

The Industrial Organization of Online Education

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Introduction

We see online education as having several advantages that will help shape the future of the higher education industry:

1. Leverage of the best professors and content creators teaching more students.
2. Time savings from less repetition in lectures (students control what to repeat or skip) and from lower commuting costs.
3. Greater flexibility in when lectures are consumed, and in the lecture format, such as the time length of lecture.
4. Greater scope for productivity improvements as capital in the form of software substitutes for labor.
5. Greater incentive to invest in quality improvements when the size of the market increases.
6. Feedback from interactive systems will be more immediate and more informative (Skinner 1958). Adaptive tutoring systems are already nearly as effective as human

tutors in many circumstances and much cheaper to scale (VanLehn 2011).

7. Greater scope for measurement and also randomized controlled trials for what works.

An eighth advantage follows from the first seven:

8. Online education will reduce the cost and increase the (price-adjusted) quality of some kinds of education (Tabarrok 2012). Furthermore as more of the value of a course comes from software and less from live teaching, productivity will improve, thus removing the cost disease.

The broader context here is that thirty percent of students already take at least one online or hybrid class. Furthermore many students or potential students live abroad, work, or are raising children and they appreciate the flexibility of online learning. Current levels of interest and experimentation, combined with the rapid growth of online portals to supplement Principles of Economics instruction, suggest online methods are likely to improve a great deal over the next generation of economics instruction.

A randomized controlled trial by Bowen et al. (2012) and a meta-review by the U.S. Dept. of Education (US DOE 2010) both indicate that online education delivers as high a quality of education as standard in-class lectures and it does so at lower cost. Bowen et al. (2012) found that the ongoing costs of teaching a hybrid course in statistics were 36% to 57% lower than a traditional format course. In addition, students learned as much material in 25% less study time, as well as saving on commuting and attendance costs. We do not yet know how broadly these educational gains can be captured, but still we expect significant growth in the online medium.

Many observers argue that the in-class experience is special and cannot be duplicated online. Even if true, this line of argument does not pin down the form education will take. For instance there is something special about the live musical experience and yet most musical consumption is of recorded music.

Under one view, the most obvious targets for online education are the large, introductory classes, currently often taught by graduate students or adjuncts. Online education competes well on quality with these large courses. Yet the per-student cost of these adjuncts is already relatively low, so in terms of lowering costs the small enrollment upper-level courses may be another growth area,

especially when the same course is taught at multiple universities. In these cases the expensive full professor may be replaced by a standardized online package, supplemented by teaching assistants. There also will be online education for classes which might otherwise not be offered at all, such as history of economic thought. Finally in hybrid models students do much of the work online but meet with a professor or adjunct on a periodic basis.

We now turn to the likely structure, conduct and performance of the online components of the education sector.

Endogenous Fixed Costs

Online teaching reduces the marginal cost of teaching and raises the fixed cost. The cost of teaching an additional student online falls because much of the grading, monitoring and so forth is automated and there are no costs of coordinating all students in the same place at the same time. As a result, online classes scale from 100 to 100,000 students or more. The marginal cost of teaching the same course a second time online also falls. The costs of teaching an in-class course also fall the second time around, but not usually as much. Thus, online education has economies of scale in both the number of students at a point in time dimension and the number of students over time.

The fixed costs of teaching an online course include the prep time and the time it takes to record lectures. These costs are not negligible. In our experience producing content at our own site, MRUniversity (MRUniversity.com), where we offer free courses and videos in economics, a 3-4 minute segment of a narrated, virtual blackboard, Powerpoint-based video can take an hour or more to produce.

Over time, online courses likely will incorporate sophisticated video, animations, interactive tutorials and adaptive grading and guided paths, all raising fixed costs.

Large courses also mean large datasets. The largest courses thus will have an advantage in drawing on the largest databases and the most sophisticated algorithms.

Producing a future online course will involve much more team production than today's courses. Today's courses are often centered around the equivalent of a one-person play, whereas many future courses will be more like video games. A video game such as the mega-hit *Halo 3* is produced by a team of actors, writers, animators, coders, physicists, psychologists and designers. The development team at Bungie Studios, for example, analyzed 3,000 hours of *Halo* play by 600 gamers to understand everything from preferences for weaponry to places where

players are most likely to get killed. A game like *Halo* must be difficult enough so that players feel challenged but not so difficult that they give up in frustration. Good educators want a course with similar characteristics.

