragic blows of fate.16

Excessive optimism may have to do with overestimation of one's own capabilities. For instance, people tend to believe that their own chances of suffering an accident are lower than the average possibility of their fellow motorists suffering the same fate, since they believe their motoring skills to be above average. A specific example of this systematic overestimation of one's own capabilities can be found in the so-called *overconfidence bias*, that is, the exaggerated confidence in one's own judgment or knowledge. This effect is easily demonstrated. Usually, test subjects are given a difficult question to answer and then asked to indicate how sure they are of their answer. Even when candidates say they are '100 percent' certain, their answers are often only 85–90 percent correct. The more difficult the questions are, the more clearly we see this effect.

A third cognitive effect, the so-called *self-serving bias*, is closely linked with the phenomena mentioned above, and it is also capable of clouding

¹⁶ Neil D. Weinstein, Unrealistic Optimism about Future Life Events, 39 J. PERSONALITY & SOC. PSYCHOL. 806 (1980).

pure Bayesian judgment. It is understood to be the human tendency to ascribe successes to one's own effort, and any failure to external factors. In our everyday lives, many examples of this become apparent: students who have done well in an exam see this as proof of their efficiency, while those who have not passed tend to blame the 'unfair' tasks. Hence, the self-serving bias also allows the individual to believe he or she has above-average talent in areas that are important for his or her self-respect.

All in all, the terminology is extremely inconsistent with regard to the phenomena discussed here. However, this is merely the symptom of a more in-depth factual insecurity. Most scientists are in agreement with regard to the findings, that is, they agree that excessive optimism and warped judgments constitute real phenomena. So far, however, the diagnosis, that is, linking the observation to a cause, has barely been systematic. It is not always clear which causes lie at the bottom of the observed phenomena. In fact, there are competing explanations for the same effect. The self-serving bias, for instance, is often explained as being motivational: people have an interest in maintaining their self-image, which distorts their perception in this direction. This would justify placing the self-serving bias in the 'wishful thinking' category. On the other hand, others claim that the bias is the result of strategic prancing about. Finally, some resort to the way our memory functions, in order to reach an explanation, stating that internal reasons for success are 'more available' to us than external ones. The latter explanation would place the effect in rather close proximity to the availability heuristic.

Finally, the best therapy to be carried out is a contentious issue as well. Positive and even wishful thinking not only has a bad side. That is shown most impressively by a group of individuals who are the only ones to evaluate their life risks correctly: the chronically depressed. By contrast, many successful entrepreneurs display a particularly pronounced faith in their own skills.

Despite all contentious issues when it comes to details, it should be clear that such far-reaching distortions of human risk perception as those mentioned above cannot simply be ignored. Rather, they should be systematized and further explored. And it is just as obvious that a legal scholar who is interested in a model of human behavior cannot ignore them either. Let us consider some practically relevant examples.

Excessive optimism and overestimation of one's own capabilities can render *deterrence* of criminals more difficult, as can easily be seen. If the perpetrator is aware of the likelihood of punishment, but does not believe it applies to him, this undermines the logic of standard theory. Note that this does not necessarily mean a higher crime rate. The perpetrator who overestimates himself might become less careful and may hence be arrested more easily.

What is more difficult than this merely descriptive observation, however, is dealing with excessive optimism and overconfidence at a normative level. What if overconfidence becomes punishable negligence? Many big fortunes were made after irrational risks had been accepted. Yet perhaps even more money was lost as a result of such moves. In view of this normative ambiguity, it remains doubtful to what extent the law might be able to set up adequate standards of care, for instance in the case of financial market regulation; it requires a normative discussion that will necessarily also include the problem of hindsight bias.

2. Decision

An important assumption in standard economic theory, and hence in the economic analysis of the law, is that people have a *stable set of preferences* that adheres to certain axioms (see Chapter 2, section I). The stability assumption is not so much empirically informed, but rather a methodological aid. If a positive theory is to remain falsifiable, then one parameter has to be treated as constant. Although the economists by no means claim that preferences can never change, they do assume that such changes occur more slowly than changes to the framework conditions (restrictions) under which the decisions are made. While this may frequently be true, behavioral economists have identified several situations in which the assumption is systematically violated. The upshot is that preferences and context.

