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Chapter 6 - CORE: bringing the economics curriculum online[1]

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This chapter provides a case study of creating a new economics course at the incoming undergraduate level where the main resources are provided online. The move to create an online resource was not a matter of simply transferring material found in traditional textbooks into an interactive and hyperlinked text with rich media. Certainly these aspects are found in the new CORE (Curriculum Open Resources in Economics) project, but the online course fundamentally reconceived the way that economics can be sequenced and taught to starting undergraduate students.

Indeed, when Rajiv Sethi, one of the authors of the CORE project, noted in his blog that 'content innovation is only part of the story' (Sethi, 2017), he was alluding to the fact that this project had broken new ground in a number of ways that may not have been fully envisaged at its outset. It is nevertheless true that content innovation was a key initial motivation which arose out of the debates that followed the financial crash of 2007 in which the canonical content of the subject came under scrutiny.

The Nobel laureate Paul Krugman (2009, see also Colander et al., 2009), for example, writing in The New York Times, suggested that economists had been mesmerized by the beauty of their analytical models and had begun to celebrate a 'convergence of vision' that for them led to what is known as the Great Moderation, two decades of relative economic stability that could be attributed to better economic policy making. To cite an example of the thinking that Krugman is referring to, just a few years previously another Noel laureate, Robert Lucas, in his presidential address to the American Economic Association had stated that: 'macroeconomics . . . has succeeded: its central problem of depression prevention has been solved, for all practical purposes, and has in fact been solved for many decades' (Lucas, 2003).

Though the initial focus of the debates that followed 2007 were concerned with the profession itself, the discussions eventually turned to the nature of what was being taught to undergraduates. If the analytical models that students were learning to help them understand the economy provided little purchase on the behaviour of actual economies, then something was surely adrift in our pedagogy.[2]

Students were quick to raise their own concerns. In 2012, students at the University of Manchester formed the Post-Crash Economics Society (PCES) which produced a report highly critical of university economics teaching.[3] The fact that their report contained a preface from Andy Haldane, the Bank of England's Chief Economist, showed how deeply the concern with undergraduate teaching had

[1] I am grateful for comments from Ashley Lait, Economics Network.

[2] One of the first volumes dedicated to reimagining economics pedagogy in the light of the crisis was Fontana and Setterfield (2009).

[3] 3 See PCES (2014).

reached. In 2012, Diane Coyle (2012) published her collection, *What's the Use of Economics?*, in which a number of chapters focused on the teaching of economics.

It was in the wake of these reflections that the CORE project was formally launched in October 2013 with a grant from the Institute for New Economic Thinking (INET). The basic economic workhorse models were very similarly taught across most countries so that the concerns around the syllabus were international. As a result, an international group of academics had already begun to contribute to these debates in a series of workshops in early 2013 at which the CORE approach and vision was discussed and developed. The unique geographically distributed authorship which is one of the project's key innovations was drawn from this international set of academics. For the print version of the text that appeared in late 2017 there were 23 main authors drawn from seven countries and a wider group of economists that had contributed multi-media content to the project. The distributed and cooperative authorship model, itself aided by online collaborative tools, is unique in economics where textbooks (and indeed research papers) are typically single or joint authored. It has necessarily entailed extensive coordination and debate about the content, sequencing and presentation that is typically absent in standard economics textbooks beyond the usual editorial and refereeing processes that publishers undertake. The production of the text is therefore unusual in that it has emerged through a process of workshops and presentations in which chapters are introduced, critiqued and a common approach to the material is forged. These regular workshops are attended not just by authors but also by publishers and others with pedagogical or e-learning expertise so that attention is paid not just to the material itself but also to the delivery of the material in the classroom.

The project itself is led from University College London by Wendy Carlin and a small production team with the partnership of Sam Bowles from the Sante Fe Institute. They have provided the leadership and organization that has brought the authorship and development team together in what has become a production unit that is broadly based but retains central direction and purpose. This authorial design has contributed to the success and longevity of the project by harnessing the power of an open model which is centred around a clear hub of activity.

The distributed model of authorship also has benefits in terms of pedagogy and content. It ensures that a variety of viewpoints from economic historians, econometricians, behavioural economists, pedagogical experts and others (including expertise from cognate disciplines) are drawn into the production of the text at every iteration. CORE's response to what Krugman had described as a 'Panglossian' and narrow approach to economics was to bring a broader understanding of human behaviour together with recent research on institutions, power, bubbles, crashes and history back into the teaching of undergraduate economics.

