Managerial Economics

Lecture Notes

© Prof. Dr. Stephan Huber (Stephan.Huber@hs-fresenius.de)

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Contents

Preface

This is work in progress and it will develop during the semester so please check for updates regularly. I appreciate you reading it, and I appreciate any comments, but please do not share this document or quote it without asking me. This script aims to support my lecture at the HS Fresenius. It is incomplete and no substitute for taking actively part in class. Do not distribute without permission.

About the author

Figure 1: Prof. Dr. Stephan Huber[1]

Prof. Dr. Stephan Huber is Professor of International Economics and Data Science at *HS Fresenius* and holds a Diploma in Economics from the *University of Regensburg* and a Doctoral Degree (summa cum laude) from the University of Trier. He completed postgraduate studies at the *Interdisciplinary Graduate Center of Excellence at the Institute for Labor Law and Industrial Relations in the European Union (IAAEU)* in Trier. He was a research assistant to Prof. Dr. Dr. h.c. Joachim Möller at the *University of Regensburg*, post-doc at the *Leibniz Institute for East and Southeast European Studies (IOS)* in Regensburg and freelancer at *Charles University* in Prague.

[1] Picture is taken from https://sites.google.com/view/stephanhuber

He has worked as a lecturer at various institutions including the *TU Munich*, the *University of Regensburg*, *Saarland University*, and the *Universities of Applied Sciences in Frankfurt and Augsburg*. He has also taught abroad for the *University of Cordoba* in Spain and the *University of Perugia*. Professor Huber has published his work in international journals such as the *Canadian Journal of Economics* and the *Stata Journal*. More on his work can be found on his private homepage www.t1p.de/stephanhuber.

Contact


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Hochschule Fresenius für Wirtschaft & Medien GmbH
Im MediaPark 4c
50670 Cologne

Office: 4b OG-1 Bü01 (Office hour: Thursday 1-2 p.m.)
Telefon: +49 221 973199-523
Mail: stephan.huber@hs-fresenius.de
Private homepage: www.t1p.de/stephanhuber
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About this course

Workload: 125 h = 42 h (in-class) + 21 h (guided private study hours) - 62 h (private self-study).

Assesment Students complete this module with a written exam of 90 minutes. A passing grade in this module is achieved when the overall grade is greater than or equal to 4.0.

Learning outcomes: After successful completion of the module, students are able to:

- describe how tools of standard price theory, location theory, production theory, and the theory of investment decision can be employed to formulate a decision problem,
- evaluate alternative courses of action and choose among alternatives,
- apply economic concepts and techniques in evaluating strategic business decisions taken by firms,
- apply the knowledge of the mechanics of supply and demand to explain the functioning of markets.

How to prepare for the exam: I am convinced that reading the lecture notes, preparing for class, taking actively part in class, and trying to solve the exercises without going straight to the solutions is the best method for students to

- maximize leisure time and minimize the time needed to prepare for the exam, respectively,
- getting long-term benefits out of the course,
- improve grades, and
- have more fun during lecture hours.

Literature: Bazerman and Moore (2017), Hoover and Giarratani (2020), Parkin, Powell, and Matthews (2017), Wilkinson (2022)

Content:

Price theory

- the market price of an efficient competitive market and sources of inefficiency
- the impact of supply and demand on the market price
- the output and price decision of a profit maximizing monopolist
- regional market power and price setting

Production and cost theory

- output and costs of firms in the short and long run
- optimization under constraints (Lagrangian multiplier)
- cost–volume–profit analysis

Location theory

- Hotelling's location model
- Thünen's model of agricultural land use
- location fundamentals and agglomeration forces (sharing, matching, learning)

Strategic behaviour of firms

- nature, scope, and elements of game theory

- static games (Nash, Cournot, and Bertrand equilibrium)
- limitations

Investment decisions

- net present value
- internal rate of return
- decision-making under risk
- decision-making under uncertainty
- common pitfalls in investment decisions

About how to learn (and prepare for the exam)

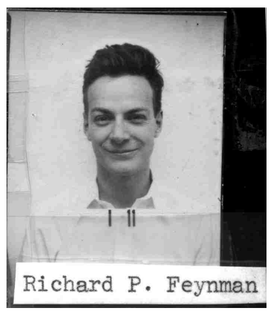

Figure 2: Richard P. Feynman's badge photo from Los Alamos National Laboratory[3]

Richard P. Feynman: "I don't know what's the matter with people: they don't learn by understanding; they learn by some other way by rote, or something. Their knowledge is so fragile!"

Stephan Huber: "I agree with Feynman: The key to learning is understanding. However, I believe that there is no understanding without practice, that is, solving problems and exercises by yourself with a pencil and a blank sheet of paper without knowing the solution in advance."

- Study the lecture notes, i.e., try to understand the exercises and solve them yourself.

[3] Picture is taken from https://repository.aip.org/islandora/object/nbla%3A299600

- Study the exercises, i.e., try to understand the logical rules and solve the problems yourself.
- Test yourself with past exams that you will find on ILIAS. The structure of the exam is more or less the same every semester.
- If you have the opportunity to form a group of students to study and prepare for the exam, make use of it. It is great to help each other, and it is very motivating to see that everyone has problems sometimes.
- If you have difficulties with some exercises and the solutions shown do not solve your problem, ask a classmate or contact me. I will do my best to help.

Chapter 1

What is managerial economics?