(a) Anchoring One example is the anchoring effect, which was initially discovered in the context of judgment. If homo economicus considers the optimal amount of information, the converse argument means he ignores irrelevant facts. However, as Daniel Kahneman and Amos Tversky have shown in a much-cited experiment, real people are indeed impressionable by cognitive interference.¹⁷ Tversky and Kahneman asked people to estimate the proportion of United Nations (UN) member states in Africa. Before they answered, a wheel of fortune was spun, which had been manipulated by the experimenters in such a way that it stopped either at 10 or at 65. Participants were then asked to state whether they thought the percentage of African member states was higher or lower than this

¹⁷ Amos Tversky and Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 185 SCIENCE 1124 (1974).

'randomly' determined value. Only then were they asked about the exact percentage. Whether the wheel of fortune showed 10 or 65 should obviously not have influenced their answer to the question later on. However, it did have an influence. When the wheel showed 10, participants gave an average of 25 percent African UN membership. When it stopped at 65, the average given was 45 percent. The randomly determined value thus served as an anchor for the later estimate.

It is well known by now that anchoring occurs not only in the realm of judgment, but in the field of decision-making also. Not only frequency or probability judgments appear to be susceptible, but the value attributed to a good also seems to be. Correspondingly, the term is by now being used to describe all unwittingly committed adjustments of a numerical judgment to an arbitrary comparative value. Such an adjustment, however, contradicts the notion of stable preferences and supports a concept of context-dependent preferences formed rather ad hoc.

Various empirical studies show that the existence of anchoring ought to be an issue for jurists, too. Two of these studies will be outlined here: Birte Englich and Thomas Mussweiler asked judges with around 15 years' professional experience to decide on the *punishment* for a rapist after they had been presented with brief outlines of the case.¹⁸ These outlines differed only with regard to the demands of the 'prosecutor', who was revealed in the outline to be a student of computer science. In one scenario, he demanded 34 months of prison and, in another, only 12 months. Englich and Mussweiler observed that the judges, while fully aware of the 'prosecutor's' ignorance of the law, were nonetheless influenced by his petition. If he demanded a prison sentence of 34 months, they would pronounce an average sentence of almost 36 months. If he demanded only 12 months, their sentence was, on average, 28 months. Similar effects were observed in various other studies.

Gretchen Chapman and Brian Bornstein have examined anchoring in the context of tort law.¹⁹ The title of their study, 'The More You Ask for, the More You Get', sums up their result quite accurately. In their experiment, the *sums awarded as compensation for damages* were quite dramatically influenced by the level of the initial demand. It is obvious that judgments being prone to chance and manipulation do

¹⁸ Birte Englich and Thomas Mussweiler, *Sentencing under Uncertainty:* Anchoring Effects in the Courtroom, 31 JOURNAL OF APPLIED SOCIAL PSYCHOLOGY 1535 (2001).

¹⁹ Gretchen B. Chapman and Brian H. Bornstein, *The More You Ask For, the More You Get: Anchoring in Personal Injury Verdicts*, 10 APPL. COGNIT. PSYCHOL. 519 (1996).

not correspond to our notion of a fair trial. However, it is not quite as clear just how the influence of anchoring can be attenuated. In many studies, it has been shown to be very robust. Even specialist knowledge, experience or the explicit warning of its influence cannot neutralize it entirely. And yet, the situation is not entirely hopeless: Studies indicate that knowing rough orientation values weakens anchoring. Thus, it may be hoped that legal practice will become more consolidated, thus containing the effect in constellations that courts frequently have to deal with.

It may at times be necessary to limit the judges' leeway in decisionmaking, as the Federal Sentencing Guidelines do in the US legal system. These guidelines are meant to harmonize sentencing across the federal states. In *United States v. Boker*,²⁰ the US Supreme Court declared this instrument to be unconstitutional in its original form, as it contravened the right to a jury trial. In consequence, the guidelines are no longer binding today, though they do serve as an orientation. Bearing anchoring in mind, the Supreme Court decision (whatever its other merits) is not to be welcomed. Where guidelines provide no orientation, a good lawyer is still not quite helpless. She can induce a judge to think up concrete arguments against the 'anchor'. Yet, the fact that those who are first to plead are at an advantage can hardly be prevented.

(b) Extremeness aversion Rational choice postulates that the choice an individual makes between two options must not change merely because a third, unelected option appears. In fact, however, this appears to be the case in real life. This well-documented effect is known as *extremeness aversion*. Salespeople are fond of using it. Let us assume, for instance, that a consumer wishes to purchase a hi-fi system. When faced with the option of purchasing either a cheaper and less powerful system for \$100 or a system of higher value for \$200, the customer might initially feel inclined towards the cheaper option. A clever salesperson will then show the customer a third option, a premium-quality system for \$800. The buyer is unlikely to opt for this system. However, extremeness aversion may now lead the consumer to view the \$200 system as a good compromise. People often instinctively prefer the middle ground. This can indeed be sensible, but it does indicate the context dependence of our preference order.

