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Workbook for Principles of Microeconomics

Second Edition

 Springer

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Foreword to the Second Edition

After 4 years, it is time to fundamentally expand and revise the textbook on which this workbook is based. This also necessitated an expansion and revision of this workbook.

The present edition retains the proven structure based on three types of exercises, including sample solutions. In particular, tasks that shed more light on the economic and methodological contexts of the theories have been newly developed and integrated into this book. Furthermore, there are tasks and sample solutions for the new chapters in the textbook. They cover (1) traditional decision theories under risk and uncertainty, (2) behavioral economics, and (3) neuroscience, evolutionary psychology, and narrative psychology. More detailed instructions can be found in the foreword to the first edition. However, it should be noted at this point that all references to chapters are to those in the textbook “Principles of Microeconomics: An Integrative Approach” by Martin Kolmar, unless otherwise specified.

We thank Corinne Knöpfel, Jan Riss, and Jan Serwart for co-authoring some of the problem sets. We also would like to thank Judith Gamp for her critical comments and careful review of the manuscript. Thanks are also due to Yara Locher, who helped us preparing the graphics. Jürg Furrer, Stefan Legge, and Alfonso Sousa-Poza are also thanked for their many constructive comments.

Also, we would like to thank the many students whose numerous notes and comments over the years have found their way into this book.

St. Gallen, Switzerland
St. Gallen, Switzerland
February 2021

Magnus Hoffmann
Martin Kolmar

Foreword to the First Edition

If you want to learn the piano, you have to sit down and start practicing. This is tedious in the beginning and will not sound particularly pretty, but things will improve over time. The same applies to economics (and other scientific theories as well). If you want to use them to better understand and analyze certain aspects of economic and social reality, you have to make them your own, understand their internal “mechanics,” and work with them. Reading textbooks or listening to lectures is only a poor substitute. Limiting yourself to it would be like wanting to learn how to play piano by just listening to a piano player and studying piano scores.

This is why we have collected a series of problems and exercises that are intended to help you to adopt step by step the theories introduced and discussed in the textbook “Principles of Microeconomics: An Integrative Approach.” You will find a chapter with different types of problems and sample solutions that correspond to a chapter in the main book. We distinguish between three different types of exercises that focus on the development of specific and complementary skills and competencies.

The first type is true or false exercises; statements that can be either true or false. At the end of each section, you will find the solutions along with short explanations, as well as links to the textbook.

The second type of problems have the character of short case studies or word problems, to answer which you will be required to develop a more complex train of thoughts. Problems like these do not have one and only one correct solution but can usually be approached from different directions. Nevertheless, this book offers you sample solutions at the end of this section that illustrate *one* possible approach. Over the years during which we have developed the problems and used them in class, we have also been able to identify typical lines of faulty reasoning. We will look into these and explain how they can be avoided.

Finally, you will find multiple-choice questions to answer in which you will have to identify one correct answer from a choice of given answers. Please note that all references to chapters are to those in the textbook “Principles of Microeconomics: An Integrative Approach” by Martin Kolmar, unless otherwise specified.

The teaching material collected in this book has grown over many years and is a result of efforts of great many people, first of all the students who worked with them. We are most thankful for their innumerable suggestions that helped us improving the

set of problems. Further, we thank Dario Fauceglia, Jürg Furrer, Carolin Güssow, Katharina Hofer, Alfonso Sousa-Poza, and Fred Henneberger for pointing out many errors, inconsistencies, and ways to improve the problems included in this book. Last but not least, we thank our student assistants Corinne Knöpfel, Jan Riss, and Jan Serwart without whom the book would not be as it is.

Science that aims at better understanding both the reality and practical application of theory is similar to jazz. A good economist is like a good pianist: both have to master their instruments to be able to improvise. You know you are there, when it starts to swing. We hope that this book will help you on your way to reaching this goal.

St. Gallen, Switzerland
St. Gallen, Switzerland
July 2017

Magnus Hoffmann
Martin Kolmar

Contents

1	First Principles	1
1.1	True or False	1
1.1.1	Statements	1
1.1.2	Solutions	4
1.2	Open Questions	8
1.2.1	Problems	8
1.2.2	Solution	9
2	Gains from Trade	11
2.1	True or False	11
2.1.1	Statements	11
2.1.2	Solutions	13
2.2	Open Questions	17
2.2.1	Problems	17
2.2.2	Solutions	18
2.3	Multiple Choice	26
2.3.1	Problems	26
2.3.2	Solutions	32
3	Markets and Institutions: Introduction	35
3.1	True or False	35
3.1.1	Statements	35
3.1.2	Solutions	36
3.2	Open Questions	38
3.2.1	Problems	38
3.2.2	Solutions	38
4	Supply and Demand	41
4.1	True or False	41
4.1.1	Statements	41
4.1.2	Solutions	43
4.2	Open Questions	45
4.2.1	Problems	45
4.2.2	Solutions	48

