University of Zurich[UZH]

# Leseaufträge «Mikroökonomik I»

# Modul 1: Einführung

# Unit 2:

– Marginalanalyse

**Quellen:**

- **Chapter 1 – Thinking Like an Economist**
  Frank, Robert H, & Cartwright, Edward. (2016). *Microeconomics and Behaviour (2nd European ed.)*. London: McGraw-Hill Education.
- **Towers of Babel**
  The Economists, March 26th 2015
- **Massive open online forces**
  The Economists, February 8th 2014

Tom should keep launching boats as long as the marginal benefit of doing so is at least as great as the marginal cost. With marginal cost constant at €100 per launch, Tom should thus keep launching boats as long as the marginal benefit is at least €100.

Applying the definition of marginal benefit to the total benefit entries in the second column of Table 1.1 yields the marginal benefit values in the third column of Table 1.2. (Because marginal benefit is the change in total benefit that results when we change the number of boats by one, we place each marginal benefit entry midway between the rows showing the corresponding total benefit entries.) For example, the marginal benefit of increasing the number of boats from one to two is €180, the difference between the €480 total revenue with two boats and the €300 with one.

**TABLE 1.2**
**How Marginal Benefit Varies with the Number of Boats Launched**

| Number of boats | Daily total benefit (€) | Daily marginal benefit (€/boat) |
|---|---|---|
| 0 | 0 | |
| | | 300 |
| 1 | 300 | |
| | | 180 |
| 2 | 480 | |
| | | 120 |
| 3 | 600 | |
| | | 40 |
| 4 | 640 | |

Comparing the €100 marginal cost per boat with the marginal benefit entries in the third column of Table 1.2, we see that the first three launches satisfy the cost–benefit test, but the fourth does not. Tom should thus launch three boats. ◆

**EXERCISE 1.4** **If the marginal cost of launching each boat had not been €100 but €150, how many boats should Tom have launched?**

The cost–benefit principle tells us that *marginal* costs and benefits—measures that correspond to the *increment* of an activity under consideration—are the relevant ones for choosing the level at which to pursue the activity. Yet many people compare the *average* cost and benefit of the activity when making such decisions. As Example 1.7 should have made clear, however, increasing the level of an activity may not be justified, even though its average benefit at the current level is significantly greater than its average cost.

## USING MARGINAL BENEFIT AND MARGINAL COST

The examples just discussed entail decisions about an activity that could take place only on specific levels—no boats, one boat, two boats, and so on. The levels of many other activities, however, can vary continuously. One can buy petrol, for example, in any quantity one wishes. For activities that are continuously variable, it is usually convenient to display the comparison of marginal benefit and marginal cost graphically.

### EXAMPLE 1.9 How much should Susan talk to Hal each month?

Susan has a mobile phone plan for which the charge is 4 cents per minute for a call to her boyfriend Hal. (Fractional minutes are billed at the same rate, so a 30-second call would cost her 2 cents.) The value to Susan, measured in terms of her willingness to pay, of an additional minute of conversation with Hal is shown on curve *MB* in Figure 1.1. How many minutes should she spend on the phone with Hal each month?

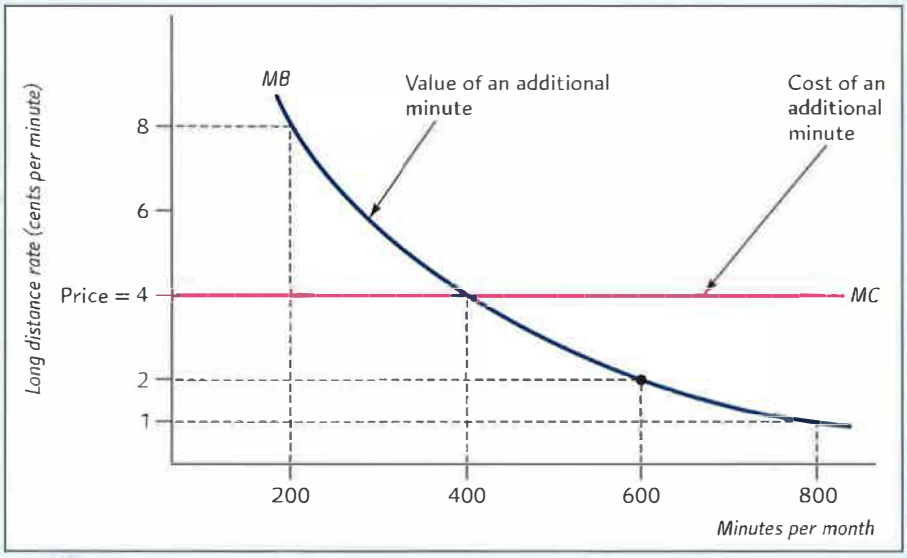


**FIGURE 1.1**
**The Optimal Quantity of Conversation**
The optimal amount of a continuously variable activity is the quantity for which its marginal benefit is just equal to its marginal cost.