Now, what relevance does this have for the field of legal studies? A study by Mark Kelman, Yuval Rottenstreich and Amos Tversky shows

²⁰ United States v. Boker, 543 U.S. 220 (2005).

that extremeness aversion also affects legal decision-making.²¹ Faced with the same facts, participants in an experiment were asked to pass judgment on a homicide case. One group had to decide between 'qualified murder', 'murder' and 'intentional homicide'. The other group had to choose between 'murder', 'intentional homicide' and 'negligent homicide'. In both groups, the middle option was chosen most often. Hence, despite being faced with the same facts, group A passed a sentence for murder, while group B merely passed a sentence for intentional homicide.

(c) Prospect theory The Coase theorem (see also Chapter 5, section I.A), which may rightly be considered the theoretical bedrock of the economic analysis of law, contains a simple quintessence: in a world with low transaction costs, the market will ensure that a good – independently of its initial distribution – will eventually go to the person who values it most. This person will purchase the good from the owner, who will receive a trade-off. This argument, however, is based on the premise of individuals having a fixed preference order with regard to individual goods. Otherwise, interpersonal comparisons would be impossible. The process, context and order of the decision should not play any part. As an example, if one prefers a Toyota Prius to a Honda Civic before purchasing any car, one should also be prepared to trade a Honda one already owns for the Toyota. The discovery of the so-called *endowment effect*, however, has cast doubt on this premise.

One experiment is cited particularly often in this context. It was conducted with students at Cornell University.²² In this experiment, a market situation was simulated, in which coffee mugs bearing the Cornell logo were traded. One half of the participating students received such a mug, while the other half was given a \$6 endowment. Those students who owned a mug were asked to specify the sum for which they would be willing to sell it. The members of the other group were asked to name the maximum price they would be willing to pay for the mug. Following this, the experimenters calculated the market clearing price, conducting the transactions that were possible at this price. The Coase theorem predicts that roughly half the mugs will switch owners. The transaction costs were close to zero, and the initial distribution was random. However, the real result was quite different. In actual fact, only very few transactions

²¹ Mark Kelman, Yuval Rottenstreich and Amos Tversky, *Context-Dependence in Legal Decision Making*, 25 J. LEGAL STUD. 287 (1996).

²² Daniel Kahneman, Jack L. Knetsch and Richard H. Thaler, *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325 (1990).

occurred. The minimum sale prices of the mug owners were, on average, twice as high as the maximum price the potential buyers were willing to pay. The experimenters therefore concluded that people value something more just because they already own it. Many other experiments have corroborated the existence of the endowment effect and excluded other causes for its occurrence, such as strategic action or wealth effects. Rather, ownership itself appears to justify the higher value of an object for people. This is in line with the discovery that the endowment effect becomes stronger the longer a person has possessed an object.

The endowment effect is probably only part of a bigger picture. As other experiments lead us to believe, it expresses the human affinity to weigh losses more strongly than benefits (loss aversion). When confronted with the choice between a sure win of €240 and a lottery that provides a 25 percent chance of winning €1000 and a 75 percent chance of winning nothing, the vast majority of people will choose the secure option. This is different when we deal with losses: a game that entails a 75 percent chance of losing $\in 1000$, vet completely avoiding a loss with a probability of 25 percent, is regularly preferred to a certain loss of €750. People therefore behave in a risk-averse manner and prefer security when it comes to winnings. On the other hand, if we are dealing with losses, people are more inclined to take risks. This result is not at loggerheads with traditional expected utility theory. This theory allows for individually differing risk preferences. However, it is not compatible with the risk preference of an individual being dependent on whether the decision is about losses or winnings. And yet, this was precisely what was observed in numerous experiments. On average, people appear to weight their losses twice as highly as potential winnings of the same level. This has not only been shown in the laboratory, but it also helps to explain certain phenomena observed in the field.