4.3	Multiple Choice	59
4.3.1	Problems	59
4.3.2	Solutions	60
5	Normative Economics	61
5.1	True or False	61
5.1.1	Statements	61
5.1.2	Solutions	63
5.2	Open Questions	65
5.2.1	Problems	65
5.2.2	Solutions	67
6	Externalities and the Limits of Markets	71
6.1	True or False	71
6.1.1	Statements	71
6.1.2	Solutions	75
6.2	Open Questions	81
6.2.1	Problems	81
6.2.2	Solutions	85
6.3	Multiple Choice	101
6.3.1	Problems	101
6.3.2	Solutions	106
7	Decisions and Consumer Behavior	109
7.1	True or False	109
7.1.1	Statements	109
7.1.2	Sample Solutions	111
7.2	Open Questions	116
7.2.1	Problems	116
7.2.2	Solutions	117
7.3	Multiple Choice	120
7.3.1	Problems	120
7.3.2	Solutions	122
8	Decisions Under Uncertainty and Risk	125
8.1	True or False	125
8.1.1	Statements	125
8.1.2	Solutions	127
8.2	Open Questions	131
8.2.1	Problems	131
8.2.2	Solutions	132
8.3	Multiple Choice	136
8.3.1	Problems	136
8.3.2	Solutions	138

9	Principles of Game Theory	139
9.1	True or False	139
9.1.1	Statements	139
9.1.2	Solutions	146
9.2	Open Questions	151
9.2.1	Problems	151
9.2.2	Solutions	156
9.3	Multiple Choice	163
9.3.1	Problems	163
9.3.2	Solutions	167
10	Behavioral Economics	169
10.1	True or False	169
10.1.1	Statements	169
10.1.2	Solutions	170
10.2	Open Questions	171
10.2.1	Problems	171
10.2.2	Solution	173
11	Foundations of Perception and Decision-Making	175
11.1	True or False	175
11.1.1	Statements	175
11.1.2	Solutions	176
11.2	Open Questions	177
11.2.1	Problems	177
11.2.2	Solution	178
12	Costs	181
12.1	True or False	181
12.1.1	Statements	181
12.1.2	Solutions	182
12.2	Open Questions	184
12.2.1	Problems	184
12.2.2	Solutions	186
12.3	Multiple Choice	194
12.3.1	Problems	194
12.3.2	Solutions	196
13	A Second Look at Firm Behavior Under Perfect Competition	197
13.1	True or False	197
13.1.1	Statements	197
13.1.2	Solutions	199
13.2	Open Questions	203
13.2.1	Problems	203
13.2.2	Solutions	204

13.3	Multiple Choice	212
13.3.1	Problems	212
13.3.2	Solutions	215
14	Firm Behavior in Monopolistic Markets	217
14.1	True or False	217
14.1.1	Statements	217
14.1.2	Solutions	221
14.2	Open Questions	227
14.2.1	Problems	227
14.2.2	Solutions	230
14.3	Multiple Choice	254
14.3.1	Problems	254
14.3.2	Solutions	260
15	Firm Behavior in Oligopolistic Markets	261
15.1	True or False	261
15.1.1	Statements	261
15.1.2	Solutions	263
15.2	Open Questions	266
15.2.1	Problems	266
15.2.2	Solutions	268
15.3	Multiple Choice	281
15.3.1	Problems	281
15.3.2	Solutions	285
16	Elasticities	287
16.1	True or False	287
16.1.1	Statements	287
16.1.2	Solutions	288
16.2	Open Questions	293
16.2.1	Problems	293
16.2.2	Solutions	295



1.1 True or False

1.1.1 Statements

1.1.1.1 Block 1

1. The more aspects of reality are taken into consideration, the more useful an economic model is.
2. According to Karl Popper, a basic requisite for the quality of scientific theories is that one can refute them.
3. Concerning logical statements: one can derive a false hypothesis from false assumptions.
4. Modern microeconomics is macro-founded.

1.1.1.2 Block 2

1. Economics, as a positive science, tries to explain why social phenomena work the way they work. Economics, as a negative science, tries to explain why social phenomena do not work the way they should work.
2. If an economist tries to determine how a country should increase taxes in the best possible way, she or he is practicing normative science.
3. If an assumption in a scientific theory is incorrect, the theory must be discarded because it cannot contribute to the understanding of reality.
4. In economics, one investigates the interplay of human behavior on the individual level.

1.1.1.3 Block 3

1. With regard to economics, positive science answers the question as to how humans should cope with the phenomenon of scarcity.
2. Quantities of goods that are not on the production-possibility frontier cannot be produced.

3. Modern macroeconomics is not “micro-founded” because it concentrates on economic aggregates.
4. Opportunity costs are costs of the past that cannot be influenced any longer.

1.1.1.4 Block 4

1. According to critical rationalism, monopoly theory is not a scientifically sound theory, because the assumption of profit maximization has been falsified.
2. According to critical rationalism, scientific theories can be verified, but cannot be falsified.
3. According to critical rationalism, a good theory can be falsified in principle, but has not been falsified yet.
4. The implication of applying Ockham’s razor to scientific theories is that a theory with fewer assumptions is preferable to one with more assumptions if both theories lead to identical hypotheses.

1.1.1.5 Block 5

1. When economists study societal phenomena, they usually distinguish between three different levels of analysis: the institutional level, the interaction level, and the aggregate level.
2. Inflation, growth, and unemployment are phenomena that are studied at the interaction level.
3. Methodological individualism is a scientific position according to which societal phenomena should not be explained with reference to individual behavior.
4. When each proof of a proposition requires a further proof, this is commonly referred to as circularity.

1.1.1.6 Block 6

1. According to the revealed-preference approach, the observation of an individual’s behavior is sufficient to infer the individual’s preferences.
2. The rational-choice paradigm postulates that individuals behave as if they would maximize a preference relation, which has to be unique and stable over time as well as complete and transitive.
3. To capture rationality, homo economicus is conceptualized as being selfish.
4. Even though homo economicus is conceptualized as a rational actor, the concept is still helpful to understand bounded rationality.