After successful completion of the module, students are able to:

- Explain what managerial economics is all about.
- Discuss the use of managerial econmics for their private and professional lifes.
- Explain how managerial economics relates to other disciplines of social sciences.

Well, that's a question that can't be answered definitively. It is whatever you would like it to be. Each instructor may find a slightly different way to define what it is. However, there are some conventions for what many people mean by it. To find out what most people mean by managerial economics, public and general sources like Wikipedia are a good source.[1].

More recent, many people start using ChatGPT for good reasons. Korinek (2023) discusses the use of it for academic research. Lets see what ChatGPT and Wikipedia say about managerial economics.

[1] Usually, it is not a good idea to cite Wikipedia in an academic paper, because everything written down in Wikipedia has to come from some other source. So Wikipedia is usually only a secondary source. However, general definitions of an important topic are sometimes worth citing, as they can be seen as a definition that is at least accepted by a more or less large group of administrators who can make changes to Wikipedia

1.1 What is managerial economics for ChatGPT?

Define managerial economics.

ChatGPT: Managerial economics is the application of economic theories, concepts, and analytical tools to solve managerial problems in business organizations. It involves the study of how economic principles can be applied to make better decisions regarding the allocation of resources, production and consumption of goods and services, pricing strategies, market analysis, and other strategic issues facing firms. The main goal of managerial economics is to provide managers with a framework to analyze business problems and make informed decisions that will maximize the firm's profits and shareholder value. It is an interdisciplinary field that draws from economics, finance, accounting, statistics, and other related fields to help managers understand the economic environment in which they operate and make effective decisions.

What distinguishes managerial economics from Microeconomics and Macroeconomics?

ChatGPT: Managerial economics is closely related to both microeconomics and macroeconomics, but it differs from these two branches of economics in several ways:

1. Scope: Microeconomics focuses on the behavior of individual economic agents, such as households and firms, while macroeconomics focuses on the behavior of the economy as a whole, including variables such as aggregate output, employment, and inflation. Managerial economics, on the other hand, focuses on the decision-making behavior of individual firms, and how they interact with the market and other firms.

2. Purpose: The purpose of microeconomics is to study the allocation of resources among different uses and the interactions of individual agents in the market, while macroeconomics is concerned with the overall performance of the economy. Managerial economics, on the other hand, is concerned with applying economic principles to solve managerial problems in business organizations, such as pricing strategies, cost analysis, and production decisions.

3. Analysis: Microeconomics uses mathematical and graphical models to

analyze the behavior of individual agents in the market, while macroeconomics uses aggregate economic data to study the overall performance of the economy. Managerial economics, however, uses both microeconomic and macroeconomic tools and techniques to analyze and solve specific managerial problems.

4. Perspective: Microeconomics takes the perspective of an individual economic agent, while macroeconomics takes the perspective of the entire economy. Managerial economics, on the other hand, takes the perspective of the manager and the firm, and how they can use economic principles to make better decisions.

In summary, while managerial economics draws from both microeconomics and macroeconomics, it focuses on the specific issues facing firms and their decision-making behavior, making it distinct from these other two branches of economics.

1.2 What is managerial economics for Wikipedia?

Read https://en.wikipedia.org/wiki/Managerial_economics

1.3 Simple definition of managerial economics

To me managerial economics is economics for managers. That means, any sort of method, information, and knowledge from economic research that can help managers somehow in making good decisions and achieve their goals can be considered to be part of managerial economics. So, now we can discuss what *economics* is all about and what therein can be helpful to managers.

1.4 What is economics?

All economic questions arise because we want more than we can get. Our inability to satisfy all our wants is called scarcity and because of scarcity, we must make choices that depend on the incentives we face. An incentive is a reward that encourages or a penalty that discourages an action.

Economics is a social science, and as in all social sciences, many of the terms used in it are poorly defined. The following quotes can demonstrate that:

> John Maynard Keynes (1883-1946): "The theory of economics does not furnish a body of settled conclusions immediately applicable to policy. It is a method rather than a doctrine, an apparatus of the mind, a technique of thinking, which helps it possessors to draw correct conclusions." Keynes (1921)
>
> Alfred Marshall (1842-1924): "Economics is a study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of wellbeing." Marshall (2009, 1)
>
> Gary S. Becker (1930-2014): "Economics is all about how people make choices. Sociology is about why there isn't any choice to be made." Becker (1960, 233)
>
> Colander (2006, 4): "Economics is the study of how human beings coordinate their wants and desires, given the decision-making mechanisms, social customs, and political realities of the society."
>
> Parkin (2012, 2): "Economics is the social science that studies the choices that individuals, businesses, governments, and entire societies make as they cope with scarcity and the incentives that influence and reconcile those choices."
>
> Gwartney et al. (2006, 5.): "[E]conomics is the study of human behavior, with a particular focus on human decision making."
>
> Backhouse and Medema (2009, 222): "[E]conomics is apparently the study of the economy, the study of the coordination process, the study of the effects of scarcity, the science of choice, and the study of human behavior."
>
> Greenlaw and Shapiro (2022, ch. 1): Economics seeks to solve the problem of scarcity, which is when human wants for goods and services exceed the available supply. A modern economy displays a division of labor, in which people earn income by specializing in what they produce and then use that income to purchase the products they need or want. The division of labor