Loss aversion itself also seems to be only a slightly larger part of the bigger picture. Together with the endowment effect, it can be understood as a facet of an effect that is sometimes called the *status quo bias*. This refers to a strong preference for the actual state as it is. People only opt for change when confronted with strong incentives. It is a fundamental assumption of the most important positive alternative model of expected utility theory, *prospect theory*, as developed by Kahneman and Tversky, that people base their decisions not so much on absolute assets, but instead evaluate changes using a particular reference point – often the status quo.²³

²³ Daniel Kahneman and Amos Tversky, *Prospect Theory: An Analysis of Decision under Risk*, 47 ECONOMETRICA 263 (1979).

Prospect theory integrates the empirical results cited so far. It models decision behavior using two central components: a value function and a function that weights the objective probabilities. If we sum up the basic elements of the theory, the following picture emerges:

- (i) The *value function* is s-shaped, displaying a sharp bend at the reference point. From here on, it is concave in the win area and convex in the loss area. This means that most people display an affinity towards risk in decisions between options that appear to be losses relative to the reference point. If, on the other hand, the options appear as winnings relative to the reference point, people display risk-averse behavior.
- (ii) These risk preferences, however, are inverted as a result of the influence of the *weighting function* in cases where there is a low probability of winnings or losses. Here, most people take risks when playing for winnings, but they are risk-averse in the face of possible loss options. The weighting function is very steep at the ends, which means that small probabilities are weighted disproportionately.
- (iii) With probabilities of 0.3–0.4, subjective sensations and the actual probability are most in sync. Smaller probabilities are overestimated, and larger ones underestimated.

Whether a reference point can actually be determined is decisive for the practical use of prospect theory. This is not always possible *ex ante*. Usually, however, the reference point results naturally. It will normally be in agreement with the actual condition, as the status quo bias suggests. In some cases, however, a certain (and ascertainable) target state is definable, for instance when we are dealing with a profit target or the fulfillment of a daily quota.

(d) Framing The fact that there is no 'objective' reference point provides the basis for manipulation. Selective influencing of the reference point is called 'framing'. The best-known illustration of this problem is the so-called Asian Disease Scenario.²⁴ Kahneman and Tversky asked two groups of test subjects to imagine they were faced with a disease that threatened the lives of 600 people and they had to choose between two possible rescue plans. The choice was presented to the first group as follows: Plan A will definitely save 200 people. With Plan B, on the other

²⁴ On this, see Tversky and Kahneman, Judgment under Uncertainty: Heuristics and Biases, 185 SCIENCE 1124 (1974).

hand, there is a likelihood of one-third that all 600 citizens will be saved, and a likelihood of two-thirds that nobody will be saved. The dilemma was presented to the second group as a decision between Plan C, which entails the certain death of 400 people, and Plan D, which has a likelihood of one-third that nobody will die and a likelihood of two-thirds that all 600 people will lose their lives. Plan A and Plan C both have the same content, as do Plan B and Plan D. The choice the two groups faced was identical. The only difference lies in the way the facts are presented. Plans A and B have a positive 'frame', that is, they present the choice as one of winning options (saving lives), while Plans C and D have a negative frame, which means a choice between losses. This difference has grave consequences. Most people prefer Plan A to Plan B, but they also prefer Plan D to Plan C. They therefore prefer the risky version in the negative frame and the secure version among the winning options. This corresponds exactly to the prognoses of prospect theory.

The observation that a tendency towards risk, and hence people's decisions, can be influenced by the depiction of the decision problem is of significance for the legal field as well. The problem of tax evasion provides a good example. The decision whether or not one wishes to avoid paying taxes corresponds to a choice between a secure option and a risky option; the outcome of the latter can be better (saving taxes) or worse (back taxes, punishment) than the secure option. The actual decision depends on individual risk disposition. This disposition, however, can be influenced - for instance, by tax-collection procedures. Direct taxes, such as income taxes in the US, are deducted at source. Manipulation is only possible when claiming reimbursements. In other countries, for instance in Switzerland, income taxes are paid from funds that are already in the employee's bank account. From the point of view of the standard approach, this difference ought not to influence the frequency of tax crimes. Prospect theory, on the other hand, allows for a different prediction: tax reimbursements are regularly perceived as gains, since they increase the existing assets. On the other hand, when taxes have to be paid from existing funds, people regularly perceive this as a loss, since the amount of money in their accounts decreases. Since people tend to be more risk-averse in the winnings camp, hence opting for the secure alternative as opposed to the risky one, tax fraud should be less frequent in countries where taxes are deducted at source, rather than in countries following a different model. This prediction is confirmed in real life. It therefore seems to be an advantage for a state to demand advance payments.