This point needs to be stressed for CORE has been criticized in some quarters for not going far enough in the direction of a pluralism of viewpoints. For some economists it was the failure of competing viewpoints that was at the heart of the malaise in the subject and which, it is argued, CORE does little to counter (see for example, Chang and Aldred, 2014). But the unique production context of CORE has led to a what Sam Bowles characterizes as an integrative pluralism (Bowles, 2018), one in which a multiplicity of viewpoints is not simply juxtaposed but where a cohesive narrative is arrived at through an intellectual openness and a multiplicity of contributions. Thus, the insights of Karl Marx on firm organization can be merged with those of Chicago economist Ronald Coase to help students understand firm behaviour without merely presenting a series of opposing ideas without prioritization or calibration against the evidence. In the afterword to the CORE text, such a view is articulated in the following way:

> [...] instead of seeing all economic activity through the lens of a single model... CORE has invited you to see the economy the way research economists see it, as a diverse combination of institutions and behaviours that is best studied by judiciously choosing among factually tested models. (CORE, 2017)

Rather than simply presenting a number of competing viewpoints therefore, CORE has chosen to prioritize explanations that have some basis in evidence. Its authors have then gone somewhat further in presenting this material using a consistent set of tools which may inadvertently appear somewhat to present a homogenous vision. It may be this pedagogic consistency that has led some commentators to criticize CORE from a pluralist perspective. Far from offering a 'settled view' of the subject, CORE might be seen as presenting the best of our current understanding. It will be an ongoing challenge for CORE to ensure that it continues to adapt its content as the subject and evidence progress so that the charge of a settled perspective cannot be levelled in future.

CORE's management and authorial structure, as noted previously, is supported by online collaboration through tools such as Dropbox and Google Docs. The online setting was a key enabler for the delivery of the project and it was always envisaged that the resulting resources would be available free of charge on the Internet. Because the problems of economics teaching were not localized to any one country, online provision maximized the ease with which departments of economics across the world could deploy the resources in moving away from the traditional canon.

Take-up of the resources was also facilitated by the modular structure of the materials which allowed departments to select and tailor the content to a variety of course formats. Such a modular structure is particularly straightforward to implement technically in an online setting. However, there is a significant pedagogical challenge involved in ensuring that the progression of the course material is not compromised by the fact that an instructor decides to omit a particular module. In the case of CORE, some of the more technical material has been pushed into separate sections (called 'Leibnizes') which may be omitted or used selectively depending on the mathematical preparation of the students in the course. It is probably the case that CORE could be pushed more in this direction of modularity, but as has been noted above, CORE has presented a diverse economics through the lens of a common set of tools which are revisited and developed as the text progresses. Such progression poses a challenge for modularity because omitting sections may compromise the understanding of material which follows. The CORE team has been working on developing various routes through the text which would allow the resources to contain a number of embedded courses. For example, the explicit focus on various challenges such as environmental problems, inequality and innovation allows a variety of courses to be constructed which emphasizes one of these themes. Colour coding of the sections that contain substantial discussions of these themes both in the online and printed versions of CORE begin the process of developing bespoke course combinations from a single text.

The online and free availability of the resources, together with the (somewhat limited) modularity has ensured that the initial take-up of the CORE curriculum was not confined to a single country or region. Its early adoption included the UK, the US, France, Italy, India, South Africa, Australia and Chile. At the time of writing it is being taught at some 75 institutions worldwide. The quick initial take-up of the course, and the speed with which it moved from development to publication, ensured that publishers became interested in CORE as a novel publishing phenomenon. Eventually the text appeared in print version in late 2017 as an Oxford University Press print text and provided a new source of funding for the project beyond its original grant from INET, a subsequent grant provided by the Friends Provident Foundation and further funding from professional organizations like the Royal Economic Society.

It was not just departments of economics that benefited from the online platforms on which CORE was implemented. Web technologies and multimedia also encouraged a personalized and active engagement by students because of the possibility of providing online quizzes with immediate feedback, video content, interactive graphs that develop step by step with annotations and additional more advanced material that students could use if they wanted. These aspects are integrated into the text and there are more extensive exercises that make use of external web resources and data that students can use to delve further into the material. The content was also free at the point of use and it meant that take-up did not depend on print runs in localized areas.

The decision to make CORE 'online-first' led not only to scalability and the pedagogical benefits sketched above but, as noted previously, a significantly expedited publication schedule (the first beta versions were online and in use in a number of universities worldwide within two years). It also enabled the development of a textbook production process that could deliver both online and print versions from a single markup source and which was not tied to the usual overheads and limitations involved in converting from fixed printed page formats. Indeed the technical production of CORE provides an example of textbook publishing that harnesses the full potential of an online process.