> allows individuals and firms to specialize and to produce more for several reasons: a) It allows the agents to focus on areas of advantage due to natural factors and skill levels; b) It encourages the agents to learn and invent; c) It allows agents to take advantage of economies of scale. Division and specialization of labor only work when individuals can purchase what they do not produce in markets. Learning about economics helps you understand the major problems facing the world today, prepares you to be a good citizen, and helps you become a well-rounded thinker.
>
> Backhouse and Medema (2009, 222): "Perhaps the definition of economics is best viewed as a tool for the first day of principles classes but otherwise of little concern to practicing economists."
>
> Jacob Viner (1892-1970): "Economics is what economists do." Backhouse and Medema (2009, 222)
>
> Parkin (2012, 2): "Microeconomics is the study of the choices that individuals and businesses make, the way these choices interact in markets, and the influence of governments. [...] Macroeconomics is the study of the performance of the national economy and the global economy."

Although many textbook definitions are quite similar in many ways, the lack of agreement on a clear-cut definition of economics does not really matter and does not necessarily pose a problem as

> "[E]conomists are generally guided by pragmatic considerations of what works or by methodological views emanating from various sources, not by formal definitions." Backhouse and Medema (2009, 231)

The important questions of economics: How do choices end up determining what, where, how, and for whom goods and services get produced? And: When do choices made in the pursuit of self-interest also promote the social interest?

Chapter 2

Decision making basics

After successful completion of the module, students are able to:

- Make decisions with a great awareness of the nature of the decision and the purpose of making a decision.
- Explain the trade-offs that should be taken into account when making a decision.
- Explain different characteristics of decisions.
- Take advantage of various decision making strategies.
- Explain the rational model of decision making and the concept of the homo economicus.
- Explain the bounded rationality of humans and its implications on their ability to make decisions.
- Apply heuristics to make good decisions.

2.1 Exercises to reflect on how we make decisions

Exercise 2.1. Brain

[1]Source: https://pixabay.com/images/id-6671455/

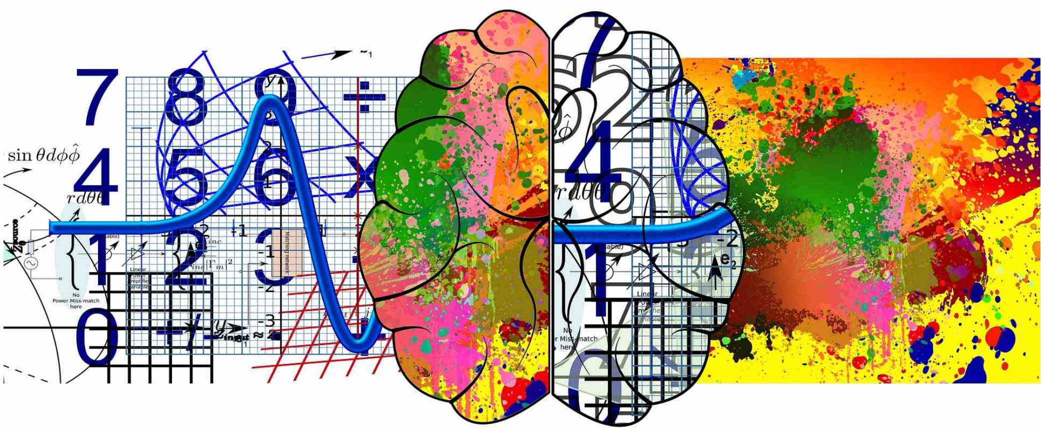

Figure 2.1: From data to decision[1]

Discuss figure 2.1. What is the message of the picture?

Exercise 2.2. Solve the puzzles

a) **The nine dots problem** Connect the dots shown in fugure 2.2 with no more than 4 straight lines without lifting your hand from the paper.

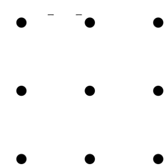

Figure 2.2: The nine dots problem

b) **The tasty cake puzzle** In figure 2.3 you see a tasty cake with the nine dots representing strawberries. Cut this cake up with exactly four straight cuts so that each portion of the cake contains just one strawberry on the top.

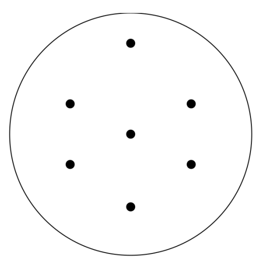

Figure 2.3: The tasty cake puzzle

Reflect on how you tried to solve the puzzles. Did you have a problem solving strategy? How did you come to the right decision? Think of restrictions you imposed on yourself which was not inherent to the problem.

Exercise 2.3. What is the house of Santa Claus?

The house of Santa Claus is an old German drawing game. It goes like this: You have to draw a house in one line where you (a) must start at bottom left (point 1), (b) you are not allowed to lift your pencil while drawing and (c) it is forbidden to repeat a line. During drawing you say: “Das ist das Haus des Nikolaus’ ’. What do you think is the success-rate of kids who play this game for the first time?

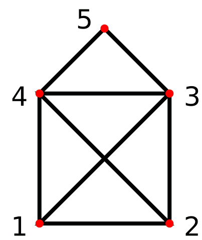

Figure 2.4: The house of Santa Claus

Figure 2.5: PINGO

Answer the question here: https://pingo.coactum.de/ Code: 666528

Please find solution to the exercise in the appendix

2.2 What defines a decision?

The statement of Eilon (1969) still holds true:

> "An examination of the literature reveals the somewhat perplexing fact that most books on management and decision theory do not contain a specific definition of what is meant by a decision. One can find detailed descriptions of decision trees, discussions of game theory and analyses of various statistical treatments of payoffs matrices under conditions of uncertainty, but the definition of the decision activity itself is often taken for granted and is associated with making a choice between alternative courses of action."