The fact that people tend to place irrational emphasis on the status quo, thus allowing themselves to be influenced by the depiction of the decision problem, casts new light on the debate whether *paternalistic regulation* is permissible. Rational choice theorists are convinced that individuals know best themselves what makes them happy. And even when this is not the case, for once, most critics of paternalism argue that people must not be forced to do what is good for them. But what if people's happiness is contingent, in the sense that the way in which one asks about it can lead to different answers?

The following example illustrates this:²⁵ In the North American states of Pennsylvania and New Jersey, people were offered an identical choice between two insurance packages. Policyholders could choose between a more expensive option with a right to sue and a cheaper option without this right. In New Jersey, the more expensive option was standard. Policyholders therefore had to make a conscious decision in order to change to the cheaper policy. In Pennsylvania, the opposite was the case. From the point of view of rational theory, one might expect that, after some time, roughly the same percentage of people in both states would, respectively, choose the expensive and the cheaper package. In actual fact, however, the vast majority in both states stuck to the respective standard options. No factual reasons for this difference could be ascertained. Obviously, the mere fact that an option was referred to as 'standard' sufficed to ensure it would be preferred. Cass Sunstein and Richard Thaler have deduced from this that paternalism is almost inevitable.²⁶ With its decision for a certain standard, they maintain, the state already manipulates the decision behavior of the population, even if people are left with a free choice to deviate from this standard. The state has to acknowledge this fact and do some of the thinking for the citizen. Sunstein and Thaler call their idea 'libertarian paternalism'. If one were to follow their line of argument, this would have far-reaching consequences for several legal fields, ranging from consumer protection to health legislation.

C. Bounded Self-control

The Asian Disease Scenario, outlined above, shows that the idea of a stable, context-independent and ordered preference system does not always correspond to reality. Rather, at times preference reversals can occur. In the case of the Asian Disease Scenario, this happens because of the different depictions (frames) of the decision problem. The fact that

²⁵ After Cass R. Sunstein, *Behavioral Law and Economics: A Progress Report*, 1 Am. L. & ECON. REV. 115, 124 (1999).

²⁶ Cass R. Sunstein and Richard H. Thaler, *Libertarian Paternalism Is Not an Oxymoron*, 70 U. CHI. L. REV. 1159 (2003).

people have differing risk preferences for a decision between gains and losses would lead, in this example, to a normatively contradictory choice.

Another instance in which our preferences can stand in contradiction to each other is one that everyone is familiar with from everyday life. In this case, we mean a *reversal of preferences over the course of time*. We may resolve to quit smoking as of today, although next week we may already suffer a relapse. Most smokers claim they 'actually really do' wish to quit smoking, but what do such phrases mean? They denote a collision between long-term preferences (i.e., staying healthy) and short-term preferences (feeding an addiction). The latter, short-term preferences, frequently prevail – the 'heat of the moment' can overwhelm us.

In his purest form, homo economicus does not know such problems. This does not mean that he would not prefer instant pleasures to future ones. However, this does follow a strictly economic reasoning. Future utility is discounted, for the future is uncertain, and we do not know if we will live to see it. There is a huge difference between \$100 today or \$100 in ten years. The money I own today can bring me interest, but in ten years inflation may have eaten up its value. Homo economicus may have a high or low *discount rate* – in other words, a strong preference either for the future or the present – without this being incompatible with rational choice theory. However, his preferences must not be contradictory. This is due to a special kind of discounting function with which economists have endowed him. Homo economicus discounts the future *exponentially*. The constant exponent, however, excludes conflicting preferences over time. So those who opt for chocolate in the evening should have no regrets when they are on the scales the next morning.

Economists, too, are aware that reality provides ample evidence for the opposite. They have become particularly interested in the numerous examples of self-binding with foresight. Many people who wish to lose weight refrain from buying chocolate so as not to eat too much of it. Casinos offer customers the possibility to ban themselves from entering for the rest of their lives. Such behavior cannot be sensibly explained by rational choice theory. The idea of voluntarily limiting our scope for decision-making in order to protect ourselves from our own preferences is not compatible with exponential discounting. However, because it cannot be denied that people frequently allow themselves to be tied to a mast, just as Ulysses did to resist the Sirens, economists have thought up new ways of modeling.²⁷ In these innovative models, an individual is assigned not one, but several

²⁷ This image is from JON ELSTER, ULYSSES AND THE SIRENS: STUDIES IN RATIONALITY AND IRRATIONALITY (Cambridge: Cambridge University Press 1984).

preference systems. Typically these models assume that we have a shortterm-oriented and a long-term-oriented 'self', each endowed with its own distinct set of preferences.