The downward slope of curve *MB* reflects the fact that the value of an additional minute declines with the total amount of conversation that has occurred thus far. (As we will see in Chapter 4, it is a common pattern that the more someone has of a good, the less value she assigns to having additional units of it.) Curve *MC* in the diagram measures the cost of each additional minute, assumed to be constant at €0.04. The optimal quantity of conversation is the quantity for which these two curves cross—namely, 400 minutes per month. If Susan speaks with Hal for less than that amount, the marginal benefit from adding another minute would exceed the marginal cost, so she should talk longer. But if they speak for more than 400 minutes per month, the amount she would save by speaking less would exceed the benefit she would sacrifice, which means they should speak less. ◆

**EXERCISE 1.5** If her marginal benefit curve is again as given in Figure 1.1, how many minutes should Susan speak with Hal each month if the call rate falls to 2 cents per minute?

Whenever the level of activity varies continuously it makes sense to equate marginal cost and marginal benefit. To be a bit more specific, let $MC(x)$ and $MB(x)$ denote the marginal cost and marginal benefit of doing an activity by amount $x$. If $MC(x) > MB(x)$ then it pays to reduce the amount of activity. If $MC(x) < MB(x)$ then it pays to increase the amount of activity. The optimal point, 400 minutes in Figure 1.1, is where $MC(x) = MB(x)$.[4]

[4]A slight complication is that there may be more than one level of $x$ where $MC(x) = MB(x)$. Then it is necessary to find which of these levels provides most total satisfaction.

### Why is airline food so bad?

ECONOMIC NATURALIST 1.4

Everyone complains about airline food. Indeed, if any serious restaurant dared to serve such food, it would quickly go bankrupt. Our complaints seem to take for granted that airline meals should be just as good as the ones we eat in restaurants. But why should they?

The cost–benefit perspective says that airlines should increase the quality of their meals if and only if the marginal benefit would outweigh the marginal cost. The marginal benefit of better food is probably well measured by what passengers would be willing to pay for it, in the form of higher ticket prices. If a restaurant-quality meal could be had for, say, a mere €10 increase in fares, most people would probably be delighted to pay it. The difficulty, however, is that it would be much more costly than that to prepare significantly better meals at 10,000 metres in a tiny galley with virtually no time. It could be done, of course. An airline could remove 20 seats from the plane, install a modern, well-equipped kitchen, hire extra staff, spend more on ingredients, and so on. But these extra costs would be more like €100 per passenger than €10. For all our complaints about the low quality of airline food, few of us would be willing to bear this extra burden. The sad result is that airline food is destined to remain unpalatable. ■

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The time and effort required to become a championship tennis player rule out the possibility of simultaneously becoming a leading concert pianist.

Many of us respond warmly to the maxim 'Anything worth doing is worth doing well'. After all, it encourages a certain pride of workmanship that is often sadly lacking. Economic Naturalist 1.4 makes clear, however, that if the maxim is interpreted literally, it does not make any sense. To do something well requires time, effort and expense. But these are scarce resources. To devote them to one activity makes them unavailable for another. Increasing the quality of one of the things we do thus necessarily means to reduce the quality of others—yet another application of the concept of opportunity cost. Every intelligent decision must be mindful of this trade-off.

Everything we see in life is the result of some such compromise. For Rafael Nadal or Roger Federer, playing championship tennis rules out becoming a concert pianist. Yet this obviously does not mean he should not spend any time playing the piano. It just means that he should hold himself to a lower standard there than in the tennis arena.