The word *decision* stems from the latin verb *decidere* which can have different meanings[2] including make explicit, put an end to, bring to conclusion,

[2] See http://www.latin-dictionary.net/search/latin/decidere

settle/decide/agree (on), die, end up, fail, fall in ruin, fall/drop/hang/flow down/off/over, sink/drop, cut/notch/carve to delineate, detach, cut off/out/down, fell, flog thoroughly.

Wikipedia defines **decision making** as follows:

> "In psychology, decision-making [. . .] is regarded as the cognitive process resulting in the selection of a belief or a course of action among several alternative possibilities. Decision-making is the process of identifying and choosing alternatives based on the values, preferences and beliefs of the decision-maker. Every decision-making process produces a final choice, which may or may not prompt action. [. . .] Decision-making can be regarded as a problem-solving activity yielding a solution deemed to be optimal, or at least satisfactory. It is therefore a process which can be more or less rational or irrational. . . "

Businessdictionary.com defines a **decision** as

> "A choice made between alternative courses of action in a situation of uncertainty."

Let's agree on the following working definition that is symbolized in figure 2.6:

> A decision is the point at which a choice is made between alternative—and usually competing—options. As such, it may be seen as a stepping-off point—the moment at which a commitment is made to one course of action to the exclusion of others. (Fitzgerald, 2002, p. 8)

2.3 Types of decisions

Decision making is a process of investing time and effort to make a decision that will lead to (good) results. In the following, we discuss some types of decisions that can help to design an appropriate decision making process.

[3] Picture is taken from https://pixabay.com/de/illustrations/entscheidung-auswahl-pfad-stra%C3%9Fe-1697537/

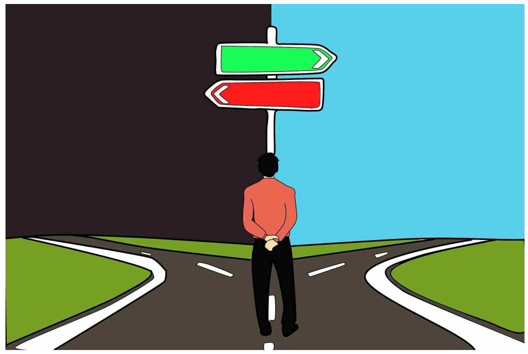

Figure 2.6: Decision-making[3]

According to Fitzgerald (2002, 9f) decisions can be roughly divided into two generic types:

- **routine decisions**: Decisions that must be made at regular intervals.
- **non-routine**: Unique, random, non-recurring decision situations.

Another common method of dividing decisions into two categories is as follows:

- **Operative decisions**: This type of decision usually involves day-to-day business operations. There is a lot of overlap with the routine category here. Examples of this type of decision include setting production levels, deciding whether to hire or deciding whether to close a particular plant. When it comes to decisions in our daily lives, an example would be where, what, when, and what we eat for lunch.
- **Strategic decisions**: This type of decision is usually about company policy and direction over a long period of time. Examples of strategic decisions include entering a new market, acquiring a competitor, or withdrawing from an industry. Renting an apartment near the university or commuting to our parents is an example of a strategic decision in our personal lives.

People often distinguish between decisions at work and private decisions. Private decisions affect fewer people on average, but usually the people involved are closer to you personally. However, both types of decisions involve the same things such as people (human resources), money (budgeting), buying and selling (marketing), how we do something (operations) or how we want to do it in the future (strategy and planning).

Some decisions are more important than others because the potential impact of a decision varies, i.e., the **scope of a decision**. For example, decisions can affect one person or millions, one pound/dollar or millions, one product/service or an entire market, one day or ten years, etc.

However, it is not entirely clear how to validate the scope. It depends heavily on the perspective of the decision-maker. For a small company, for example, an investment of 10,000 euros may be a big decision, while for a multinational cooperation it is a drop in the bucket. So the scope for decisions is relative, not absolute. It depends entirely on the context in which the decision is made and on the characteristics of the person(s) making it.

2.4 Three conditions of decision making

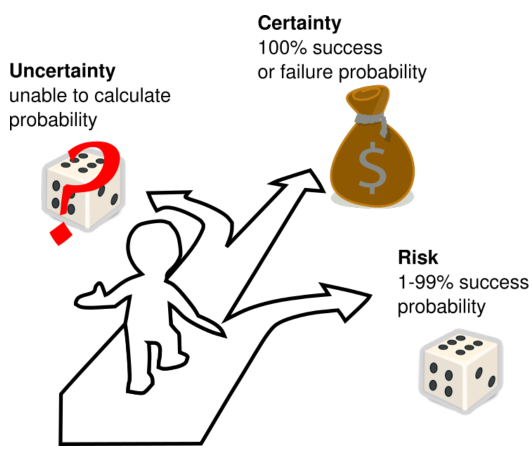

Figure 2.7: Conditions of decision making[4]

There are three general conditions (see 2.7) that determine the design of the optimal decision making process: certainty, risk and uncertainty.

