

The riddle of the use of impossible examples in microeconomics textbooks

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Abstract

This paper examines the use in microeconomics textbooks of what we call 'impossible examples', looking specifically at certain examples employed in chapters dealing with the production process or markets for factors of production. After showing that such examples are mostly to be found in textbooks for beginners, it asks what beginner students can possibly learn through them, taking the case of a concept (the marginal product), a law (the law of diminishing marginal product), and a theory (the income theory of distribution). The use of impossible examples in such textbooks appears to be a riddle, since, by using them to introduce, present, or explain parts of neoclassical theory, authors are in effect teaching a fake and inconsistent version of that theory.

Key words

Economics education, microeconomics textbooks, examples, marginal product, theory of distribution.

1. Introduction

Since Kuhn's work, we have been well aware of the paradigmatic character of examples found in scientific textbooks, for "[i]t is [...] the sense of 'paradigm' as standard example that led originally to [his] choice of that term" (1977 [1974], 307).¹ According to Kuhn, the standard examples students read in scientific textbooks are an essential part of the process by which they not only absorb the significance and scope of theories, but also tacitly assimilate a "group-licensed way of seeing" (1970, 189) the world, so that differences in the nature and use of examples reveal the structure of the subgroups within the scientific community (1970, 186-7, 189, 191, 1977 [1974], 298, 306-8, 1977, xix):

"these books [textbooks in physics] exhibit concrete problem solutions that the profession has come to accept as paradigms, and they ask the student [...] to solve for himself problems very closely related in both method and substance to those through which the textbook or the accompanying lecture has led him. Nothing could be better calculated to produce "mental sets" or *Einstellungen*. Only in their most elementary courses do other academic fields offer as much as a partial parallel." (1977 [1959], 229)

Within this framework, the use in textbooks of 'impossible examples' thus seems somewhat puzzling, and stands in need of further examination.

¹ 'Paradeigma' is a Greek word for 'example'.

What do we mean by ‘impossible examples’? In a previous paper dealing with examples in microeconomics textbooks concerning the competitive firm, we distinguished examples by reference to the four types of world they describe: real, abstract, imaginary or impossible (Jallais 2018).

First, an example can describe the *real world*, as in this passage of Mankiw’s microeconomics textbook:

“We begin our discussion of costs at Caroline’s Cookie Factory. Caroline, the owner of the firm, buys flour, sugar, chocolate chips, and other cookie ingredients. She also buys the mixers and ovens and hires workers to run this equipment. She then sells the cookies to consumers. By examining some of the issues that Caroline faces in her business, we can learn some lessons about costs that apply to all firms in an economy.” (Mankiw 2015, 260)

or as in this one of Pindyck and Rubinfeld (2018):

“An example is the reconstruction of concrete sidewalks using jackhammers. It takes one person to use a jackhammer — neither two people and one jackhammer nor one person and two jackhammers will increase production. As another example, suppose that a cereal company offers a new breakfast cereal, Nutty Oat Crunch, whose two inputs, not surprisingly, are oats and nuts. The secret formula for the cereal requires exactly one ounce of nuts for every four ounces of oats in every serving. If the company were to purchase additional nuts but not additional oats, the output of cereal would remain unchanged, since the nuts must be combined with the oats in a fixed proportion. Similarly, purchasing additional oats without additional nuts would also be unproductive.” (229)

Note that what we call ‘real-world examples’ can be invented (as is Caroline’s Cookie Factory in the above-quoted passage): they need only to describe a plausible fact, even if the world posited thereby is highly simplified.

Second, examples can also describe *abstract worlds*. This is the case where the output is not specified at all, as in this passage of Kreps (2013):

“A *netput* vector is a vector from \mathbb{R}^k , where a negative component connotes a net *input* into the firm’s production process and a positive component connotes a net *output*. So, for instance, if $k = 5$, the netput vector $(-2, 0, 3, -1, 2)$ is interpreted as the firm transforming two units of the first commodity and one unit of the fourth into three units of the third and two units of the fifth.” (319)

In the same vein, but far less frequently, examples can describe *imaginary worlds*, where the firm produces an imaginary output such as the snarks in Begg, Fisher and Dornbush (1989) or the pfillips in Kreps (1990):

“In a particular economy, a product called *pfillip*, which is a nonnarcotic stimulant, is produced by a competitive industry. Each firm in this competitive industry has the same production technology, given by the production function

$$y = k^{1/6}l^{1/3},$$

where y is the amount of pfillip produced, k is the amount of *kapitose* (a specialty chemical) used in production, and l is the amount of *legume* (a common vegetable) used in production.” (Kreps 1990, 274)

Finally, we also find examples in microeconomics textbooks which describe *impossible worlds*: in impossible worlds, firms don’t produce pfillips or snarks, but real outputs such as clothes or cookies, but the production technology they use does not exist (yet). For example, Mankiw introduces the notion of marginal product of labor through Caroline’s Cookie Factory. In order to “simplify” the presentation, Mankiw has previously assumed “that the size of Caroline’s factory is fixed”, a “realistic” assumption “in the short run” (2015, 263). The equipment is then fixed, as well as somewhat oversized because otherwise it would be impossible to produce more cookies. So far so good: simplification is a good way to teach difficult or abstract concepts. But then Mankiw introduces a table (table 1) containing the following columns:

Number of workers	Output (quantity of cookies produced per hour)	Marginal Product of Labor
0	0	
1	50	50
2	90	40
3	120	30
4	140	20
5	150	10
6	155	5

As one might guess from column 3, Mankiw uses this table to explain marginal product of labor without speaking about (among other things) all the ingredients needed to make cookies (flour, sugar, chocolate chips, and so on):

“When the number of workers goes from 1 to 2, cookie production increases from 50 to 90, so the marginal product of the second worker is 40 cookies. And when the number of

workers goes from 2 to 3, cookie production increases from 90 to 120, so the marginal product of the third worker is 30 cookies.” (Mankiw 2015, 264)

If Caroline’s factory were real, inputs would not be substitutes but complements: Caroline could not replace flour by labor, labor by ovens, nor ovens by chocolate chips. Furthermore, there would be no need to reduce the number of inputs for the sake of simplicity, for any student will understand that, unless something like the miracle of the loaves and fishes was to be repeated, no one could produce more cookies without, say, more flour, even by working more: the marginal product of labor would therefore be zero (not 50, 40 or even 5 per hour). Indeed, the concept of the marginal product of an input requires that this input be increased by one unit while all other inputs are held constant. This consequence is obvious wherever the production process needs material inputs, as Moseley (2015) clearly puts it;² but this is also exactly what happens in the two real-world examples of Pindyck and Rubinfeld’s textbook quoted above, including the example of ‘the reconstruction of concrete sidewalks using jackhammers’ which does not mention any other input except labor. For, as has been known for a long time, if the production function is fixed proportions, “then an extra unit of one factor, unaccompanied by an increase in the other, will yield precisely no addition to the total product” (Hicks, 1932, 81): the marginal product of each input is then zero.³

Hence *either* Mankiw’s table 1 is appropriate to present the concept of the marginal product of labor, and this example describes an impossible world where “the second worker”, whose name might be Jesus, can produce 40 cookies without any flour, sugar, or chocolate chips’;⁴ *or* this example describes our world and therefore can’t be used to explain what marginal product of labor means, since the figure 40 cannot indicate the increase in the quantity of output obtained from one additional unit of labor *holding the used quantity of all other inputs fixed*.