### Why are smartphones so powerful?

ECONOMIC NATURALIST 1.5

In 1965 Gordon Moore, who would later found Intel Corporation, predicted that the number of transistors that could be put on a computer chip at optimal cost would double every year. Subsequently he changed his prediction to a doubling every two years. This prediction or 'law' has proved remarkably accurate. Which is why transistors are now as small as a few nanometres and the average smartphone can do an unbelievable amount of computation. But why has Moore's law proved so successful?

A simple answer would seem to be technological progress. In 1965 we simply had not got a clue how to produce a transistor a few nanometres wide. Scientific advances were, therefore, necessary in order to get where we are now. Technology, though, is only half the story. As Moore recognized, we also need to think about cost. It is not enough to know how to produce a smaller transistor. We also need to know how to produce a smaller transistor cheaply enough that people will want to buy it. Only then can it be profitable to mass produce for market. So, the success of Moore's law follows from a careful balancing of the marginal cost and marginal benefit of producing smaller and more powerful computers. ■

# Free exchange | Towers of Babel

**Is there such a thing as a skyscraper curse?**

THE world is in the middle of a skyscraper boom. Last year nearly 100 buildings over 200 metres tall were built—more than ever before. This year China's business capital will welcome the Shanghai Tower, which will be the world's second-tallest building. Saudi Arabia is building Kingdom Tower, which will be the world's tallest (and twice the height of One World Trade Centre in New York, the tallest building in the Americas). Does this frenzy of building augur badly for the world economy? Various academics and pundits, many of them cited by *The Economist*, have long argued as much, but new research casts doubt on it.

In 1999 Andrew Lawrence, then of Dresdner Kleinwort Benson, an investment bank, identified what came to be known as the "skyscraper curse".* Mr Lawrence noticed a curious correlation between the construction of the world's tallest buildings and economic crises. The unveiling of the Singer Building and the Metropolitan Life Tower in New York, in 1908 and 1909 respectively, roughly coincided with the financial panic of 1907 and subsequent recession. The Empire State Building opened its doors in 1931, as the Great Depression was getting going (it was soon dubbed the "Empty State Building"). Malaysia's Petronas Towers became the world's tallest building in 1996, just before the Asian financial crisis. Dubai's Burj Khalifa, currently the world's tallest building, opened in 2010 in the middle of a local and global crash.

Skyscrapers can be hugely profitable, since by building upwards developers can rent out more floor space on a given plot of land. But at some point extra storeys are no longer a good deal, since marginal costs—for more lifts and extra steel to stop the building from swaying in the wind, for example—increase faster than marginal revenues (rents or sales). William Clark and John Kingston, an economist and an architect writing in 1930, found that the profit-maximising height for a skyscraper in midtown New York in the 1920s was no more than 63 storeys. (The ideal height is probably not much different today.) Record-breaking skyscrapers could therefore be seen as an indication that gung-ho investors are overestimating the probable future returns from new construction. Indeed, developers may be building record-breaking towers even though they know they are economically inefficient. There is, after all, a certain cachet to having a very tall building with your name on it. In 1998 Donald Trump, a magnate, presented a plan to build the world's tallest residential building in New York as the righting of a historical wrong, not a shrewd business move. "I've always thought that New York should have the tallest building in the world," he proclaimed. If such vanity projects can secure funding, the theory goes, financial markets must be out of control and will soon suffer a sharp correction. Mr Trump's tower opened just as the dotcom bubble was bursting.

Historical analysis suggests that developers are prone to bouts of irrationality. In a paper from 2010, Jason Barr of Rutgers University looked at 458 skyscrapers (those at least 100 metres tall) completed in Manhattan between 1895 and 2004. The number of skyscrapers built and their average height depended in part on the growth in population and employment in office jobs. But Mr Barr's calculations suggest that the height of towers was also shaped by those nearby, especially during economic booms. In the 1920s, Mr Barr estimates, New York builders added four to six more floors per project, just to stand out in the skyline.

## Phallic sample

Until recently, however, there had been no formal analysis of the skyscraper curse. A new paper by Mr Barr, Bruce Mizrach and Kusum Mundra (all of Rutgers) investigates Mr Lawrence's musings in detail. They look at the building of 14 world-record-breaking skyscrapers, from New York's Pulitzer (which opened in 1890) to the Burj Khalifa, and compare them to American GDP growth (which they see as a decent proxy for the world economy).