As with online courses, video games have low marginal costs and high fixed costs. Most importantly, the fixed costs of video games are *endogenous*. Shaked and Sutton (1987) and Sutton (2001) show that when quality is primarily vertical, meaning that there is a measure of quality such that all consumers agree that higher quality is more preferred, then increased market size does not result in reduced concentration. Instead, as market size increases, firms invest more in quality, which endogenously increases economies of scale and maintains market concentration.

Along related lines, Berry and Waldfogel (2010) show that there are many more restaurants in larger than smaller cities, but even as city size increases by a factor of 10 there is no tendency for the number of newspapers to increase. Larger cities have more restaurants than smaller cities because economies of scale are limited and quality differs "horizontally," according to taste (thus, larger cities have more diverse restaurants). Yet larger cities are served by roughly the same number of newspapers as smaller cities because quality is more vertical, most

newspaper consumers want more coverage, better writers and more features.

It remains to be seen how much demand there will be for product diversity in online classes. Nonetheless to the extent future courses look like super-textbooks, we may learn something about the coming market for courses by looking at today's market for texts. In the United States there are approximately 8,000 instructors who teach principles of economics, thus 8,000 or so "courses." Courses today look something like restaurants, namely lots of diverse sellers with even the largest sellers selling to only a small share of the market. In contrast, the top-four principles textbooks control over 50% of the market and there are fewer than twenty textbooks with a market share greater than 1%. As with video games, textbooks are produced by teams. One or two people may share the author byline, but the textbook package is a multi-million dollar creation of graphic designers, copy-editors, Powerpoint designers, test bank producers and authors of study guides and instructor manuals. The final product is marketed by a trained sales staff and updated regularly. Unlike (current) courses, textbooks are rarely produced by universities, although the authors of the text usually work at universities.

A course is already a combination of a textbook and a lecture. If textbooks were

packaged with lectures and other teaching materials, the economics of the textbook could supersede the economics of courses. We would thus expect many courses to be dominated by a handful of superstar teachers working with a team to produce a high tech, integrated course package. Inequality in teacher incomes would increase. Advertising and sales of courses, like textbooks and video games today, would be more extensive as suppliers compete for scale.

When it comes to concentration in the upper and more expensive tiers of the market, we see similar features of concentration in the video game industry. In the last twenty years, the costs of developing a leading video game have increased by a factor of roughly 100 (Rogers 2012). The explanation for rising costs is not higher input prices, but the endogenous response of video game producers to larger markets. That means investing in higher quality to increase market share, while keeping the price low by spreading the fixed costs over a larger audience.

One model of a future course is a super-textbook: lectures, exercises, quizzes, and grading all available on a tablet with artificial intelligence routines guiding students to lectures and exercises designed to address that student's deficits and with human intelligence—tutors—on call on an as-needed

basis, possibly for extra marginal fees. In some cases, the slick, gamified package might be presented by a charismatic celebrity, perhaps in animated form, to generate student interest and involvement (“Lebron does Market Demand”).

That all said, the endogenous sunk cost model is unlikely to describe the entire online market. We can expect the proliferation of significant fringe market segments, often on a lower-cost and more competitive basis. These suppliers will offer amateur videos, low-tech talkie videos, taped live lectures, ideologically affiliated videos, and other diverse outputs, often given away free of charge. Some fringe producers will be motivated by the chance of very rapid scaling, much as low-paid actors hope to be discovered.

Many free, lower-cost outputs will be offered and a small percentage of them will “stick.” This side of the market likely will be especially important in lower-income countries and also for part-time users who are seeking particular bits of learning but are not looking to pay for an entire course and its grading and accreditation. Or if a course is still taught in the traditional manner by a live professor, when looking for supplements that professor may prefer the menu freedom and non-institutionalized feel available from this lower-cost side of the market. The video game

market has similarly bifurcated into games like Grand Theft Auto that encompass entire worlds and simple apps, including games like Angry Birds designed to occupy a few minutes of time on the metro.

One possibility is that this lower cost side of the market is quite competitive due to low entry barriers. An alternative is that a small number of dominant portals arise for reputational reasons, much as web users often visit the broad-based services of Google or Amazon more or less automatically for their needs.

Further horizons

We have considered relatively pure forms of online higher education, but the question remains which human inputs might remain bottlenecks in education. For instance we can imagine scenarios where professors become more important as coaches and motivators rather than as purveyors of information. The economics of education then will, over time, in some ways become more like the older economics of personalized, individualized tutoring. Standardized classroom lectures will decline in importance and new methods of teaching will focus on skills less easily developed online such as generating ideas and working with teams. Whichever are the

remaining human or “behavioral” bottlenecks in education and student motivation, they also may become proportionally more important in the economics of the online sector and that topic awaits further research.

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