We use the terminology “impossible examples” to designate these kinds of example that either describe an impossible world (where real outputs are produced through a technique which does not exist) or are inconsistent with the very concept or hypothesis they are supposed to exemplify (production techniques are plausible but don’t fit the concept or hypothesis). In short, impossible examples are either *impossible-world examples* or *real-world-but-inconsistent examples*.

While examples describing real, abstract, or imaginary worlds are, in many ways, very useful from a pedagogical point of view (see Jallais 2018), this is not so obvious for impossible examples. Unless they are unambiguously presented as being impossible, the use of this sort of example seems to be an

² “[I]t is not possible to incorporate materials inputs (and intermediate goods in general) into the theory in a reasonably coherent way, because materials inputs *cannot be held constant as output increases*. In order to increase output in goods-producing industries, the quantity of materials used to produce these goods must also be increased (e.g. more wood to produce another chair, more cloth to produce another shirt, more tires to produce another car). [...] the existence of materials inputs in the production process renders the concept of the marginal productivity of capital impossible in reality (this fundamental problem also applies to the marginal product of labor).” (Moseley 2015, 294-5)

³ This phenomenon was well known, for example, by Pareto at the end of the 19th century. Pareto notes, in fact, that “when some of the production coefficients are constant, considering the marginal product cannot be done without correction. Indeed, if, for example, the quantity of iron ore is to be proportional to the quantity of metallic iron produced, one cannot assume that the product will rise by by increasing only one of the other production factors.” (Pareto 1897, §717, 85).

⁴ In Moseley 2012b, examining the example of a bakery given in Mankiw’s “best-selling intermediate Macroeconomics textbook (Chapter 3)”, Moseley speaks about ‘the additional bakery worker’ as ‘a miracle worker’. ‘Jesus would be jealous’ he adds (Moseley 2012b, 118).

aberration: *a priori* they cannot enable students to understand a concept or a hypothesis, and even less so its scope. We may ask, then: why do microeconomists use such examples? and what can students learn from them? Before these questions can be answered, we will (in Sect. 2) present the textbooks we have examined and explain how we chose them. We will then (Sect. 3) propose a typology of these textbooks according to their intended audience. This will allow us to reveal the kind of students who are reading impossible examples. The presentation of the uses of impossible examples and the way they are — or aren't — justified (Sect. 4) will then allow us to infer what these students can learn through this type of examples, addressing the cases of a concept (Sect. 5), a law (Sect. 6), and the related theory (Sect. 7).

2. Corpus

The material we chose to investigate for this research is composed of “popular” microeconomics textbooks, meaning those that are used by a wide range of students. To make our selection, we examined the rankings of the “top” or “best” microeconomics books provided by three websites. First, we used two rankings provided by Goodreads, based on the recommendations of the readers:⁵ the top ‘microeconomics’ books and the ‘popular microeconomics books’ ranking. We also examined BookAuthority’s ranking, based on multiple criteria, including the recommendations of “domain experts”. BookAuthority claims to be “the world’s leading site for nonfiction book recommendations”. It uses various data to “identify and rate the best nonfiction books, using dozens of different signals, including public mentions, recommendations, ratings, sentiment, popularity and sales history. This includes maintaining the most comprehensive collection of book recommendations from domain experts such as Elon Musk, Warren Buffett, Prof. Daniel Kahneman, Sheryl Sandberg, and David Allen” (<https://bookauthority.org/about>). Last, we used ‘Amazon Best Sellers Rank’, as a representation of general sales of textbooks throughout the world.⁶ These rankings were then narrowed down to academic textbooks (the result may be found in the Annex).

We then chose an initial set of textbooks comprising the first two textbooks of each of the four rankings. This set contained six different textbooks, and includes the five best-sellers (according to Amazon’s ranking). We also looked into other textbooks that were further down in the rankings if the author was a major figure in the academic field. For instance, we chose to examine Varian’s *Intermediate Microeconomics* and *Microeconomic Analysis*, which appear among the first ten or eleven textbooks of two rankings; and although David M. Kreps’s *Microeconomic Foundations* was ranked 9th in ‘popular microeconomics books’ but only 22nd in the global BookAuthority list (and 15th if we exclude double rankings), we chose to examine this textbook because its author, like Krugman, was also awarded the John Bates medal in 1989 by the American Economic Association.

Hence, we studied the ten following textbooks:

- [Frank, *Microeconomics and Behavior*, 9th ed., 2014](#) [1991].⁷
- Kreps, *Microeconomic Foundations I*, 2013.

⁵ “Goodreads is the world’s largest site for readers and book recommendations. Our mission is to help people find and share books they love. Goodreads launched in January 2007”. It claims to have 90 million members, over 2.6 billion books, and 90 million reviews (<https://www.goodreads.com/about/us>).

⁶ “The Amazon Best Sellers calculation is based on Amazon.com sales and is updated hourly to reflect recent and historical sales of every item sold on Amazon.com.” (<https://www.amazon.com/gp/help/customer/display.html?nodeId=GGMZK378RQPATDJ>)

⁷ The year in brackets is that of the first edition, when the edition used is more recent.

- Krugman & Wells, *Microeconomics*, 4th ed., 2015 [2006].
- Mankiw, *Principles of Microeconomics*, 7th ed., 2015 [2000]
- Mas-Colell, Whinston & Green, *Microeconomic Theory*, 1995.
- Mateer & Coppock, *Principles in Microeconomics*, 2nd ed., 2018 [2014].
- McConnell, Brue & Flynn, *Microeconomics: Principles, Problems and Policies*, 21st ed., 2018 [1975]
- Pindyck & Rubinfeld, *Microeconomics*, 9th ed., 2018 [1988]
- Varian, *Intermediate Microeconomics: A Modern Approach*, 9th ed., 2014 [1987]
- Varian, *Microeconomic Analysis*, 3rd ed., 1992 [1978]

Within this corpus, we decided to focus our analysis on the presentation of the “competitive firm” and on the examples given in chapters dealing with the production process or markets for factors of productions. This choice — of the firm over the consumer, for example — was motivated by the fact that output is real, whereas utility (‘satisfaction’) is a notion more difficult to grasp. As Varian puts it: “the output of a production process is generally observable, whereas the ‘output’ of consumption (utility) is not directly observable” (2014, 350). Furthermore, impossible examples are unlikely to be found in chapters on consumers, since any kind of preference seems to be *a priori* possible: hence if microeconomics textbooks were dealing only with consumer theory, our question would have been of no interest.