1.1.1.7 Block 7

1. Scarcity applies to situations where the wants exceed the means. As such, it rarely plays a role in everyday life and is only relevant as a concept for specific analyses in economics.
2. While commuting to your economics lecture, you are one of the few lucky commuters to find a seat on the crowded bus. Since you found a seat, the scarcity of bus seats does not impact you.

3. Study places for neither economics nor physics are limited, and it is simply a matter of choice which of the subjects one studies. Due to the absence of scarcity, there are no opportunity costs in studying.
4. Generally, people weigh different alternatives before making a decision and are, in fact, evaluating opportunity costs in order to make an informed decision.

1.1.1.8 Block 8

1. Homo economicus is a concept underlying mainstream economics that specifies assumptions regarding individual decision-making and allows economists to make predictions about behavior.
2. Homo economicus is the result of the most recent step in human evolution. Thus, every homo sapiens is necessarily also a homo economicus.
3. Economists in the tradition of Pareto use concepts from psychology as well as the principle of rational choice to infer motivations behind human behavior.
4. In economic literature, the term homo economicus is mostly used in a purely prescriptive way.

1.1.1.9 Block 9

Consider the following model:

Assumption 1: It never rains in Southern California.

Assumption 2: St. Gallen is located in Southern California.

Hypothesis: It is always rainy in St. Gallen.

1. The model is logically inconsistent because Assumption 2 is wrong: St. Gallen is not located in Southern California.
2. The model is valid because the hypothesis is true. Models are primarily judged by the validity and usefulness of their hypotheses.

Now consider the following model:

Assumption 1: Rich students are happy.

Assumption 2: All students are rich.

Assumption 3: You are a student.

Hypothesis: You are happy.

3. This model is not a good model because it is not very plausible and therefore has no use.
4. This model is a good model but not a good basis for a theory.

1.1.1.10 Block 10

1. Economics, like any other science, is concerned with the development of positive propositions and therefore free of any value judgments.
2. Instrumentalism argues that assumptions are instrumental for the understanding of causal mechanisms and, therefore, need to be as realistic as possible.

3. According to critical rationalism, scientific theories need to be formulated in such a way that they can be verified by empirical evidence.
4. A point of criticism of critical rationalism is its unscrutinized belief in empirical falsification.

1.1.1.11 Block 11

1. A non-hierarchical discourse strives to create a level playing field for scientific debate where the success of an argument is neither influenced by money nor power.
2. According to Ockham's razor, a simple theory should be preferred to a complex theory if both theories explain the same empirical phenomena.
3. According to critical rationalism, scientific theories can never be falsified but can, in principle, be verified.
4. According to moral realism, ethical sentences express propositions which refer to subjective features of the world.

1.1.2 Solutions

1.1.2.1 Sample Solutions for Block 1

1. **False.** An important criterion for good models is simplicity or frugality. The idea is often referred to as "Ockham's razor," which states that, among competing models, the one with the fewest and simplest assumptions should be selected. Ockham's razor necessarily implies that the assumptions of a model should not be realistic in the naïve sense that the assumptions shall fit reality. See Chapter 1.2.3.
2. **True.** According to Karl Popper, scientific theories can never be verified but can, in principle, be falsified by confronting them with empirical evidence. See Chapter 1.2.6.
3. **True.** See examples in Chapter 1.2.2.
4. **False.** Modern macroeconomics is micro-founded. See Chapter 1.1.

1.1.2.2 Sample Solutions for Block 2

1. **False.** The goal of positive theories is to explain phenomena. Normative theories, on the other hand, try to determine what people should do. Thus, they are based on value judgments. See Chapter 1.2.7.
2. **True.** See the sample solution to Block 2, Statement 1.
3. **False.** Assumptions are necessarily simplifications. The important thing is to find the correct balance between reasonable simplification and the supported causal mechanisms on the one hand and the content explained by the derived hypotheses on the other hand. See Chapter 1.2.4.
4. **False.** On the individual level, one investigates individual behavior. Individual interactions are investigated on the interaction level. See Chapter 1.1.

1.1.2.3 Sample Solutions for Block 3

1. **False.** With regard to economics, positive science answers the question as to how humans cope (without value judgment) with the phenomena of scarcity. See Chapter 1.2.7.
2. **False.** The production-possibility frontier indicates the maximum quantity that can be produced. Every quantity below the frontier can be produced as well. See Chapter 1.2.5.
3. **False.** The micro-foundation of macroeconomics is a research program that tries to explain the regularities on the aggregate level, like relationships between inflation and unemployment, through individual's behavior and interactions. The current macroeconomics mainstream is, in this sense, largely micro-founded. See Chapter 1.1.
4. **False.** Opportunity costs are costs that result from, for example, forgoing an alternative use of capital or time (such as the salary that a student forgoes, because he is not working). See Chapter 1.1.

1.1.2.4 Sample Solutions for Block 4

1. **False.** Falsification means disproving hypotheses by confronting them with empirical evidence. One can only falsify hypotheses, not assumptions. See Chapter 1.2.6.
2. **False.** According to the theory of critical rationalism, scientific theories can never be irrevocably proven, but they can in principle be falsified. See Chapter 1.2.6.
3. **True.** Theories should be formulated such that their hypotheses are falsifiable. Good theories are those that have a large empirical content, but have not been falsified so far. See Chapter 1.2.6.
4. **True.** This is true by definition. See Chapter 1.2.3. See also the sample solution to Block 1, Statement 1 in this chapter of the workbook.