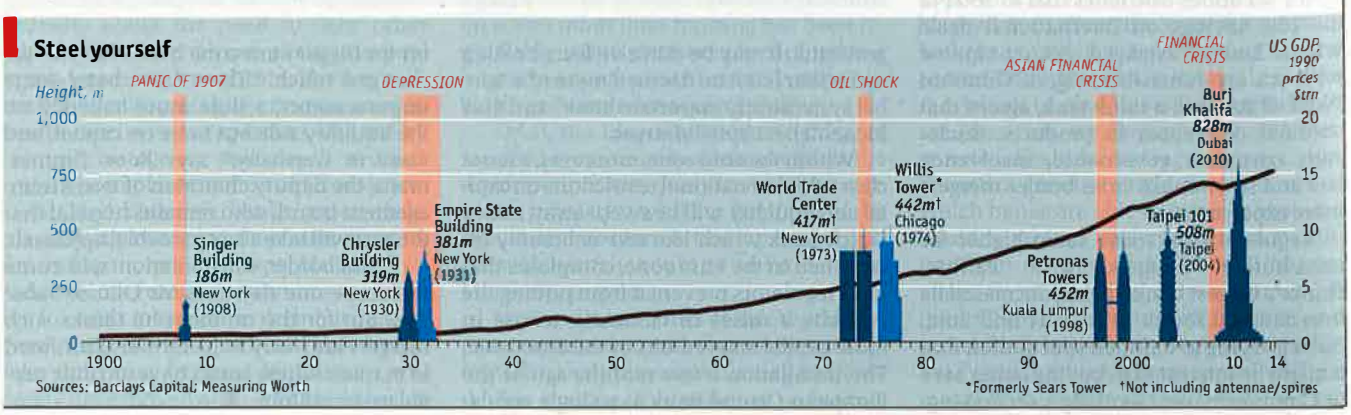
If, as the skyscraper curse suggests, the decision to build the biggest towers happens near the peak of the business cycle, then you could use record-breaking projects to predict the future path of GDP. However, the range of months between the announcement of the towers and the business-cycle peak is large, varying from zero to 45 months. And only seven of the 14 opened during a downward phase of the business cycle (see chart). In other words, you cannot accurately forecast a recession or financial panic by looking at either the announcement or the completion of the world's tallest building.

With such a small sample, it is tricky to draw firm conclusions. But the paper expands the sample to 311 by looking at the tallest building completed each year in four countries (America, Canada, China and Hong Kong). The authors then compare building height to GDP per person. They find that in all countries GDP per person and skyscraper height are "cointegrated", a fancy way of saying that the two things track each other. In other words, developers tend to be profit-maximisers, responding rationally to rising incomes (and thus increased demand for office space) by making buildings bigger. While ego and hubris afflict the skyscraper market, the authors argue, its foundations appear sound. ■

* Studies cited in this article can be found at www.economist.com/skyscrapers15

Economist.com/blogs/freeexchange

**Steel yourself**

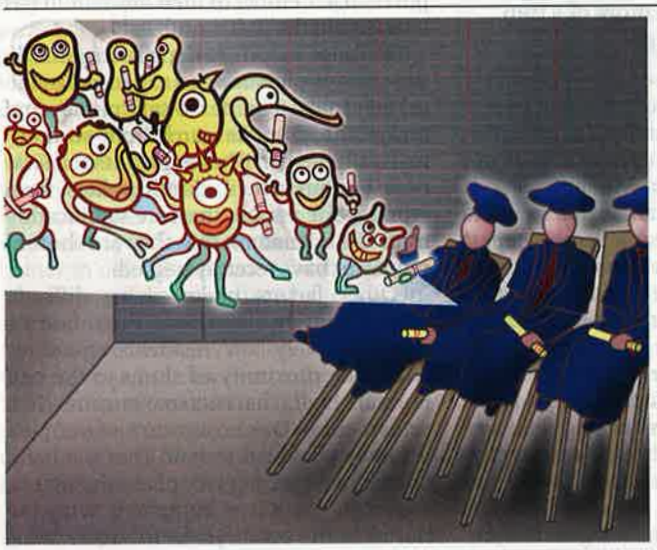



Sources: Barclays Capital; Measuring Worth

*Formerly Sears Tower †Not including antennae/spires

# Free exchange | Massive open online forces

**The rise of online instruction will upend the economics of higher education**



UNIVERSITIES have not changed much since students first gathered in Oxford and Bologna in the 11th century. Teaching has been constrained by technology. Until recently a student needed to be in a lecture hall to hear the professor or around a table to debate with fellow students. Innovation is eliminating those constraints, however, and bringing sweeping change to higher education.