3. A typology of textbooks

Our focus on the use of impossible examples in the chapters we were interested in led us to categorize textbooks into three distinct groups: beginner, intermediate and advanced textbooks. Krugman and Wells 2015, Mankiw 2015, Mateer and Coppock 2018, McConnell, Brue and Flynn 2018, and Pindyck and Rubinfeld 2018 are beginner textbooks: they aim at first-year college students who will not necessarily major in economics. This characteristic makes them ‘bestsellers’ because of the number of students taking Econ 101.⁸ On the other end of the spectrum, Kreps 2013, Mas-Colell, Whinston and Green 1995 and Varian 1992 are what we called “advanced” textbooks, addressed at first-year graduate students taking a course in microeconomic theory (Mas-Colell, Whinston & Green 1995, xiii, Kreps 2013, 16). Falling between these, in a way we explain below, we labeled Varian 2014 and Frank 2014 “intermediate” textbooks.

The purpose of beginners’ textbooks is primarily to ‘help’ students to “think like economists” (Mateer & Coppock 2018, xxvi; Mankiw 2015, 19),⁹ so that they can understand economic issues and policies (McConnell, Brue & Flynn 2018, x), and grasp how the economy — or even the world — works (Pindyck & Rubinfeld 2018, 15), or more specifically “what people do and how they interact” (Krugman & Wells 2015, xvii). But they aim also to show students how they can “apply economic principles to their decision-making” (Mateer & Coppock 2018, xxvi), whether they are a manager, a public policy maker, or something else entirely (Pindyck & Rubinfeld 2018, 15).

⁸ “We have been extremely gratified by the success of the first three editions of *Economics*, which has made it one of the best-selling economics textbooks” say Krugman & Wells (2015, xvii), while McConnell, Brue & Flynn begin with this welcoming phrase: “Welcome to the 21st edition of *Economics*, the best-selling economics textbook in the world. An estimated 15 million students have used *Economics* or its companion editions, *Macroeconomics* and *Microeconomics*” (2018, x). For his part, speaking about all his textbooks, Mankiw guesses that, “including translations, about four million copies of [his] books are in print” (2020, 215).

⁹ More precisely, Mankiw invites his readers to use the economists’ language to think about the world in which they live. His purpose is to “help” students “learn the economist’s way of thinking” (Mankiw 2015, 19).

On the contrary, the avowed objective of advanced textbooks is technical and theoretical, as is apparent from their titles: ‘Microeconomic *Theory*’, ‘Microeconomic *Analysis*’ and ‘Microeconomic *Foundations*’ (emphasis added). For example, Varian 1992 is aimed at helping students “[master] the standard tools of economic analysis” (xiv). These textbooks aim first at rigor and precision (Mas-Colell, Whinston & Green 1995, xiv). Kreps describes the main differences between beginner and advanced textbooks as follows:

“The standard textbooks are not written with command or mastery of the material as their primary objective. Because they are written to serve very broad audiences, breadth of coverage is stressed over depth, and the authors sometimes omit technical details, to avoid panicking less well-prepared readers. This book sacrifices breadth for depth, avoids compromises about details (with a few exceptions), and tries to explain to the reader both why economic foundations are done the way they are done and what are some of the limitations in how things are done.” (Kreps 2013, 14)

Hence beginner textbooks present microeconomic concepts and assumptions through stories, make extensive references to the real world, and seldom contain mathematical equations or demonstrations.¹⁰ On the contrary, advanced textbooks are very technical. Their authors concentrate on mathematical hypotheses and demonstrations of neoclassical producer theory, and seem to have little interest in linking their presentation to real-world issues.¹¹

Finally, like beginner ones, intermediate textbooks are aimed at undergraduate students, but with a more thorough treatment of microeconomic theory. They are therefore hereafter categorized as intermediate since they both try to refer to real-world stories while also proposing a formal presentation of microeconomic theory.¹² As Varian puts it:

“My aim in writing the original text was to present a treatment of the methods of microeconomics that would allow students to apply these tools on their own and not just passively absorb the predigested cases described in the text. I have found that the best way to do this is to emphasize the fundamental conceptual foundations of microeconomics and to provide concrete examples of their application rather than to attempt to provide an encyclopedia of terminology and anecdote.” (Varian 2014, xix)

In the same vein, Frank writes: “My goal in writing *Microeconomics and Behavior* was to produce an intellectually and challenging text that would also be accessible and engaging to students. [...] Some texts have done well by sacrificing rigor in the name of user-friendliness. [...] Other texts have succeeded in sacrificing accessibility in the name of rigor, where rigor all too often means little more than mathematical density” (Frank 2015, p. vii).

¹⁰ “We believed that students’ understanding of and appreciation for models would be greatly enhanced if they were presented, as much as possible, in the context of stories about the real world, stories that both illustrate economic concepts and touch on the concerns we all face as individuals living in a world shaped by economic forces.” (Krugman & Wells 2015, xvii)

¹¹ As Kreps says: “Some first-year graduate students are utterly turned off by their first-year theory courses. They have come to the study of economics to understand real-world phenomena and, perhaps, to make a difference in the real world, not to study mathematics. To those students, my response is that if you plan to use economic techniques to understand the real world and to see how to make a difference, your effectiveness will depend in part on how well you understand those techniques; doing all this math builds your understanding of the techniques.” (Kreps 2013, 17)

¹² We named this category after Varian (2014).