Behavioral economics continues in the vein of these so-called 'multipleselves models'. Instead of several selves, with exponential discounting, behavioral economists choose a different modeling technique. This has become known as *(quasi-)hyperbolic discounting.*²⁸ The essence of the approach lies in the idea of a 'present bias', which corresponds to an extreme overrating of immediate consumption. This effect can lead to decisions that may be regretted later, which in turn highlights why selfbinding can indeed make sense at times.

Successful self-binding, however, presupposes that an individual knows how to assess future needs correctly. Whether or not this is the case remains controversial among behavioral economists. The truth probably depends on the situation in question. A more accurate reception of psychological insights is needed in order to give adequate answers.

For jurists, the problem of self-control deficits is of major interest, as a few examples can illustrate. Some see it as supporting the idea of '*selfpaternalism*'. If people are able to predict collisions between current and future preferences, this helps to explain why self-exclusions from gambling establishments should be enforced and non-enforcement should make the operator liable for compensation if the gambler loses money.

Some researchers want to rethink narcotics regulation along these lines.²⁹ The state, they propose, ought to develop a license system that gives adults free access to drugs that are still illegal today, once the risks have been explained to them. However, this system should also allow for the possibility of determining a personal maximum limit or opting for complete self-exclusion. This proposal is not absurd in itself. In view of the evident failure of the 'war on drugs', the search for alternative means of regulation would seem one of the next logical steps. It is obvious that criminal sanctions, no matter how harsh, will not effectively influence the cost–benefit analysis of substance abusers whose long-term preferences are probably at odds with their drug habit anyway, but whose short-term-oriented self values a high more than anything. That said, self-paternalism does not provide a satisfactory answer to the question of how those who have closed off their own path towards the legal channels can be prevented

²⁸ Seminally, David Laibson, *Golden Eggs and Hyperbolic Discounting*, 112 Q.J. ECON. 443 (1997).

²⁹ James A. Leitzel, *Self-Exclusion*, SSRN (4 April 2011), accessed 19 July 2015 at http://ssrn.com/abstract=1126317.

from finding their way back to the black market whenever they are overcome by their addiction.

By taking self-control deficits seriously, behavioral economics furthermore aligns itself with modern *criminological theory*. Some criminologists even view a lack of self-control as the essential determinant of deviant behavior.³⁰ If people are naïve vis-à-vis their future needs, a threat of prosecution will rarely achieve anything. If the state still wishes to prevent certain behavioral practices, it must rely instead on *ex ante* regulation. In other words, it should not threaten to punish people for losing control. If this happens, they are already out of reach of the threat ('I no longer knew what I was doing'). Instead, the legal system ought to address them before control is lost, erecting barriers around situations in which loss of control is common.

IV. OPEN QUESTIONS

Homo economicus was seen by many as being a little too rough around the edges. His behavioral economics counterpart, on the other hand, comes across as more likeable and, above all, more human. This humanity, however, comes at a price. The more economics strays from its traditionally sparse behavioral model, opening the gates towards a complex reality, the higher the risk becomes of it being submerged by a tidal wave of information. A map on a scale of 1:1 is of little use. Similarly, behavioral economists face the difficult question of how much *complexity* a model of human behavior can bear. This conflict between the proximity to reality, on the one hand, and the sparseness of model assumptions, on the other, has not vet been resolved. However, this conflict seems less daunting if we recall that the economic analysis of law is not about an abstract image of humanity, but rather about solving concrete problems that are often made up of many small parts. This insight opens up the possibility of problemspecific micro-theories that depart from the standard approach by taking into account those psychological insights that are of particular relevance in the specific context.

Many behavioral economists, however, expect to fly higher in the future. They are looking for a 'grand design', a new and *independent behavioral theory* that will one day replace rational choice, or at least relegate it to a situation-specific subset. The fundamental utility of research in the

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³⁰ See MICHAEL A. GOTTFREDSON AND TRAVIS HIRSCHI, A GENERAL THEORY OF CRIME (Stanford, Calif.: Stanford University Press 1990).

field of behavioral economics is not called into question by considering such ambitions to have no prospect of success, at least for the time being. The insights are still too disparate. Even the relationship between similar anomalies is, for the most part, unclear and based not so much on understanding, but on (admittedly well-argued) speculation. In addition, the limitations of their occurrence are far from clearly defined. Sometimes a slight rewording of the decision problem causes an effect to vanish completely and the predictions of rational choice theory to be rehabilitated.