Online learning takes many forms. Wikipedia, a user-generated online encyclopedia, contains wonderfully detailed explanations. YouTube offers instruction on how to boil an egg as well as lectures on cosmology. Within many universities the online is displacing the offline. Professors publish course materials and videos of their lectures on the web. Students interact with each other and submit assignments by e-mail. Even those living on university campuses may nonetheless learn largely online, skipping lectures and reporting only for the final exam.

In America, bowing to the inevitable, universities have joined various startups in the rush to provide stand-alone instruction online, through Massive Open Online Courses, or MOOCs. Though much experimentation lies ahead, economics can shed light on how the market for higher education may change.

Two big forces underpin a university's costs. The first is the need for physical proximity. Adding students is expensive—they require more buildings and instructors—and so a university's marginal cost of production is high. That means that even in a competitive market, where price converges towards marginal cost, modern education is dear.

It is also hard to raise productivity. University lecturers can teach at most a few hundred students each semester—the maximum that can be squeezed into lecture halls and exam-marking rosters. Because it is so labour intensive higher education relies on large numbers of instructors paid relatively modest salaries.

MOOCs work completely differently. Alex Tabarrok, an economist at George Mason University and co-founder of an online-education site, Marginal Revolution University, reckons the most salient feature of the online course is its rock-bottom marginal cost: teaching additional students is virtually free. The fixed cost of creating an online course is relatively high, however. Getting started means putting together a curriculum, producing written and recorded material to explain it, and creating an interactive site that facilitates discussion and feedback.

Having invested in the production of a course, a provider's incentive is to sell it to as many students as possible. After the initial cost is covered each additional unit sold is pure profit. A low price maximises registrations and profit. But as prices converge towards marginal cost, there will be little scope for undercutting the competition. Instead MOOCs are likely to compete on quality, Mr Tabarrok reckons. Higher production costs are a small price to pay to attract much greater numbers of students. Such markets often evolve into winner-take-all, "superstar" competitions. The best courses attract the most customers and profit handsomely as a result. In this respect online education may more closely resemble information industries such as film-making than service industries such as hair-cutting.

The market for textbooks already fits this description. New textbooks are costly to write and design but can be reproduced fairly cheaply. Not surprisingly, only four introductory economic texts account for half of the American market, according to Mr Tabarrok. Indeed, says Tyler Cowen, a co-founder of Marginal Revolution University, it is possible that textbook publishers are better equipped than universities to develop MOOCs profitably.

The market for instructors will also be transformed. The best teachers will be fabulously productive, reaching hundreds of thousands of students. There may therefore be far fewer of them, each compensated like superstars in the entertainment industry.

MOOCs' low marginal cost is responsible for some of the bad press they occasionally receive. Consumers risk little by signing up, so both registrations and drop-out rates are high. Yet that is not necessarily a reflection of poor quality. An analysis of over 1000 studies of online-course results conducted by America's Department of Education found that people who complete such courses do better on average than students in face-to-face instruction.

### Ivory glowers

Caroline Hoxby, an economist at Stanford University, argues that MOOCs threaten different universities in different ways. Less selective institutions are close substitutes for MOOCs. Course content is often standardised and interaction with professors is limited in order to keep costs down. Students generally pay the cost of their education themselves and upfront, but drop-out rates are nonetheless high. MOOCs can provide a similar experience with more flexibility and at much less cost. Though some such institutions could prosper as portals for courses developed elsewhere, or by awarding degrees based in part on mastery of MOOCs, most are at serious risk of displacement.

Elite institutions face very different circumstances, Ms Hoxby reckons. They operate like venture-capital firms, offering subsidised, labour-intensive education to highly qualified students. They aim to cultivate a sense of belonging and gratitude in students in order to recoup their investment decades later in the form of donations from successful alumni.

Ironically, these universities may have threatened their own business model by embracing MOOCs. Online courses break the personal link between students and university and, if offered cheaply to outsiders, may make regular graduates feel more like chumps than the chosen few. For top schools, the best bet may simply be to preserve their exclusivity. ■

Economist.com/blogs/freeexchange