1.1.2.5 Sample Solutions for Block 5

1. **False.** Economists use the individual level, the interaction level, and the aggregate level to analyze societal phenomena, but not the institutional level. See Chapter 1.1.
2. **False.** Inflation, growth, and unemployment are phenomena that are traditionally studied at the aggregate level. See Chapter 1.1.
3. **False.** Methodological individualism is a scientific position according to which all societal phenomena must be traced back to the behavior of individuals. See Chapter 1.1.
4. **False.** If every proof of a proposition is in turn based on a proposition, one speaks of infinite regress. See Chapter 1.2.

1.1.2.6 Sample Solutions for Block 6

1. **True.** Note that the revealed-preferences approach does not postulate that an individual maximizes a preference relation, merely that it behaves *as if* it would maximize one. See Chapter 1.1.

2. **True.** The assumptions on the preference relation are necessary for behavior to satisfy certain consistency requirements. See Chapter 1.1.
3. **False.** Terms like egoism or altruism refer to (psychological) motives about which nothing can be said according to the revealed-preference approach. See Chapter 1.1.
4. **True.** Boundedly rational behavior follows patterns, and these patterns are easier to detect if they are measured against the reference point of rational behavior. See Chapter 1.1.

1.1.2.7 Sample Solutions for Block 7

1. **False.** *Scarcity* does refer to situations where the wants exceed the means. However, these situations are quite common in everyday life and are highly relevant for human beings. The reference to wants implies that scarcity has its origin in human physiology and psychology. See Chapter 1.1.
2. **False.** Bus seats on the crowded bus are objectively scarce (i.e., the demand for seats exceeds the supply). This has implications for you (as a lucky seated commuter), too, e.g., you could charge a fee for offering your seat to another commuter.
3. **False.** Decision-making under the conditions of scarcity directly refers to the concept of opportunity cost. See Chapter 1.1. In this example, time. While one studies Economics, one cannot use one's time to study Physics or earn a wage on the labor market. The opportunity costs of studying Economics correspond to the value of the best forgone alternative.
4. **False.** The concept of opportunity cost allows one to better understand how decisions are or should be made. However, it is far from obvious that people always evaluate opportunity costs correctly and act accordingly. Underlying the evaluation of alternatives by means of opportunity costs is the assumption of rationality. See Chapter 1.1.

1.1.2.8 Sample Solutions for Block 8

1. **True.** See Chapter 1.1
2. **False.** Homo economicus is a concept used by economists in order to understand and predict human behavior. It has no biological meaning and cannot describe modern human beings in all their complexity. See Chapter 1.1.
3. **False.** After Pareto and Samuelson, economists abandoned psychological concepts and based their science exclusively on the principles of rational choice. The idea is that one can only observe choices and behavior, but not the mental processes that motivate behavior. See Chapter 1.1.
4. **False** In the economic literature, the term homo economicus is used in a purely descriptive sense. See Chapter 1.1.

1.1.2.9 Sample Solutions for Block 9

1. **False.** The model is logically inconsistent because the hypothesis does not follow from the assumptions. The assumptions cannot explain the observation, which makes the model useless for any theory. See Chapter 1.2.2.

2. **False.** Even though the hypothesis might be correct empirically, the assumptions cannot explain the observation, which makes the model useless for any theory. A consistent model is a necessary condition for a good theory. See Chapter 1.2.2.
3. **False.** The model fulfills all the requirements of a good model. All assumptions are spelled out explicitly, and the hypothesis follows logically from the assumptions. See Chapter 1.2.2.
4. **True.** The model is logically consistent. However, logical consistency is a necessary but not a sufficient criterion for a good theory. It is difficult to imagine that a theory based on this model would get the approval of many experts. See Chapter 1.2.2.

1.1.2.10 Sample Solutions for Block 10

1. **False.** Following the fact-value dichotomy, economists are supposed to be experts in deriving positive but not normative propositions. However, even positive theories have a normative core. As illustrated by the Münchhausen trilemma, even positive theory must rely on dogmatic principles. This implies that every scientific theory starts from a value judgment about its basic principles. See Chapter 1.2.1. and Chapter 1.2.7.
2. **False.** Instrumentalism argues that assumptions do not matter at all. Instead, a theory should be judged by the validity and usefulness of its hypotheses. The extreme view that assumptions are completely irrelevant, however, is flawed because it prevents one from learning anything about the causal mechanisms that drive the hypotheses. See Chapter 1.2.4.
3. **False.** According to critical rationalism, scientific theories can never be verified, but need to be formulated in such a way that they can be falsified. See Chapter 1.2.6.
4. **True.** From an epistemic point of view, falsification is nothing else than the proof of the logical inconsistency of two different theories: a theoretical and an empirical theory. Which will be refuted relies on value judgments or experts' opinions. See Chapter 1.2.6.

1.1.2.11 Sample Solutions for Block 11

1. **True.** See Chapter 1.2.6.
2. **True.** The principle says that one should prefer a simple explanation to a complicated one, if the explanatory content is the same. See Chapter 1.2.3.
3. **False.** See Chapter 1.2.6.
4. **False.** Moral realism is a position that grants positive and normative propositions the same epistemic status. See Chapter 1.2.7.

1.2 Open Questions

1.2.1 Problems

1.2.1.1 Problem 1

How does the approach to misaligned wants and means (or, in other words, scarcity) differ between Buddhism and economics? If you think about the desire for consuming goods (vacations, fancy cars, clothes, etc.) and limited financial resources, what is the solution proposed in (1) economics and in (2) Buddhism?