All these textbooks use examples, and most of them stress their usefulness, albeit for very different reasons. Examples in advanced textbooks are designed to illustrate the mathematical issues underlying microeconomic producer theory, and to help students acquire the technical tools of neoclassical modeling. Examples in beginner textbooks are used to present the main concepts, assumptions, and properties, seeking to attract the students' interest to the topics, motivate their learning, and increase their understanding of the models as well as their relevance and application to the real world.¹³ For example, McConnell, Brue and Flynn's 'boxes' aim to provide "analogies, examples, or stories that help drive home central economic ideas in a student-oriented, real-world manner" (2018, xi). Krugman and Wells seem to be the most fervent defenders of the use of examples:

"We believed that students' understanding of and appreciation for models would be greatly enhanced if they were presented, as much as possible, in the context of stories about the real world, stories that both illustrate economic concepts and touch on the concerns we all face as individuals living in a world shaped by economic forces. [...] Because Robin and I both feel that the teaching of economics is at its best when it engages students with real-life issues and problems, we have done a major updating of examples, stories, and cases to incorporate many of the most current economics topics. No other economics textbook updates examples as extensively with each new edition as ours does. This thorough refreshing of examples was one major focus of the revision." (Krugman & Wells 2015, xvii)

Between these cases, Varian (2014, xx) says he "put in a lot of examples of how to use the theory described here" to teach students how "to translate an economic story into an equation or a numerical example".¹⁴

All this at least partly explains the kind of examples these different textbooks use. Advanced textbooks refer exclusively to abstract examples in the chapters we examined.¹⁵ In the intermediate textbooks, a few real-world or impossible examples are given to illustrate the concepts presented in chapters relating to production. For instance, in Varian's (2014) chapters relating to technology, competitive firm behavior, or markets for factors of production, he refers to: holes made by a man and a shovel (352); "the case of farming [with] one man on one acre of land" (357); the pumping capacity of an oil pipeline (360); a data center (360); and Intel's "'fab plants' that fabricate, assemble, sort, and test advanced computer chips" (361). Similarly, in his chapter on production, Frank speaks of: meals produced with equipment-hours/week and person-hours/week (250); the FM radio broadcast of classical music (251); the owner of a fishing fleet (258); "trips" produced by "two types of gasoline inputs, Texaco and Amoco" (263); and typing letters using typewriters (263). Yet, in both of these textbooks, the rest of the concepts

¹³ Pindyck & Rubinfeld insist on this last use of examples: "This applied emphasis is accomplished by including examples." Indeed, students "want and need a good understanding of how microeconomics can actually be used outside the classroom" (Pindyck & Rubinfeld 2018, 16).

¹⁴ Similarly, Frank argues that "applications and examples are integrated fully into the text" (vii), and that "more than any other text currently available in the marketplace, *Microeconomics and Behavior* prepares students for its end of chapter problems by taking them through a sequence of carefully crafted examples and concept checks within each chapter" (Frank 2015, viii).

¹⁵ Note that they may contain other kinds of examples in other chapters. Mas-Colell, Whinston & Green, for example, use a few real-world examples in the chapters dealing with preference or consumer choice, among others: "For example, imagine that a poor consumer initially is fulfilling much of his dietary requirements with potatoes because they are a low cost way to avoid hunger. Etc." (1995, 26).

are either illustrated by abstract examples or are introduced without any example at all. On the contrary, beginner textbooks contain mostly real-world and impossible examples.¹⁶

It is in this latter category of textbooks that most impossible examples can be found: the authors refer to numerous producers (most of whom are even given surnames) and real products to introduce, present, explain, or even define the theoretical concepts. For example, Krugman and Wells appeal to George and Martha's farm (2015, 330 et sq.), Marty's Frozen Yogurt "a small shop that sells cups of frozen yogurt" (2015, 353), Magnificent Blooms "a florist specializing in floral arrangements" (2015, 353), or Noelle's Christmas tree farm (2015, 361 et sq.). Mankiw makes extensive use of "Caroline's Cookie Factory" (2015, 260 et sq.) or "Conrad's Coffee Shop" (2015, 266 et sq.) when dealing with firm behavior (part V of his "Principles of microeconomics") while Mateer and Coppock do the same thing with a "McDonald's restaurant" (2018, 251-4). Pindyck and Rubinfeld evoke, among others, a "bakery" producing "such outputs as bread, cakes" (2018, 212), "the number of personal computers that can be produced each year with a 10,000-squarefoot plant and a specific amount of assembly-line labor" (2018, 213), or a "clothing factory" (2018, 214). Finally, McConnell, Brue and Flynn refer to a "farmer who is deciding on how much corn to plant" (2018, 53), "Leah, an apple grower" (2018, 79), "Carlos, Courtney, Chuck, Cindy, Craig and Chad, orange growers" (80), "a table-making firm" (2018, 180), a "small t-shirt manufacturer" (2018, 182), or "a wood-shop manufacturing furniture frames" (2018, 184). These are only a few of the very numerous examples given by these authors when presenting producer theory.

Beginner textbooks also sometimes include boxes with real data on issues pertaining to the sector they have presented. For instance, when Krugman and Wells introduce the production process with George and Martha's farm, they also include a Box on "wheat yields around the world" (with FAO data and analysis of the differences of wheat yields in various countries) (Krugman & Wells 2015, 332).

4. What justification for the use of impossible examples?

As mentioned in the introduction to this paper, the pedagogical usefulness of impossible examples is far from obvious. We therefore looked carefully for a justification of their inclusion in beginner textbooks; we found none.

Beginner textbooks systematically refer to examples when presenting concepts, and it appears that they generally use impossible examples to illustrate, introduce, present, or explain part of the core concepts, assumptions, or theorems of microeconomic neoclassical theory — such as the marginal product, the law of diminishing marginal product, or the distribution of revenue.

In fact, the textbook authors never mention that the example they may be using while presenting these particular aspects happens to be impossible. To add to the confusion, the same basic storyline — e.g. Caroline's Cookie Factory or Conrad's Coffee Shop (Mankiw 2015), George and Martha's farm (Krugman & Wells 2015) or even McDonald's (Mateer & Coppock 2018) — can switch from real to impossible without any warning. As a matter of fact, impossible examples are often introduced as real-world examples, and the reader is never alerted when the latter turn into the former (or when these impossible examples turn once again into real-world examples, when the concept to which they pertain is not inconsistent with reality).

¹⁶ We did not find any example describing an imaginary world in our corpus.

But if students don't guess this metamorphosis — and as beginners how could they? — what can they possibly learn through these examples? To illustrate our point we will focus on the concept of the marginal product (Sect. 5), the law of diminishing marginal product (Sect. 6), and the income theory of distribution (Sect. 7).

5. What can students possibly learn through impossible examples? The case of the concept of the marginal product

Let us recall that the marginal product of labor is the increase in the quantity of output obtained from one additional unit of labor, holding the quantity of all other inputs fixed. In our beginner textbooks, marginal product (most frequently — but not always — of labor) is *always* presented through at least one impossible example. Yet, in our view, undergraduate students cannot possibly understand the concept of the marginal product when it is introduced, explained, and finally defined through impossible examples, for throughout these examples they are never told that '*holding the quantity of all other inputs fixed*' means '*holding the used quantity of all other inputs fixed*', if indeed they are ever informed about the existence of such a condition.