Certainty: A condition under which taking a decision involves reasonable degree of certainty about its result, what are the opportunities and what conditions accompany this decision.

Risk: A condition under which taking a decision involves reasonable degree of certainty about its result, what are the opportunities and what conditions

[4]Source: CEOpedia (2021)

accompany this decision.

Uncertainty: A condition in which decision maker does not know all the choices, as well as risks associated with each of them and possible consequences.

2.5 Decision making strategies

Exercise 2.4. Different schemes of a decision making process

a) Google for *"decision making strategies"* and look at the images that Google suggests you.

b) Read Indeed Editorial Team (2023) and discuss the twelve decision making strategies. The article can be found here.

c) Compare these strategies to the scheme shown in figure 2.8.

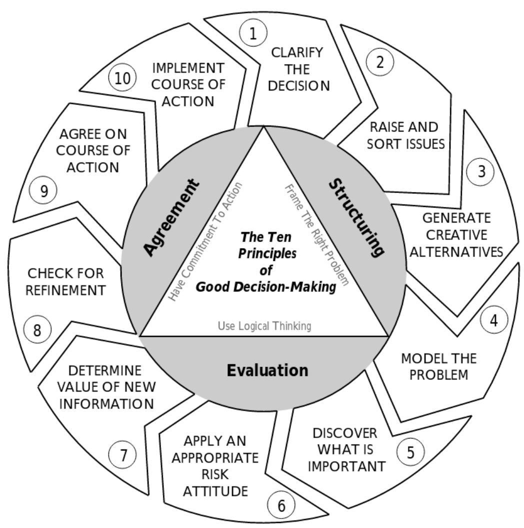

Figure 2.8: Decision-making[5]

d) Choose a problem of your choice and try to solve the problem using the two illustrations above by making a good decision.

e) Discuss in class whether the diagram or the strategies in Indeed Editorial Team (2023) are helpful in making a wise decision or solving a problem.

[5]Picture is taken from https://pixabay.com/de/illustrations/entscheidung-auswahl-pfad-stra%C3%9Fe-1697537/

f) Watch `https://youtu.be/pPIhAm_WGbQ` and answer the following questions: How is the nature of decisions discussed here? Does it contain a rational model of problem solving? Reflect on which ways to solve a problem and come to a decision, respectively, have been addressed.

Exercise 2.5. The businessman and the fisherman

A classic tale that exist in different version^[This one stems from thestorytellers.com. A famous version stems from Paulo Coelho^[See https://paulocoelhoblog.com and it goes like this:

> One day a fisherman was lying on a beautiful beach, with his fishing pole propped up in the sand and his solitary line cast out into the sparkling blue surf. He was enjoying the warmth of the afternoon sun and the prospect of catching a fish.
>
> About that time, a businessman came walking down the beach, trying to relieve some of the stress of his workday. He noticed the fisherman sitting on the beach and decided to find out why this fisherman was fishing instead of working harder to make a living for himself and his family. "You aren't going to catch many fish that way", said the businessman to the fisherman.
>
> "You should be working rather than lying on the beach!" The fisherman looked up at the businessman, smiled and replied, "And what will my reward be?" "Well, you can get bigger nets and catch more fish!" was the businessman's answer. "And then what will my reward be?" asked the fisherman, still smiling. The businessman replied, "You will make money and you'll be able to buy a boat, which will then result in larger catches of fish!" "And then what will my reward be?"" asked the fisherman again.
>
> The businessman was beginning to get a little irritated with the fisherman's questions. "You can buy a bigger boat, and hire some people to work for you!" he said. "And then what will my reward be?" repeated the fisherman. The businessman was getting angry. "Don't you understand? You can build up a fleet of fishing boats, sail all over the world, and let all your employees catch fish for you!"
>
> Once again the fisherman asked, "And then what will my reward

> be?" The businessman was red with rage and shouted at the fisherman, "Don't you understand that you can become so rich that you will never have to work for your living again! You can spend all the rest of your days sitting on this beach, looking at the sunset. You won't have a care in the world!"
>
> The fisherman, still smiling, looked up and said, "And what do you think I'm doing right now?"

Define the cost and benefits of both persons. Who do you think has a better life overall. Who is acting rationally here? In other words, who is maximizing utility here? The fishermen or the businessmen? Both? None?

2.6 The rational model

Economists view the choices that people make as *rational*. A rational choice is one that compares costs and benefits and achieves the greatest benefit over cost for the person making the choice. Whatever the benefits and the costs maybe, a decision maker have to consider all and make a decision. Of course, in reality it is often difficult if not impossinle to sum up benefits and costs as the nature of both may be totally different. To get rid of these problems economists use a theoretical concept that measures both in *utility*. That is a general and abstract measure to model worth or value. Its usage has evolved significantly over time. The term was introduced initially as a measure of pleasure or happiness within the theory of utilitarianism. It represents the satisfaction or pleasure that people receive for consuming a bundle of goods and services, for example.

According to CEOpedia (2021) rational decision making is a style of decision making based on objective data and a formal process of analysis. It excludes acting based on subjective feelings and intuitive approach. The model assumes that deducting decisions with full information and all alternatives allows for the creation of cognitive skills that allow the evaluation of all possible options and then the selection of the best one.

It essentially consists of a logical sequence of steps. Here is an example taken from Fitzgerald (2002, 13):

1. **Clearly identify the problem**. A *problem* can be defined as a

perceived gap between the current reality and the desired reality.