1.2.1.2 Problem 2

How can the concept of opportunity cost be applied to charities and donations? Name two applications of charitable behavior in the spirit of *effective altruism*. Do you think this utilitarian approach to being charitable has merit? What are potential downsides? (Please note that you are not required to deliver a perfect answer. Just elaborate on your thoughts on the matter.)

1.2.1.3 Problem 3

Consider the following concepts:

1. Scientific theory,
2. Münchhausen trilemma,
3. paradigm,
4. model,
5. infinite regress.

Match the above terms to the appropriate definitions and explanations:

- (A) A set of practices that defines a scientific discipline at any particular period of time. It is similar to the dogmatic principles of a theory. For economics, rational choice and methodological individualism are important parts of it.
- (B) A conceptual approach that makes reasonable conjectures about causal relationships in the world.
- (C) In a never-ending process, every proof requires further proof, i.e., every proposition requires a proof, which is given in form of a proposition which in turn, again, requires a proof.
- (D) It makes assumptions about reality and derives hypotheses from these assumptions in a logically consistent way. Its crucial function is to make sure that the causal mechanisms underlying a theory are made explicit and logically consistent.
- (E) There are only three unsatisfactory ways to deal with the fact that scientific reasoning requires that proof is provided for every proposition. In the end, only infinite regress, circularity, or dogmatism can deal with this situation.

1.2.1.4 Problem 4

What is the difference between enlightenment in Buddhism and in the Western philosophies?

1.2.2 Solution

1.2.2.1 Solution to Problem 1

If means and wants are misaligned, the approach of economics is to increase the means in order to better fulfill the wants. In Buddhism, however, the goal is to overcome the wants so that they match the means. Concerning wants for consumption goods, this either means (1) increasing your income or (2) overcoming wants. See Chapter 1.1.

1.2.2.2 Solution to Problem 2

Effective altruism seeks to maximize the good from one's charitable donations. This approach aims at maximizing the utility generated by a donation and, thus, stands in a utilitarian tradition of ethical theories. The implications of applying the concepts of opportunity cost and utilitarianism to charitable donations are obvious: one should spend one's charitable resources in the most effective way. This can imply

- that one seeks a career path that yields the highest possible income in order to be able to donate as much money as possible (instead of working directly for a nonprofit organization).
- that one donates to the charity that will achieve the most with the donated money, instead of making donations for emotional or personal reasons.

On the one hand, there is a lot of evidence that donations are highly irrational. People may donate to charity because it addresses a crisis that is currently in the news. At the same time, less known charities may be underfunded but here in principle in a better position to help more people with less money. In this context, the concept of *effective altruism* has a lot of merit.

On the other hand, utility is not an easily measurable concept, and comparing different individuals' utilities can be difficult in practice as well as morally offensive. Is it more useful to finance the education of a child or to save the eyesight of an adult? How would we measure and compare resulting changes in utility? Additionally, the demands of *effective altruism* are quite high. Making a donation only makes sense if the charitable person has sufficient information about its consequences. In practice, being fully aware of all the alternatives and potential consequences is impossible. See Chapter 1.1.

Table 1.1 Solution to problem 3

$1 \rightarrow B$	$2 \rightarrow E$	$3 \rightarrow A$	$4 \rightarrow D$	$5 \rightarrow C$
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1.2.2.3 Solution to Problem 3

See Table 1.1.

1.2.2.4 Solution to Problem 4

In the Western philosophy, enlightenment refers to the independent use of reason to gain insight into the true nature of the world. Other (spiritual) traditions claim that reason alone is an obstacle on the way to enlightenment. An example is Zen Buddhism, where reason has to be transcended with the help of meditation and *kōans*. See Chapter 1.2.



2.1 True or False

2.1.1 Statements

2.1.1.1 Block 1

There are two individuals, A and B , who can produce two goods, 1 and 2. The production-possibility frontiers of both individuals are $x_1^A = a - b \cdot x_2^A$ and $x_1^B = c - d \cdot x_2^B$, in which a , b , c and d are strictly larger than zero.

1. If $b > d$, then A has a comparative advantage in the production of good 1.
2. If $a > c$, then A has an absolute advantage in the production of both goods.
3. If $a = c$, then no individual has a comparative advantage.
4. If $a = 100$ and $b = 2$, then A can produce 50 units of the second good at maximum.

2.1.1.2 Block 2

1. A situation in which there is no trade between countries is defined as “autarky.”
2. The theory of comparative advantage is only valid for linear production-possibility frontiers.
3. If a country has a comparative disadvantage in the production of a good, it should not trade this good with other countries.
4. All countries always benefit from specialization and trade.

2.1.1.3 Block 3

Charlotte and Phil are both bakers. Charlotte can either bake 20 cakes, 15 pizzas, or any linear combination of the two in 1 day. Phil can either bake 10 cakes, 5 pizzas, or any linear combination of the two.

1. Charlotte has a comparative advantage in baking pizza.
2. Charlotte has an absolute advantage in baking pizza.
3. Phil's opportunity costs for a pizza are equivalent to two cakes.
4. Charlotte's opportunity costs for cake are lower than Phil's.

2.1.1.4 Block 4

1. Assume linear production-possibility frontiers. If two individuals have identical opportunity costs, then neither individual has a comparative advantage.
2. When compared with autarky, two individuals are never worse off if they specialize according to their comparative advantage and subsequently trade.
3. The theory of comparative advantage describes and explains the international trade of goods.
4. The sequence of integration of several potential trading partners is irrelevant for their assessment of the advantage of the trade agreement.