Before introducing the concept of the marginal product, authors generally reduce the number of inputs and only consider two: generally speaking 'labor' and 'equipment', 'capital', 'machines', 'factory', or even 'land'. The question is then: where have all the other inputs gone?

Let's take the case of Caroline's Cookie Factory. For precision, let us cite Mankiw's exact phrasing:

"In the analysis that follows, we make an important simplifying assumption: we assume that the size of Caroline's factory is fixed *and that Caroline can vary the number of cookies produced only by changing the number of workers she employs*. This assumption is realistic in the short run but not in the long run." (2015, 263, our emphasis)

Since the assumption "Caroline can vary the number of cookies only by changing the number of workers she employs" is not presented as an impossible but as a "realistic" one "in the short run", students are probably led to understand that the factory is oversized — like the fixed amount of 'capital' or 'equipment' in Pindyck and Rubinfeld's clothing factory (2018, 214 et sqq.), for example — and that the term 'factory' (or 'equipment' or 'capital') includes all other inputs, as in Mateer and Coppock's McDonald's example in which capital "includes the building itself, the equipment used, the parking lot, the signs, and all the hamburger patties, buns, fries, ketchup, and other foodstuffs" (2018, 251), or in McConnell, Brue and Flynn's woodshop:

"Assume a woodshop is manufacturing furniture frames. It has a specific amount of equipment such as lathes, planes, saws, and sanders. If this shop hired just one or two workers, total output and productivity (output per worker) would be very low. The workers would have to perform many different jobs, and the advantages of specialization would not be realized. Time would be lost in switching from one job to another, and machines would stand idle much of the time. In short, the plant would be understaffed, and production would be inefficient because there would be too much capital relative to the amount of labor. The shop could eliminate those difficulties by hiring more workers. Then the equipment would be more fully used, and workers could specialize in doing a single job." (2018, 184, our underlining)

In Mankiw's example, students would then understand the term 'factory' to include, among other things, enough 'flour, sugar, chocolate chips, and other cookie ingredients' to produce at least 155 cookies (per hour). Hence, they would misunderstand what 'marginal product' means: *the increase in the number of cookies that arises from one additional unit of labor* would not be then obtained *holding the used quantity of all other inputs (flour, sugar, chocolate chips, ...) fixed*. This condition is, by the way, not specified by Mankiw when he defines the marginal product:

"The marginal product of any input in the production process is the increase in the quantity of output obtained from one additional unit of that input." (2015, 264)¹⁷

Most of the time, the composition of the equipment, machines, capital, factory, or even land is not sufficiently precisely specified for students to know whether it includes all other inputs. Students can therefore reasonably ask themselves where all those other inputs are. Where are the seeds, fertilizer, tools, or agricultural machines in George and Martha's farm (Krugman & Wells, 2015, 330 et sq.), for example?

On the contrary, sometimes it is very clear that the oversized equipment, machines, capital, or land does not include all other material inputs. Yet this doesn't seem to matter, since the quantity of those inputs nevertheless increases with the quantity of labor, as in the second problem proposed by Krugman and Wells (2015) at the end of their chapter 11, 'Behind the supply curve: inputs and costs':

"Marty's Frozen Yogurt is a small shop that sells cups of frozen yogurt in a university town. Marty owns three frozen-yogurt machines. His other inputs are refrigerators, frozen-yogurt mix, cups, sprinkle toppings, and, of course, workers. He estimates that his daily production function when he varies the number of workers employed (and at the same time, of course, yogurt mix, cups, and so on) is as shown in the accompanying table. [similar to Mankiw's table 1 quoted above]

Quantity of labor (workers)	Quantity of frozen yogurt (cups)
0	0
1	110
2	200
3	270
4	300
5	320
6	330

¹⁷ He is not the only one. Krugman & Wells, for example, don't mention this condition in the definition of marginal product, but do so later, when explaining diminishing returns to an input:

"In general, the **marginal product** of an input is the additional quantity of output that is produced by using one more unit of that input." (2015, 331)

"In general, there are diminishing returns to an input when an increase in the quantity of that input, holding the quantity of all other inputs fixed, reduces that input's marginal product. Due to diminishing returns to labor, the marginal product of labor curve is negatively sloped." (2015, 332)

The condition "holding the quantity of all other inputs fixed" cannot be understood by an undergraduate student since it is indicated using an impossible example.

[...] c. What is the marginal product of the first worker? The second worker? The third worker? Why does marginal product decline as the number of workers increases?" (Krugman & Wells 2015, 353, our underlining.)

In this case, as in the previous one (where equipment-capital-land included all other inputs), "marginal product of labor" seems to designate the increase in the quantity of output (frozen yogurt, here) that arises from one additional unit of labor, *and "of course" from additional used quantities of all other inputs* (yogurt mix, cups, and so on). And when reading Mankiw's textbook, for example, if students do not guess that Caroline lives in an impossible world — and how could it be otherwise? — they cannot understand anything but this ill-defined concept of the marginal product of labor. Whether or not they believe that capital-factory-equipment-land includes all inputs but labor, they cannot understand that, in all those examples, the output increases after the use of an additional unit of labor *holding the used quantity of all other inputs fixed*, because, in all those examples, it is clearly impossible.

This confusion is the reason why beginner students can end up believing that the marginal product of labor can be positive in the case of a fixed-proportions production function (such as that of a cookie or furniture frames factory, a farm, or a Frozen Yogurt shop). Hence, for these students, when the marginal product of labor is null — as in Pindyck and Rubinfeld's example of "reconstruction of concrete sidewalks using jackhammers" (2018, 229) quoted above — it can't be because of a fixed-proportions production function, for it is positive in Caroline's Cookie Factory (Mankiw 2015) or in Pindyck and Rubinfeld's clothing factory (Pindyck & Rubinfeld 2018, 214 et sqq.); they probably think that this only occurs when the quantity of other inputs is not excessive.

6. What can students possibly learn through impossible examples? The case of the law of diminishing marginal product

Yet, at this stage of their reading, the beginner students will certainly think that the marginal product of an input is the increase in the quantity of output that arises from one additional unit of this input, and "of course" from additional used quantities of all other inputs, unless the quantity of (at least) one of these other inputs cannot be increased, in which case the marginal product of the input is null. What else could they possibly be thinking?