2. **Generate potential solutions**. For routine decisions, various alternatives can be identified relatively easily using predetermined decision rules, but non-routine decisions require a creative process to find new alternatives.

3. Using appropriate analytical approaches, select a solution from the available alternatives, preferably the one with the largest expected value. In decision theory, this is called **maximizing the expected utility of the outcomes**.

4. **Implement the solution**. Managers often undermine implementation by not ensuring that those responsible for implementation understand and accept what they need to do, and that they have the motivation and resources needed for successful implementation.

5. **Evaluate the effectiveness of the implemented decision**

While these rational models may be helpful, they can also be criticized in a number of ways. In particular, it is a belief that managers actually optimize their decision behavior based on rationality because they consciously select and implement the best alternatives. This is a misconception because any rational optimization is based on a number of dubious assumptions. For example, (Fitzgerald, 2002, p. 13):

- it is hardly possible to know in advance all possible alternative solutions and to know in advance the specific outcomes that will result from each of them;
- there is actually an optimal solution, and this solution is among the alternatives identified;
- it is possible to accurately and numerically weight the various alternatives, the probabilities of their outcomes, and the relative desirability of these alternatives and outcomes;
- the decision makers always act rationally and therefore the decision making is free of emotion, bias, and politics; and
- business decisions are driven entirely by the desire to maximize profits.

The **rational model can be considered normative** because it prescribes a strict logical sequence of steps to be followed in any decision-making situation. The rational models are based on the assumption that human behavior is logical and therefore predictable under certain circumstances. This is not necessarily what actually happens in the real world. Consider, for example, the findings in the field of behavioral economics, which clearly show that homo economicus is a (useful) concept that is weak in several aspects.

2.7 Bounded rationality

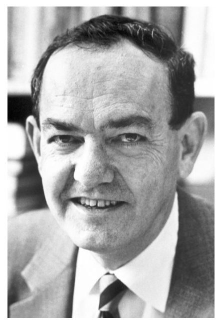

Figure 2.9: Herbert A. Simon[6]

Herbert A. Simon (1916-2001) shown in figure 2.9 received the Nobel Memorial Prize in Economic Sciences in 1978 and the Turing Award[7] in 1975. According to NobelPrize.org (2021), he

> "combined different scientific disciplines and considered new factors in economic theories. Established economic theories held that enterprises and entrepreneurs all acted in completely rational ways, with the maximization of their own profit as their only goal. In contrast, Simon held that when making choices all people deviate from the strictly rational, and described companies as adaptable systems, with physical, personal, and social components. Through these perspectives, he was able to write about decision-making processes in modern society in an entirely new way".

In particular, he proposed **bounded rationality** as an alternative basis for

[6]Picture is taken from Nobel Foundation archive

[7]The Turing Award is an annual prize given by the Association for Computing Machinery (ACM) for contributions of lasting and major technical importance to the computer field. It is generally recognized as the highest distinction in computer science and is known as or often referred to as 'Nobel Prize of Computing'.

the mathematical and neoclassical economic modelling of decision-making, as used in economics, political science, and related disciplines.

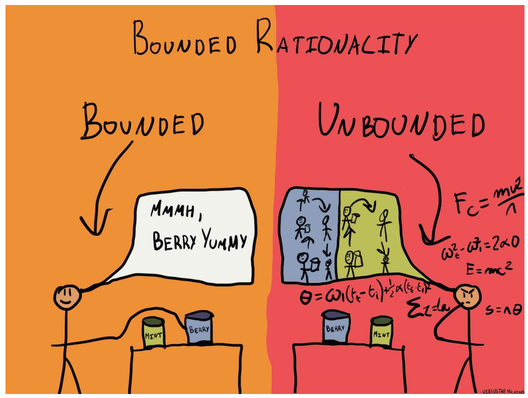

Figure 2.10: Bounded rationality[8]

Bounded rationality proposes that decision making is constrained by managers' ability to process information, i.e., the rationally is *bounded* (see figure @fig:boundedrationality). Managers use shortcuts and rules of thumb which are based on their prior experience with similar problems and scenarios. Given the constraints of managers in their position, they do not actually *optimize* their choice given the available information. It is more like finding a *satisfactory* solution, not necessarily the *best* or the *optimal* solution.

Exercise 2.6. Optimal vs. satisfactory solution

Using the following images, explain the idea of bounded rationality in the context of decision making.

Figure 2.11: Picture A

Please find solution to the exercise in the appendix.

[8]Picture is taken from https://thedecisionlab.com/wp-content/uploads/2019/08/Bounded-Rationality.jpg

Figure 2.12: Picture B

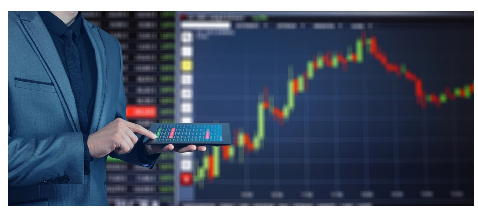

Figure 2.13: Picture C

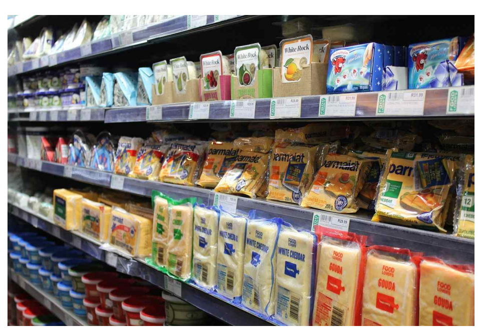

Figure 2.14: Picture D

Exercise 2.7. Are we irrational?