2.1.1.5 Block 5

1. Individuals A and B can both produce either roses or computers. If they can become better off by trading, then one of the individuals will consign to only producing roses, while the other will consign to solely producing computers.
2. A comparison of opportunity costs allows one to identify potential absolute advantages.
3. An individual can have a comparative advantage in the production of one good and an absolute advantage in the production of a different good.
4. Two individuals with identical linear production-possibility frontiers can be better off by trading with each other.

2.1.1.6 Block 6

Roberto and Chiara are cobblers. Roberto can either produce ten shoes, eight boots, or any linear combination of the two. Chiara can either produce five shoes, six boots, or any linear combination of the two.

1. Roberto has a comparative advantage in the production of shoes.
2. Chiara has an absolute advantage in the production of boots.
3. Roberto's opportunity costs of producing five shoes are four boots.
4. Given the opportunity to specialize in production and trade, Chiara will end up producing more boots than Roberto.

2.1.1.7 Block 7

1. Ontology is the study of knowledge, and epistemology is the study of being.
2. Epistemology is the study of knowledge, and ontology is the study of being.
3. Ontology asks about the nature of existence and how one acquires knowledge about this nature.
4. Epistemology asks about the conditions of knowledge and how one can know what is true.

2.1.1.8 Block 8

1. The production of material goods is the primary goal of economic activities.
2. Unlike physical objects, the existence of institutions relies on conventions.
3. Given that institutions like markets or currencies rely on social conventions, they are ontologically objective.
4. The theory of comparative advantage has important implications not only for economics but also for business administration and law.

2.1.1.9 Block 9

1. The theory of comparative advantage applies equally to individuals and to countries.
2. The traders' preferences are important for the structure of an optimal trade agreement.
3. The theory of comparative advantage only holds with linear production possibility frontiers.
4. Exploitation and alienation are potential downsides of specialization.

2.1.2 Solutions

2.1.2.1 Sample Solutions for Block 1

Opportunity costs of good i in units of good j for individual k are $OC_{ij}^k = \left| \frac{dx_j^k}{dx_i^k} \right|$, where $i, j \in \{1, 2\}$ and $k \in \{A, B\}$. Individual A 's opportunity costs are $OC_{12}^A = \frac{1}{b}$ and $OC_{21}^A = b$. Individual B 's opportunity costs are $OC_{12}^B = \frac{1}{d}$ and $OC_{21}^B = d$. See Chapter 2.2.

1. **True.** If $b > d$, then A 's opportunity costs for good 1 are lower than B 's and, thus, A has a comparative advantage in the production of good 1.
2. **False.** One cannot determine that A has an absolute advantage in the production of the second good solely based on $a > c$.
3. **False.** One cannot derive that conclusion from $a = c$. In order for this property to be the case, $b = d$ must hold as well.
4. **True.** Individual A can produce $x_1^A = 100 - 2 \cdot x_2^A$ units of good 1. If A produces zero units of the first good, this would mean $0 = 100 - 2 \cdot x_2^A$, and thus $x_2^A = 50$.

2.1.2.2 Sample Solutions for Block 2

1. **True.** See Chapter 2.1.
2. **False.** See the discussion about strictly concave and strictly convex production-possibility frontiers in Chapter 2.3.
3. **False.** This is exactly a case where an individual is able to be better off through trade, because a comparative disadvantage in the production of one good always implies a comparative advantage in the production of another good. The

individual can then specialize in the production of the good that he or she has a comparative advantage in and become better off due to trade. See Chapter 2.1.

4. **False.** The sequence of integration plays a role as well. Additionally, countries with identical opportunity costs do not have any gains from trade from trading with each other. See Chapter 2.3.

2.1.2.3 Sample Solutions for Block 3

Opportunity costs of good i in units of good j for individual k are $OC_{ij}^k = \left| \frac{dx_j^k}{dx_i^k} \right|$, where $i, j \in \{C, P\}$ and $k \in \{Ch, Ph\}$. Charlotte's opportunity costs are $OC_{CP}^{Ch} = \frac{15}{20} = \frac{3}{4}$ and $OC_{PC}^{Ch} = \frac{20}{15} = \frac{4}{3}$. Phil's opportunity costs are $OC_{CP}^{Ph} = \frac{5}{10} = \frac{1}{2}$ and $OC_{PC}^{Ph} = \frac{10}{5} = 2$. See Chapter 2.2.

1. **True.** $OC_{PC}^{Ch} = \frac{4}{3} < 2 = OC_{PC}^{Ph}$. Thus, Charlotte has a comparative advantage in baking pizza.
2. **True.** Charlotte can bake 15 pizzas, while Phil can only bake 5. Therefore, Charlotte has an absolute advantage in baking pizza.
3. **True.** $OC_{PC}^{Ph} = 2$.
4. **False.** $OC_{CP}^{Ch} = \frac{3}{4} > \frac{1}{2} = OC_{CP}^{Ph}$.

2.1.2.4 Sample Solutions for Block 4

1. **True.** Given identical opportunity costs, both individuals have to curb the production of one good by the same amount in order to produce an additional unit of the other good. Consequently, no individual has a comparative advantage. See Chapter 2.1.
2. **True.** By specializing in one's comparative advantage, one is able to produce a surplus, which makes at least one of the individuals better off. The consumption under autarky can always be guaranteed. See Chapter 2.3.
3. **True.** The concept of comparative advantage cannot only be applied to individuals but also to countries. See Chapter 2.1.
4. **False.** It is very relevant. See the detailed discussion about sequential integration in Chapter 2.3.