And yet, it is not that clear: as a matter of fact, such a comprehension does not explain Mankiw's table 1 (Mankiw 2015, 263)¹⁸ for it does not allow the marginal product of any input to be diminishing. This ill-defined concept of the marginal product looks more like 'returns to scale' than like 'marginal product', since the used quantities of all inputs increase at the same time. Yet, as it appears in intermediate or advanced textbooks, the diminishing returns to scale is a knotty point, and cannot happen in models in which the production function reflects nothing but technology. As Mas-Colell, Whinston and Green put it:

"It is important not to lose sight of the fact that the production set describes technology, not limit on resources. It can be argued that if all inputs [...] are explicitly accounted for, then it should always be possible to replicate production. After all, we are not saying that

¹⁸ Nor does it explain, among many others, Pindyck & Rubinfeld's table 6.1 (2018, 215), Mateer & Coppock's figure 8.1 (2018, 253), or tables in Krugman & Wells (2015, 353).

doubling output is actually feasible, only that in principle it would be possible if all inputs [...] were doubled.” (1995, 134)¹⁹

Hence, according to them, the usual explanation of diminishing returns to scale is the scarcity of (at least) one forgotten (Varian 2014, 360)²⁰ or ‘unlisted’ input:

“In this view, which originated with Marshall and has been much emphasized by McKenzie (1959), decreasing returns must reflect the scarcity of an underlying, unlisted input of production.” (MasColell, Whinston & Green 1995, 134)

For the same reason, Varian regards diminishing returns to scale as “a short-run phenomenon, with something being held fixed” (Varian 2014, 360).²¹

Nevertheless, if we look back at Mankiw’s table 1, this would only explain why the second worker added 40 cookies to the total product, while one worker could produce 50: the reason could be an insufficient quantity of flour or a congestion of the oven or whatever. But, in this case, the third worker could not, however, produce any additional cookies, so that his marginal product must be zero, not 30 as in Mankiw’s table 1.²²

There is, however, an exception in the textbooks we examined: the case where the fixed, underlying, unlisted input is land. Krugman and Wells, for example, explain the diminishing returns through the example of George and Martha’s farm:

“To grasp why diminishing returns can occur, think about what happens as George and Martha add more and more workers without increasing the number of acres of land. As the number of workers increases, the land is farmed more intensively and the number of bushels produced increases. But each additional worker is working with a smaller share of the 10 acres — the fixed input — than the previous worker. As a result, the additional worker cannot produce as much output as the previous worker. So it’s not surprising that the marginal product of the additional worker falls.

The crucial point to emphasize about diminishing returns is that, like many propositions in economics, it is an “other things equal” proposition: each successive unit of an input will raise production by less than the last *if the quantity of all other inputs is held fixed.*” (Krugman & Wells 2015, 333)²³

¹⁹ Varian says almost the same thing in his intermediate textbook: “This case [diminishing returns to scale] is somewhat peculiar. If we get less than twice as much output from having twice as much of each input, we must be doing something wrong. After all, we could just replicate what we were doing before!” (Varian 2014, 360). “If the firm has twice as much of each input, it can just set up two plants side by side and thereby get twice as much output. With three times as much of each input, it can set up three plants, and so on” (Varian 2014, 359).

²⁰ “The usual way in which diminishing returns to scale arises is because we forgot to account for some input.” (Varian 2014, 360)

²¹ In his advanced textbook, Varian claims almost the same thing: “It turns out that it can always be assumed that decreasing returns to scale is due to the presence of some fixed input” (Varian 1992, 16).

²² And Mateer & Coppock’s figure 8.1 (2018, 253) or Pindyck & Rubinfeld’s table 6.1 (2018, 215), for example, are problematic for the very same reasons.

²³ We find almost the same example in Varian’s intermediate textbook (Varian 2014, 357).

It is then obvious that “all other inputs” means not only “the fixed input” land, but also seeds, fertilizer, tools, or agricultural machines, etc., the used quantities of which must necessarily increase unless, again, the marginal product of labor is soon to be negligible.²⁴ “Fixed” here means two different things: the fixed quantity of land which is farmed more and more intensively, and the fixed, but sufficient, quantities of all other inputs for the number of bushels produced to increase. Here beginner students who were taught the Ricardian theory of rent surely, and unfortunately, will not see the difference between the law of diminishing marginal product of labor in neoclassical theory and the diminishing return on land which generates rent in Ricardo’s *Principles* (2001 [1821]).²⁵

But beyond the fact that land is a somewhat particular input, all this takes us very far indeed from what diminishing marginal product of labor means in neoclassical theory.

7. What can students possibly learn through impossible examples? The case of distribution of revenue

Marginal product is a key concept of neo-classical economics, for, in the perfect competition model, it determines inputs’ demands (the quantities chosen by a competitive profit-maximizing firm are such that the value of the input’s marginal product equals the input’s real price). It is then a core concept of neoclassical distribution theory, the so-called ‘marginal productivity theory of income distribution’ (McConnel, Brue & Flynn 2018, chapter 16, 6th section’s title, 325), in which the price of each input equals its marginal productivity. This is generally what appears in the chapter of beginners’ textbooks which deals with “the markets for the factors of production”,²⁶ which students read thinking that marginal productivity of an input is the increase in the quantity of output that arises from one additional unit of that input, *and “of course” from additional used quantities of all other inputs.*

Yet, concerning the presentation of distribution theory, using impossible examples to explain marginal product has two unfortunate pedagogical consequences, consequences that are all the more unfortunate that they happen to be conflicting. On the one hand, (i) it leads to an absurd, and sometimes inconsistent, income distribution theory; on the other hand, (ii) it (more or less explicitly) encourages students to interpret our world through this dubious theory without further questioning.

- i. Our beginner students, to whom the concept of the marginal product (most of the time, labor) has been presented through examples with a fixed-proportion production function and excess quantities of all inputs (except labor), must surely be thinking that an additional unit of labor leads to something similar to the consequences of the withdrawal of one unit of factor, to which Hicks draws attention in the following passage:

²⁴ This is the one issue on which we would disagree with Moseley (2015).

²⁵ For it seems to be what is described in this passage (among others): “It often, and, indeed, commonly happens, that before No. 2, 3, 4, or 5, or the inferior lands are cultivated, capital can be employed more productively on those lands which are already in cultivation. It may perhaps be found, that by doubling the original capital employed on No. 1, though the produce will not be doubled, will not be increased by 100 quarters, it may be increased by eighty-five quarters, and that this quantity exceeds what could be obtained by employing the same capital, on land No. 3. In such a case, capital will be preferably employed on the old land, and will equally create a rent; for rent is always the difference between the produced obtained by employment of two equal quantities of capital and labour.” (Ricardo 2001 [1821], 42)

²⁶ This is the title of Mankiw’s (2015, 373) chapter 18; the title of chapter 19 in Krugman & Wells (2015, 543) is “Factor Markets and the Distribution of Income”; the title of chapter 14 in Pindyck & Rubinfeld (2018, 543) is “Markets for Factor Inputs”.