Discuss the following statement:

> Since the rationality of individuals is bounded and it is obvious that individuals do not make optimal decisions, we can say that individuals act irrationally.

2.8 Homo economicus

The so-called *homo economicus* is often modeled by the assumption of perfect rationality. Actors are assumed to always act in a way that maximizes their utility (as consumers) and profit (as producers), and to this end they are capable of arbitrarily complex reasoning. That is, it is assumed that they are always capable of thinking through all possible outcomes and choosing the course of action that leads to the best possible outcome.

Of course, the assumption of *homo economicus* is heroic, and I doubt that any serious economist has ever assumed that this assumption can be found one-to-one in reality. However, it is an assumption that helps to make predictions and explain the behavior of people and societies to some extent. I mean, what would happen if microeconomics went to the other extreme assuming irrationally acting individuals. The result would be, more or less, that we would not be able to make predictions and the future would be a random walk.

Nevertheless, economists and anyone who wants to make, apply, or think about economic theories should be aware of all the pitfalls that arise in our decision making and know that our ability to act rationally is limited. In real life, we often use heuristics to solve problems and make decisions.

A **heuristic** is any approach to solving a problem that uses a practical method that is not guaranteed to be optimal, perfect, or rational. However, a heuristic should–at best–be sufficient to achieve an immediate, short-term goal or approximation. Overall, people use heuristics because they either cannot act completely rationally or want to act rationally but do not have the time it would take to compute the perfect solution. Moreover, the effort is probably not worth it or simply not possible given the time constraints under which the problem must be solved. A heuristic is a mental shortcut or rule of thumb to make decisions and solve problems quickly and efficiently. It helps individuals to arrive at a solution without extensive analysis or evaluation of all available information. Heuristics are usefull when time, resources, or information are limited.

While heuristics can be helpful in many situations, they can also lead to errors and biases, particularly when they are overused or misapplied. We will discuss some of these biases later on in greater detail.

2.9 Review

- Decision analysis is about using information in order to come to a decision.
- A structured and rational process can help improve the chances of receiving good decision outcomes.
- As decision problems are often (too) complex to fully capture or solve rationally. Thus, a good decision analysis should try to use the available information and the existing understanding of the problem as transparent, consistent, and logical as possible.
- A complex decision problem should be simplified and hence decomposed into its basic and most important components.
- There are hundred of different *schemes* or *strategies* how to make decisions in certain circumstances. Many heuristics exist how to think, behave, and calculate to come to a wise decision.
- Mostly decisions are based on subjective expectations. These expectations are difficult to validate.
- Articulating exact expectation and preferences is a difficult task and the information that stems from these articulation is full of biases. Decision analytic tools need to take that into consideration.

Exercise 2.8. Lisa is pregnant

The following question stems from a study carried out by Kahneman and Tversky (1972): Lisa is thirty-three and is pregnant for the first time. She is worried about birth defects such as Down syndrome. Her doctor tells her that she need not worry too much because there is only a 1 in 1,000 chance that a woman of her age will have a baby with Down syndrome. Nevertheless, Lisa remains anxious about this possibility and decides to obtain a test, known as the Triple Screen, that can detect Down syndrome. The test is moderately accurate: When a baby has Down syndrome, the test delivers a positive result 86 percent of the time. There is, however, a small 'false positive' rate: 5 percent of babies produce a positive result despite not having Down syndrome. Lisa takes the Triple Screen and obtains a positive result for Down syndrome.

Given this test result, what are the chances that her baby has Down syndrome?

a) 0-20 percent chance
b) 21-40 percent chance
c) 41-60 percent chance
d) 61-80 percent chance
e) 81-100 percent chance

Think about the question and put your answer here:

`https://pingo.coactum.de/` Code: 666528

Please find solution to the exercise in the appendix.

Exercise 2.9. Three categories

Read Finne (1998) and answer the following questions: a) Explain the three categories of decision making. b) Give examples of the three categories of decision making. c) Explain the four criteria for decision making under uncertainty. d) Table 7 is full of errors. Can you play referee and correct them.

Chapter 3

Appendix

3.1 Solutions to exercises

Solution to exercise 2.3: What is the house of Santa Claus?

There are 44 solutions and only 10 different ways to fail. Thus, the probability to fail is about 18.5% and hence the probability to succeed is about 81.5%. In the course 10 persons participated in the poll. Here are the answers:

Nobody came close to the correct probability.

Solution to exercise 2.6: Optimal vs. satisfactory solution

A) Collecting and analyzing the available information about a product is costly. It is also difficult to analyze the importance of product features for the intended purpose.
B) Individuals often use rules of thumb to make a satisfactory decision.
C) It is difficult to understand complex situations such as the market for financial products. For some people, it is simply not possible to find the best product in these complex markets.