2.1.2.5 Sample Solutions for Block 5

1. **False.** If two individuals can be better off by trading, then there is a comparative advantage. The individuals will specialize according to their comparative advantage; however, whether they will completely specialize or not depends on their preferences. See Chapter 2.2.
2. **False.** See Chapter 2.2.
3. **True.** Consider the example in Chapter 2.2 where Ann has both an absolute advantage in the production of tomatoes and a comparative advantage in the production of pears.
4. **False.** Because neither individual has a comparative advantage, neither of them can be better off through specialization and trade. See Chapter 2.1.

2.1.2.6 Sample Solutions for Block 6

The production-possibility frontier (PPF) for Roberto is

$$x_B^R = 8 - \frac{8}{10} \cdot x_S^R = 8 - \frac{4}{5} \cdot x_S^R.$$

The PPF for Chiara is

$$x_B^C = 6 - \frac{6}{5} \cdot x_S^C.$$

For Roberto, the opportunity cost of good i , measured in units of good j , is given by $OC_{ij}^R = \left| \frac{dx_j^R}{dx_i^R} \right|$, with $i, j \in \{S, B\}$ and $i \neq j$. Hence, we find that $OC_{SB}^R = \frac{8}{10} = \frac{4}{5}$ and $OC_{BS}^R = \frac{10}{8} = \frac{5}{4}$. For Chiara, we find that $OC_{SB}^C = \frac{6}{5}$ and $OC_{BS}^C = \frac{5}{6}$. See Chapter 2.2.

1. **True.** $OC_{SB}^R = \frac{4}{5} < OC_{SB}^C = \frac{6}{5}$. Hence, Roberto has a comparative advantage in the production of shoes.
2. **False.** Chiara can only produce six boots at maximum, while Roberto can produce eight.
3. **True.** $OC_{SB}^R = \frac{4}{5}$. Thus, Roberto's opportunity costs of producing five shoes are four boots.
4. **False.** This depends on the consumers' preferences. Let's illustrate this with an example. The joint PPF of Chiara and Roberto is

$$x_B = \begin{cases} 14 - \frac{4}{5} \cdot x_S & \text{for } x_S \leq 10, \\ 18 - \frac{6}{5} \cdot x_S & \text{else.} \end{cases}$$

Assume that preferences are given by $x_B = \alpha \cdot x_S$. The optimum is characterized by

$$14 - \frac{4}{5} \cdot x_S = \alpha \cdot x_S \quad \Leftrightarrow \quad \bar{x}_S = \frac{70}{4 + 5 \cdot \alpha}.$$

and

$$\bar{x}_B = 14 - \frac{4}{5} \cdot \bar{x}_S = \frac{70 \cdot \alpha}{4 + 5 \cdot \alpha}.$$

Consequently, Roberto does produce more boots than Chiara, if

$$\bar{x}_B > 12 \quad \Leftrightarrow \quad \alpha > 4.8.$$

2.1.2.7 Sample Solutions for Block 7

1. **False.** Vice versa: Epistemology is the study of knowledge and ontology is the study of being. See Chapter 2.4.
2. **True.** See Chapter 2.4.
3. **False.** Ontology asks about the nature of existence; epistemology asks about how one can know about this nature. See Chapter 2.4.
4. **True.** See Chapter 2.4.

2.1.2.8 Sample Solutions for Block 8

1. **False.** The production of material goods is only a means for and not the end of economic activities. What ultimately counts is what material goods can do for people—how they contribute to their well-being. The term gains from trade refers to a measure of this increase in subjective well-being. See Chapter 2.2.
2. **True.** See the discussion about why institutions are, at the same time, epistemologically objective and ontologically subjective in Chapter 2.4.
3. **False.** Ontology is the study of “what there is.” Hence, given that institutions rely on social conventions, they are ontologically subjective. On the contrary, physical objects exist independently of human beings—they are ontologically objective. See Chapter 2.4.
4. **True.** Business administration: The divisional structure of a firm reflects a specific form of the division of labor, in which, for example, employees specialize as engineers, workers, or accountants. Law: Making use of comparative advantages requires contract law. See Chapter 2.1 and Chapter 2.4.

2.1.2.9 Sample Solutions for Block 9

1. **False.** A trade agreement can have very diverse effects within a country. While it ideally makes the country as a whole “better off” in terms of final consumption, there can always be winners and losers on the individual level within this country. The reason for this is twofold: First, unlike individuals, countries are not unitary actors. Second, market integration between countries is a special form of sequential integration where the starting point is not autarky, but a situation in which the countries have partially integrated markets with individuals specializing in different industries. See Chapter 2.1 and 2.3.
2. **True.** This is easy to see with an extreme example. Suppose that Ann can produce ten pears and Bill can produce ten tomatoes. If Ann wants to consume only pears and Bill wants to consume only tomatoes, obviously there will be no trade. If, on the other hand, Ann wants to consume only tomatoes and Bill wants to consume only pears, they will likely end up trading their entire production. See Chapter 2.1.
3. **False.** See the discussion on strictly concave and strictly convex production-possibility frontiers in Chapter 2.3.
4. **True.** See Chapter 2.3.

2.2 Open Questions

2.2.1 Problems

2.2.1.1 Problem 1

Explain the theory of comparative advantage. Point out the theory's importance for economics, business administration, and law.