“If the proportions are fixed, then [...] the withdrawal of one unit will lead to a far greater diminution in the product that can fairly be attributed to that unit alone, since its removal put corresponding units of other factors out of action. If all the factors were paid according to their marginal products calculated in this second manner, their total pay would undoubtedly be far in excess of the value of the goods they produced. Which is absurd.” (Hicks 1932, 81)

For example, if returns to scale are constant, and if we choose units of measure so that the quantity of each of the n inputs needed to produce one unit of output equals 1, if the quantities of $n - 1$ inputs are sufficiently excessive, then an additional unit of the n^{th} input will lead to the production of an additional unit of output. If we calculate the marginal product of each input in this manner, for each unit of output produced, the total pay for inputs will be n times greater than the total product!^{27 28}

This ill-defined concept is also clearly inconsistent with the normative content of the marginal productivity theory of distribution, be it implicit — as when Mankiw speaks about the marginal product of a factor as “its marginal *contribution* to the production of goods and services” (Mankiw 2015, 390, emphasis added) — or explicit — as in McConnel, Brue and Flynn 2018, which claims: “In this **marginal productivity theory of income distribution**, income is distributed according to contribution to society’s output”, and “To each according to the value of what he or she creates” (McConnel, Brue & Flynn 2018, 325). For, when inputs are complements, their physical productive contributions are impossible to disentangle: it is obviously impossible to separate out the productive contribution of each input.²⁹

- ii. Explaining marginal product and factor prices through impossible examples presented as if they were real-world examples make students believe that the theory by and large reflects the world in which they live, whereas it is in fact almost impossible to find real-world examples of positive marginal (physical) product. This illusion is implicitly reinforced given that the marginal product theory of distribution generally appears at the end of a presentation where the invented impossible examples — “Siam Soups” (McConnel, Brue & Flynn 2018, 321 et sq.), an apple producer (Mankiw 2015, 374 et sqq.), and so on — through which it is explained are entangled with boxes full of empirical data. But authors can also make it absolutely clear, as do Krugman and Wells in the following passage:

“It leads us to the **marginal productivity theory of income distribution**, which says that each factor is paid the value of the output generated by the last unit of that factor

²⁷ Of course, the problem remains even if only a few factors are considered. For example, Krugman & Wells (2015, 544) sometimes consider four of them (land, labor, physical capital or capital, human capital), and sometimes only two (labor and capital), which is still (at least) one too many.

²⁸ In the first decade of the 20th century, Hobson formulated this kind of argument — of excessive total factor payments — to criticize the marginal productivity theory of distribution, as for example in Hobson 1900; this is stressed by Mandler (1999, 21), who supports Hobson’s criticism using the example of a Leontiev production function.

²⁹ According to Pullen (2010), this theoretical problem, called the ‘disentanglement problem’, is well known, at least since Hobson’s criticism of the marginal product theory of distribution (for example in Hobson 1972 [1900] or Hobson 1969 [1910]), and persists — even if it is less obvious — when inputs are substitutes, since the increase in the total product that occurs after the employment of one additional unit of an input is seldom a monocausal phenomenon.

employed in the factor market as a whole — its equilibrium value of the marginal product.

To understand why the marginal productivity theory of income distribution is important, look back at Figure 19-1 [2015, 546], which shows the factor distribution of income in the United States [in 2013], and ask yourself this question: who or what decided that labor would get 66% of total U.S. income? Why not 90% or 50%?

The answer, according to the marginal productivity theory of income distribution, is that the division of income among the economy's factors of production isn't arbitrary: it is determined by each factor's marginal productivity at the economy's equilibrium. The wage rate earned by *all* workers in the economy is equal to the increase in the value of output generated by the last worker employed in the economy-wide labor market." (Krugman & Wells 2015, 555)³⁰

8. Conclusion

"[I]n economics nothing is more important than teaching, because, as Galbraith senior once observed, economics is primarily a teaching profession. This makes economics pedagogy a natural starting point for an analysis both of how economics went so horribly wrong and of how it might be made less a facilitator of human disaster in the future." (Fullbrook 2009, 17)

In presenting and explaining the marginal product, authors of beginners' textbooks generally use what we call impossible examples. In doing so, as we have shown, they instil misconceptions about neoclassical theory: since beginner students are never told and cannot possibly guess the nature of these examples, they can only acquire an ill-defined conception of marginal product, e.g. that the marginal product of an input designates the increase in the quantity of output that arises from one additional unit of this input, and "of course" from additional used quantities of all other inputs. Furthermore, not only is this ill-defined concept inconsistent with the diminution of what is alleged to be the marginal product of an input, but it leads to an absurd income distribution theory where, as Hicks put it, the sum of the incomes "would undoubtedly be far in excess of the value of the goods they produced" (Hicks 1932, 81). Consequently, the most motivated students — those who try hard to understand — must at least end up confused, if they don't indeed conclude that the theory is absurd or logically inconsistent: which would be a pity given the way this theory was originally built. Anyhow, there is no way for the beginner students to understand the theory that these examples are allegedly designed to present. In the chapters of beginners' textbooks dealing with the production process and the market for factors of production, they are taught nothing but a fake and inconsistent version of neoclassical theory.

Thus, our examination of beginners' textbooks shows that, unlike the use of other types of examples (Jallais 2018), the use of impossible ones is an aberration, at least from a pedagogical point of view.

Let us recall what Krugman and Wells (2015) claim:

³⁰ At the end of the chapter, they conclude that "the marginal productivity theory of income distribution is not a perfect description of how factor incomes are determined but that it works pretty well" (Krugman & Wells 2015, 562).

“Chapters build intuition through *realistic examples*. In every chapter, we use real-world examples, stories, applications, and case studies to teach the core concepts and motivate student learning. The best way to introduce concepts and reinforce them is through real-world examples; students simply relate more easily to them. [...] We use a fluid and friendly writing style to make concepts accessible and, whenever possible, we use examples that are familiar to students.” (Krugman & Wells, 2015, xix, our emphasis)

But instead of using realistic examples to explain why the marginal product of labor (or of any other input) is null whenever inputs are complements — which even a beginner student can easily understand — they choose examples with inputs which present a fake concept of the marginal product, hiding the fact that the marginal productivity theory of the demand for factors does not apply in the case of fixed proportion production functions.