Behavioral economics has made substantial progress towards systematizing and connecting its observations. Nonetheless, a theoretical framework is still lacking for the most part. It is conceivable that a better understanding of the way our brain works will remedy this situation in the long term by exposing the mechanisms 'behind' many of the observed effects and their associations. Daniel Kahneman recently presented a model that attracted a lot of attention. It is based on the differentiation between a slow, conscious thinking process, on the one hand, and an intuitive and automatic one, on the other.³¹ This approach strays far from the classic utility maximization model, but it does explain many of the observed anomalies. Some researchers also hope to gain more insights from the amalgamation of economics and *neuroscience*.³² However, many still doubt that a neuroeconomic approach will become a valuable source of insights.

Further, the *normative dimension* of behavioral economics is still not clear. Its primary target was doubtless the positive theory of rational choice. However, from the very early stages, the attack on this theory has caused much collateral damage in the theoretical realm. The descriptive insights of behavioral economists do not always agree with the normative metrics of traditional welfare economics. The Coase theorem is one example of this. What is the significance of a good falling into the hands of those who value it most, if the appreciation is dependent on current ownership, that is, if being determines consciousness? If someone is prepared to pay \$100 for a good, but would not sell it for less than \$150, while another person would spend \$120 for it and sell it for \$140, our normative analysis will soon go off the rails. What should be imitated if the requirements for the Coase theorem do not count – market behavior or market results?

Moreover, the ambivalence of many effects makes it difficult to evaluate

³¹ DANIEL KAHNEMAN, THINKING, FAST AND SLOW (London: Penguin Books 2012).

³² Colin Camerer, George Loewenstein and Drazen Prelec, *Neuroeconomics: How Neuroscience Can Inform Economics*, 43 J. ECON. LIT. 9 (2005).

their impact. Unrealistic optimism showed us that a debiasing, that is, the neutralization of the effect, cannot be the best answer at all times. Likewise, hardly anyone would want to change people's fairness preferences. At times, the evaluation of effects depends on where one sees their causes. Some scientists look at the insights gleaned from behavioral economics through the lens of *evolutionary theory*.³³ In their view, some 'errors' that seem cognitively embedded turn out to be the expression of an evolutionarily adaptive strategy. The question whether this strategy is still adaptive today or whether the framework conditions have changed will in turn influence the normative analysis. Most behavioral economists have so far remained 'agnostic' in the face of such interpretations.

Even if this should change some day, evolutionary biology will not be able to solve all normative issues. Already it seems clear that some of the observed effects from the behavioral economics kit can be irrational at a local (i.e., individual) level, but very sensible at the global level (i.e., looking at an entire life span). Such ambivalence cannot be brushed aside. Heuristics may lead us to draw the wrong conclusions in individual cases, but they do help us navigate our way through a world so complex that it would otherwise paralyze us. As a well-known example puts it, an emergency physician does not have the time to recapitulate his or her entire years of study when treating a severely injured patient. Instead, the physician must make a quick decision on the basis of a rule of thumb that has proved effective.

Happiness research,³⁴ as it is called, may be regarded as a further attempt to endow behavioral economics with a normative foundation (see Chapter 1). From the point of view of neoclassical economic analysis, individuals consistently maximize their utility, which is why they should be spared infringements of their freedom as much as possible. However, if an individual has conflicting preferences, as suggested by cognitive psychology, this premise is undermined. Some people hope that, if we actually knew what makes people happy in the long term, we might be able to identify their 'real' preferences and hence gain a little more normative ground to stand on. So far, however, research in this field has not come far enough to base concrete political measures on this. Additionally, happiness

³³ See John Tooby and Leda Cosmides, *The Past Explains the Present: Emotional Adaptations and the Structure of Ancestral Environments*, 11 ETHNOLOGY & SOCIOBIOLOGY 375 (1990); Paul H. Rubin and C. Monica Capra, *Rationality and Utility: Economics and Evolutionary Psychology*, in APPLIED EVOLUTIONARY PSYCHOLOGY 319 (2011).

³⁴ For an overview of this field, see BRUNO S. FREY AND ALOIS STUTZER, HAPPINESS: A REVOLUTION IN ECONOMICS (Cambridge, Mass.: MIT Press 2008).

research raises philosophical questions, for instance on the legitimacy of the attempt to force people towards their own good, and these questions are more complex than some researchers are willing to believe.