[1] Taken from https://de.wikipedia.org/wiki/Haus_vom_Nikolaus
[2] Taken from https://de.wikipedia.org/wiki/Haus_vom_Nikolaus

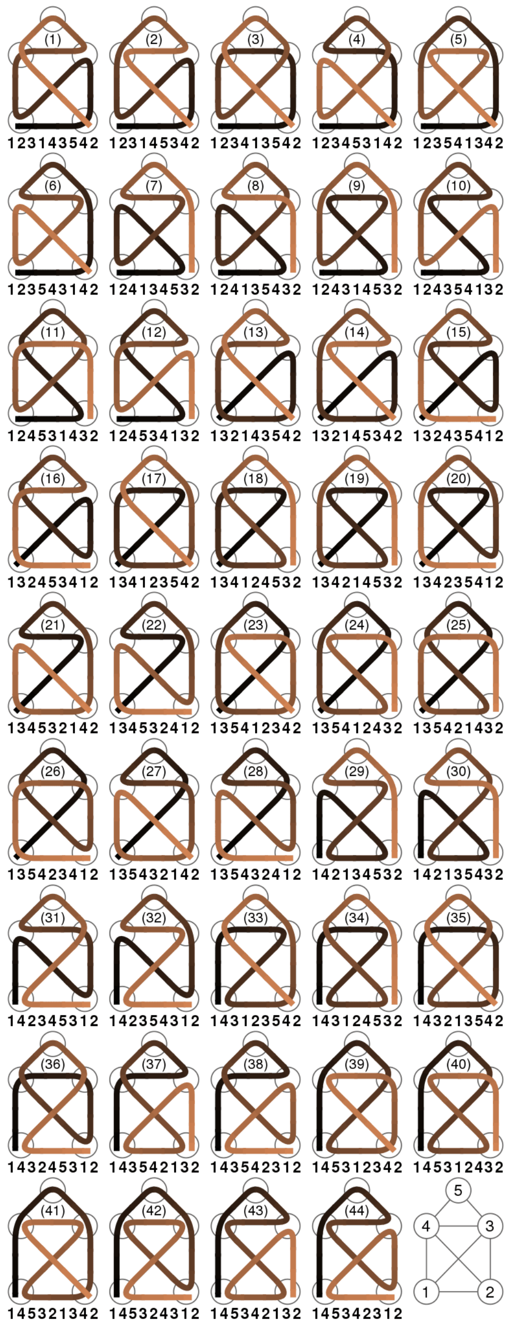

Figure 3.1: Forty-four ways to solve the puzzle[1]

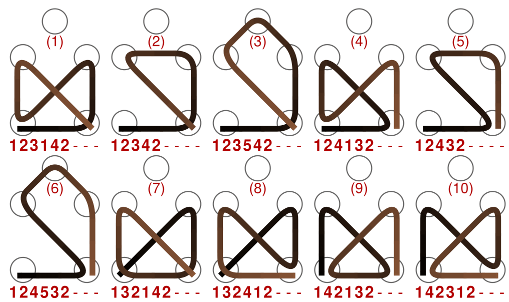

Figure 3.2: Ten ways to fail in the puzzle[2]

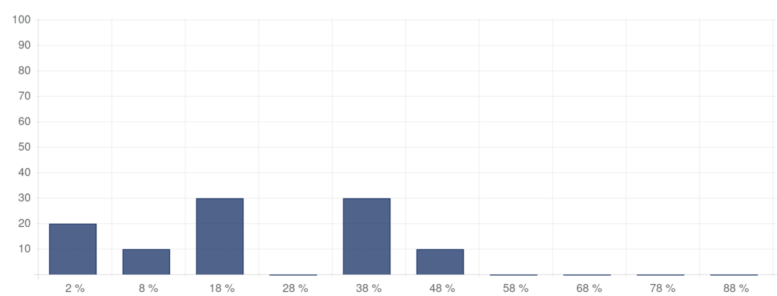

Figure 3.3: PINGO

D) Consumers are often confronted with many variants of a product. The differences are negligible and therefore it is not worthwhile for consumers to analyze the situation in detail. Thus, they make a decision that may not be optimal, but they are satisfied with it.

Solution to exercise 2.8: Lisa is pregnant

At the beginning of the *Inferential Statistics* course at summer 2020, I also asked student this question. Here are the results of the 16 students who participated:

Option	Frequency of answers	Percentage
a)	3	19%
b)	2	13%
c)	2	13%
d)	3	19%
e)	6	38%

How did they reach their answers? Like most people, they decided that Lisa has a substantial chance of having a baby with Down syndrome. The test gets it right 86 percent of the time, right? That sounds rather reliable, doesn't it? Well it does, but we should not rely on our feelings here and better do the math because the correct result would be that there is **just a 1.7 percent chance of the baby having a Down syndrome**.

Now, let us proof the result that there is just a 1.7 percent chance of the baby having a Down syndrome using *Bayesian Arithmetic* which is explained in the following videos:

Also, consider this interactive tool here: https://www.skobelevs.ie/BayesTheorem/

Let A be the event of the Baby has a Down syndrom and B the test is positive.

Then,

$$\begin{aligned}
P(A) &= 0.001 \\
P(B \mid A) &= 0.86 \\
P(B \mid \neg A) &= 0.05 \\
P(B) &= \frac{999 \cdot 0.05}{1000} + \frac{1 \cdot 0.86}{1000} = \frac{50.81}{1000} = 0.05081 \\
P(A \mid B) &= \frac{P(B \mid A)P(A)}{P(B)} = \frac{0.86 \cdot 0.001}{0.05081} = 0.016925802
\end{aligned}$$

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