Why? Why do authors of beginner textbooks choose to teach a fake and inconsistent version of neoclassical theory? What pedagogical or epistemological principle can support such a practice? Do they do this because they can't find any real-world examples that fit the concept or the law? If so, why not tell the students? Or why not at least replace these impossible examples by abstract or imaginary ones? The mystery remains.

Almost 70 years since Joan Robinson pointed this out, it seems that “the production function” is still “a powerful instrument of miseducation” (Robinson, 1953-4, 81). For this way of teaching economics is the exact opposite of what is generally expected from a university education, e.g. “the training of the student in critical thinking”³¹ as French economics professors put it when answering the students' petition which initiated the “post-autistic” economics movement in June 2000 (Fullbrook, 2003, 1-9).

This particular way of excluding critical thinking — by teaching a fake and inconsistent version of the neoclassical theory of the competitive firm and of distribution through impossible examples — is quite different from the many other ways of excluding critical thinking that have been identified by these movements.³² Hence it seems to us that we have found a new “clue as to how both the economics profession and the public which it educates became so ignorant, misinformed, and unobservant of how economies work in the real world” — a clue which Fullbrook (2009, 17) invited us to seek³³ — since, on the one hand, beginner textbooks are the most widely used and, on the other, this pedagogical practice leads people to interpret our world by means of concepts and theories they are not aware of misusing.

Hence, until the relevant authors explain themselves, or until they change their way of teaching economic concepts, laws, and theories, we must continue to warn beginner students, following Hill and Myatt, that it “is not enough” to “study a conventional textbook (and to solve the multiple choice questions that supposedly test understanding of the subject)”; that they “need to read with a critical eye, and to note what is omitted [...] what is unsupported” (Hill and Myatt, 2010, 254); and, of course, that they must recognize what is inconsistent, whether this be in the explanation of a law, between a concept and an example, between two examples, or between two alleged pieces of the same theory.

³¹ “Two fundamental features of university education should be the diversity of the student's degree course and the training of the student in critical thinking” (“The French Professor Petition”, in Fullbrook Edward (ed.), 2003. *The Crisis in Economics. The post-autistic economics movement: the first 600 days*. Routledge. London, p. 17)

³² See for example Fullbrook 2003 & 2009, Collectif Peps Économie 2013, <http://www.isipe.net/>, <http://www.rethinkeconomics.org/>, Reardon 2009 & 2015.

³³ Although we did not find this in the textbook by Mankiw that Fullbrook invited us to explore, it was present in all the best-ranked microeconomics textbooks for beginner students (including Mankiw's).

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Annex

I. Goodreads' rankings

<https://www.goodreads.com/> (accessed 22 March 2019)

The top microeconomics books

1. Robert S. Pindyck & Daniel L. Rubinfeld, *Microeconomics*, 1989
2. Paul Krugman & Robin Wells, *Microeconomics*, 2004
3. Gregory Mankiw, *Principles of Microeconomics*, 1997
4. Jeffrey M. Perloff, *Microeconomics*, 1998
5. Andreu Mas-Colell, Michael D. Whinston, Jerry R. Green, *Microeconomic Theory*, 1995
6. Hal R. Varian, *Intermediate Microeconomics : A modern Approach*, 1987
7. A.Koutsoyiannis, *Modern Microeconomics*, 1975
8. Paul Samuelson & William Nordhaus, *Microeconomics*, 1989
9. Michael Parkin, *Microeconomics*, 1990
10. Robert Frank, *Microeconomics and Behavior*, 2006
11. Hal R. Varian, *Microeconomic analysis*, 1980

Popular microeconomics books ranking

This ranking is slightly different from the previous list. If we choose to narrow this list to academic authors and textbooks (with microeconomics in the title), the ranking goes:

1. Pindyck (Microeconomics)
2. Mas-Colell (Microeconomic theory)
3. Mankiw (Principles)
4. Varian (Intermediate)
5. Varian (Microeconomic analysis)
6. Nicholson (Microeconomic theory)
7. Koutsoyiannis (Modern Microeconomics)
8. Ichiishi (Microeconomic theory)
9. Kreps (Microeconomic foundations) : notes on the theory of choice is prior in the general ranking, and a course in microeconomic theory is 3 ranks below) 10. Jehle (Advanced microeconomic theory)

II. Bookauthority

<https://bookauthority.org/> (accessed 22 March 2019)

The best microeconomics books

BookAuthority ranking was narrowed (excluding business books or macroeconomic books which figured in the ranking)

1. Lee Coppock & Dirk Mateer, *Principles of Microeconomics* (ranked 16th again)
2. Campbell R. McConnell, Stanley L. Brue, Sean Masaki Flynn, *Microeconomics with Connect*
3. Felix Munoz-Garcia, *Advanced Microeconomic Theory : an intuitive approach with examples*
4. Paul Krugman & Robin Wells, *Microeconomics* (Canadian edition, with Iris Au & Jack Parkinson, ranked 13th ; ranked 17th)
5. R. Glenn Hubbard & Anthony Patrick O'Brien, *Microeconomics* (ranked again 14th)
6. Daron Acemoglu, David Laibson & John List, *Microeconomics*

7. Gregory Mankiw, *Principles of Microeconomics*, 7th edition (6th edition « with coursemate » is ranked 8th, and the 7th is ranked again 9th)
8. Astan Goolsbee, Steven Levitt, Chad Syverson, *Microeconomics*
9. Eric Chiang, *Microeconomics*
10. Neva Goodwin, Jonathan Harris, Julie Nelson, Biran Roach, *Microeconomics in context*

III. Amazon bestsellers

<https://www.amazon.com/> (accessed 22 March 2019)

The best sellers in microeconomics list (narrowed down to microeconomic textbooks):

1. McConnell, Brue & Flynn, *Microeconomics*
2. Mankiw, *Principles of Microeconomics*
3. Krugman & Wells, *Microeconomics*
4. Pindyck & Rubinfeld, *Microeconomics*
5. Coppock & Mateer, *Principles of microeconomics*
6. Cowen & Tabarrock, *Modern Principles of Microeconomics*
7. Frank, *Principles of microeconomics*
8. Chiang, *Microeconomics : Principles for a Changing World*
9. Varian, *Workouts in Intermediate Microeconomics*
10. Baumol, *Microeconomics : Principles and Policy*
11. Mas-Colell, Whinston & Green, *Microeconomic Theory*
12. Goolsbee, *Microeconomics*

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SUGGESTED CITATION:

Bénicourt, Emmanuelle, Sophie Jallais & Camille Noûs (2021) "The riddle of the use of impossible examples in microeconomics textbooks." *real-world economics review*, issue no. 98, 14 December, pp. 2-22,
<http://www.paecon.net/PAERreview/issue97/BenicourtJallaisNoûs98.pdf>

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