V. CONCLUSION

The above notwithstanding, behavioral economics is still a step away from being a unified theory comparable to the traditional rational choice approach. Lawyers interested in behavioral analysis should bear this fact in mind. It will prevent them from jumping to conclusions and, for example, drawing far-reaching conclusions from the observation of an effect, the exact scope and implications of which are yet largely unclear. If this temptation is avoided, however, behavioral economics can certainly be of great use. The approach offers many insights of relevance to both the analysis and design of institutions and the legal field should not miss the chance to pick up on these.

FURTHER READING

- AXELROD, ROBERT, THE EVOLUTION OF COOPERATION (Rev. ed., New York, NY: Basic Books 2006).
- Bowles, Samuel and Herbert Gintis, Homo Reciprocans, 415 NATURE 125 (2002).
- BOWLES, SAMUEL, HERBERT GINTIS, ROBERT BOYD AND ERNST FEHR, THE MORAL SENTIMENTS AND MATERIAL INTERESTS: THE FOUNDATIONS OF COOPERATION IN ECONOMIC LIFE (Samuel Bowles et al. eds, Cambridge, Mass.: MIT Press 2005).
- CAMERER, COLIN F., GEORGE LOEWENSTEIN AND MATTHEW RABIN, ADVANCES IN BEHAVIORAL ECONOMICS (Colin F. Camerer et al. eds, New York: Russell Sage Foundation 2004).
- Coase, Ronald, The Problem of Social Cost, 3 J. L. & ECON. 1 (1960).
- Fehr, Ernst and Simon Gächter, Fairness and Retaliation: The Economics of Reciprocity, 14 J. ECON. PERSPECT. 159 (2000).
- GIGERENZER, GERD AND REINHARD SELTEN, BOUNDED RATIONALITY: THE ADAPTIVE TOOLBOX (Cambridge, Mass.: MIT Press 2001).
- Jolls, Christine, Cass R. Sunstein and Richard Thaler, A Behavioral Approach to Law and Economics, 50 STAN. L. REV. 1471 (1998).
- Kahan, Dan M., *The Logic of Reciprocity: Trust, Collective Action, and Law*, 95 MICH. L. REV. 2477 (2003).
- KAHNEMAN, DANIEL AND AMOS TVERSKY, CHOICES, VALUES, AND FRAMES (Daniel Kahneman et al. eds, Cambridge: Cambridge University Press 1982).
- KAHNEMAN, DANIEL, THINKING, FAST AND SLOW (London: Penguin Books 2012).
- Kahneman, Daniel and Amos Tversky, Prospect Theory: An Analysis of Decision under Risk, 47 ECONOMETRICA 263 (1979).
- Kehlmann, Mark, Law and Behavioral Science: Conceptual Overviews, 97 Nw. U. L. Rev. 1347 (2003).

- Korobkin, Russell B. and Thomas S. Ulen, Law and Behavioral Science: Removing the Rationality Assumption from Law and Economics, 88 CALIF. L. REV. 1051 (2000).
- Rabin, Matthew, Psychology and Economics, 36 J. ECON. LIT. 11 (1998).
- Sen, Amartya K., Rational Fools: A Critique of the Behavioral Foundations of Economic Theory, 6(4) PHILOS. PUBLIC AFF. 317 (1977).
- SUNSTEIN, CASS R., BEHAVIORAL LAW AND ECONOMICS (Cambridge: Cambridge University Press 2000).
- THALER, RICHARD H., QUASI-RATIONAL ECONOMICS (New York, Russell Sage Foundation 1991).
- THALER, RICHARD H., THE WINNER'S COURSE: PARADOXES AND ANOMALIES OF ECONOMIC LIFE (Princeton, NJ: Princeton University Press 1994).

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Emanuel V. Towfigh is at the EBS University for Business and Law and the Max Planck Institute for Research on Collective Goods, Germany and **Niels Petersen** is at the University of Münster, Germany.

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The Lypiatts, 15 Lansdown Road, Cheltenham, Glos GL50 2JA, UK Tel: + 44 (0) 1242 226934 Fax: + 44 (0) 1242 262111 Email: info@e-elgar.co.uk

William Pratt House, 9 Dewey Court, Northampton, MA 01060, USA Tel: +1 413 584 5551 Fax: +1 413 584 9933 Email: elgarinfo@e-elgar.com