2.2.1.2 Problem 2

There are two goods, 1 and 2, and two countries, A and B . Both goods are homogeneous and can be produced by both countries using labor as the only input, with each worker supplying 1 unit of labor. Each worker in A can produce 10 units of good 1, 10 units of good 2, or any linear combination of the two. In B , each worker can produce α units of good 1, 9 units of good 2, or any linear combination of the two. There are 100 workers in each country. The gains from trade are distributed among all workers in a country in a manner that makes everybody better off.

1. Determine and draw both countries' production-possibility frontiers for $\alpha = 8$.
2. Determine each country's opportunity costs of producing goods 1 and 2 for any given $\alpha > 0$.
3. Determine each country's comparative advantage depending on α .
4. Individuals in both countries always consume goods 1 and 2 in equal quantities. Determine the optimal production and consumption plans for $\alpha = 9$.
5. Assume that $\alpha = 10$. Show that both countries are better off, in comparison to autarky, when they specialize completely in the production of the good for which they have a comparative advantage.

2.2.1.3 Problem 3

There are three countries, A , B and C , and each can produce two goods, 1 and 2. The production-possibility frontiers are given as

$$\begin{aligned}x_1^A &= 1 - x_2^A, \\x_1^B &= 1 - \frac{1}{2} \cdot x_2^B, \\x_1^C &= 1 - \frac{1}{4} \cdot x_2^C.\end{aligned}$$

Each country is inhabited by individuals who always consume both goods in equal amounts. Potential gains from trade are distributed equally among the inhabitants of a country.

1. Determine the countries' production and consumption plans in autarky.
2. Assume countries A and C establish a free-trade agreement, such that a good produced in one of the two countries can be sold in both countries (without

additional shipping costs). Determine the optimal production and consumption plans in these two countries if

- (a) gains from trade are split equally between the countries, with consumption under autarky (see Question 1) serving as a reference point.
 - (b) country *C* reaps all the benefits alone.
3. Assume countries *A*, *B*, and *C* establish a free-trade agreement. Determine the optimal production and consumption plans of the countries if
- (a) gains from trade are split equally, with consumption under autarky (see Question 1) serving as a reference point.
 - (b) gains from trade are split equally, with consumption under the first AC-agreement (see Question 2(a)) serving as a reference point.
 - (c) gains from trade are split equally, with consumption under the second AC-agreement (see Question 2(b)) serving as a reference point.
4. What are the implications for trade policy?

2.2.1.4 Problem 4

Answer the following questions in one sentence.

1. According to the view of the early theorists of capitalism, what was the merit of an economy based on specialization and trade?
2. How does this view differ from the one held by mainstream economists in the twentieth century?
3. How can free trade and competition be understood as a form of moral education?
4. What did Milton Friedman have to say about a competitive economy and discrimination against particular religious, racial, or social groups?

2.2.2 Solutions

2.2.2.1 Solutions to Problem 1

In general, each individual has a comparative advantage in the production of one good, irrespective of whether she has an absolute advantage in the production of a good or not. An individual has a comparative advantage in the production of a given good if she can produce the good at lower opportunity costs, measured in units of the other good, than the other individuals. According to their view, specialization has the potential to make all individuals better off. Therefore, the concept of comparative advantage is the basis for all further contemplation about the organization of economic activities, because one has to ask how economic activities have to be organized to further specialization and trade.

Significance for Economics

Economics tries to understand how human beings organize (positive) or should organize (normative) economic activities in order to cope with the phenomenon of scarcity. The theory of comparative advantage explains why the organization of

economic activities is at the core of economics and helps with the development of hypotheses about the purpose of organizations.

Significance for Business Administration

Business administration analyzes firms or corporations. A firm is nothing more than a specific way to organize economic activities. One can, therefore, apply the same logic to the analysis of the organization of such an entity. What is a firm’s comparative advantage? How should it organize its internal activities? Where are a firm’s boundaries? Should it produce a component itself (insourcing) or buy it in the market (outsourcing)?

Significance for Law

The backbone of the economy is its legal structure. Laws define rights and obligations. Contract law, for example, defines the types of contracts that can be used to organize economic activities, and competition law regulates firm behavior, to name only two fields. The legal structure of an economy, therefore, promotes or constrains specialization and trade. Hence, one can ask how laws influence economic activities.

2.2.2.2 Solutions to Problem 2

1. The production-possibility frontier for $\alpha = 8$ is
 Country A: $x_1^A = 1000 - x_2^A$,
 Country B: $x_1^B = 100 \cdot \alpha - (\frac{\alpha}{9}) \cdot x_2^B \Rightarrow x_1^B = 800 - \frac{8}{9} \cdot x_2^B$.
 Both production-possibility frontiers are illustrated in Fig. 2.1.
2. The opportunity costs of good i for a given country k in units of good j are given by $OC_{ij}^k = \left| \frac{dx_j^k}{dx_i^k} \right|$, where $i, j \in \{1, 2\}, i \neq j$, and $k \in \{A, B\}$. The results are given in Table 2.1.
3. Looking for comparative advantages, one has to compare the countries’ opportunity costs, which leads to the following question: For what values of α does one have $OC_{12}^A \left\{ \begin{matrix} \geq \\ \leq \end{matrix} \right\} OC_{12}^B$? By plugging in the results from Question 2, the

Fig. 2.1 Problem 2.1. The production-possibility frontiers of countries A and B for $\alpha = 8$