Some of the most important changes that are inaugurated by the CORE project involve the interaction of content changes and pedagogy. As discussed above, CORE was initially motivated by a perceived problem with the content of introductory economics that was being taught to students and its mismatch with the types of knowledge that were needed to understand and comment on real events in the world economy. This situation resulted from the fact that the core theoretical workhorse models in economics had a remarkably resilient history. Much of the core theoretical material taught to first year principles of economics students had not significantly changed over the post Second World War period.

Over the same period, the subject of economics as a field of research had in fact developed, notably into areas such as game theory, behavioural, institutional and information economics. It is true that much of this literature had found its way into economics textbooks but this usually happened through the addition of extra chapters at the end of textbooks without significant alteration to the existing corpus of theory in the main parts of textbooks.[4] One problem with such an approach is that instructors may find they cannot complete both the original material and the newly added material in a standard length course, or indeed that the positioning of the newer material at the end of textbooks signals its relative lack of importance in an introductory course. It is therefore not unusual to see economics programmes where the first year comprises a very traditional exposition of theories without reference to game theory, behavioural economics, institutions or information economics. These aspects are then introduced in more advanced courses.

A more significant problem is that the insights from incorporating institutions, power, information and strategic behaviour into economic reasoning make many of the traditional approaches untenable. To take a single example, the explanation of persistent unemployment is very difficult in a traditional labour market framework in which the market 'clears', in other words, in a situation in which wage flexibility restores full employment at all times. Unemployment can exist in such a setting but it has to be explained on the basis of some labour market frictions that are increasingly difficult to accord with the movement towards unregulated labour markets in many countries. On the contrary, the CORE

[4] See for example Varian (2010) in which chapters on game theory, behavioural economics and information economics are numbered 28, 30 and 37.

approach to labour markets incorporates a structural feature of asymmetry of information in the labour contract that can explain why the wage contract implies a certain level of unemployment.

Central to CORE, therefore, is the belief that the findings from recent research into policy making, game theory, behavioural economics and information economics, to take a few examples, alter our understanding of human behaviour to such an extent that the previous canonical theories can no longer be taught in their unaltered form. The task that CORE faced therefore, was a full integration of the later chapters, so to speak, into the earlier chapters of the standard textbook. This is of course a significant undertaking and it meant that some of the much-loved theoretical frameworks that generations of students have passed through their ranks (the so-called IS-LM model for example) have had to be dropped or demoted. Similarly, the 'perfect competition' model of markets, loved and reviled in almost equal measure and which has been typically set as a benchmark in many accounts of economics, is now relegated to a limiting theoretical case rather than (implicitly) a desired actual state. Markets themselves, which had been the privileged if not the only institutional form discussed at length in introductory accounts of economics, are now configured as one of a set of institutional frameworks (including for example legal settings, democracy and cultural norms) which influence economic outcomes. The reorientation of content along these lines had a number of pedagogical effects that are outlined in what follows.

First, there was an explicit attempt to relate economic models and learning to the lived reality of students. This was partly achieved by extensive use of empirical evidence and data drawn from around the world. There are upwards of 200 datasets included in the resources for CORE. The online nature of the text enabled easy access to these datasets either directly from the text itself or through linking to databases where the original data are stored. Thus, inclusion of material and exercises that used data was much easier and students are encouraged to see the economic models they are learning as applicable to, and testable through, data. The integration of data in this way has also meant that basic data literacy, for example the presentation of data, logarithmic graphs, the nature of correlation and causality and the use of experiments could be incorporated into CORE in a natural way. These aspects of data analysis are traditionally taught separately in a statistical course.

Second, a significant aspect of the re-envisioning of content in the CORE text involves the centrality of institutions and rules within which human behaviour takes place. Moving away from the assumptions of consistently rational behaviour that Krugman criticizes entails an examination of how the wider context of rules and cultural norms affects human behaviour. This is the realm of game theory and behavioural economics, domains in which complex human interactions are modelled and examined formally. It so happens that much of the research in this area involves empirical experimentation in an effort to study actual rather than presumed behaviour. Thus, the subject area lends itself to a pedagogy in which students can play the games themselves in the classroom and learn about human behaviour first hand before theorizing it. Many of these games can also be played online and the use of an online format enables a natural blending of the face-to-face and online environments.

Third, the sequencing of content in CORE may be described as an inversion of the traditional approach. There are a number of inversions at work. One has been mentioned already, that the project is online-first. But more substantially the traditional mode of exposition in economics, which proceeds from simple analytical building blocks (supply and demand, markets in 'perfect' competition, economies with just two people or two countries) towards more complex case studies is here reversed. Most chapters (called 'units') begin with a complex historical narrative and this is then followed by a development of theories and tools which might help to explain it. Indeed, one of the early catch-phrases popular in the community that produced CORE was that the back of the textbook was being brought to the front.

The importance of this sequencing rests in both its motivational function[5] and the fact that it demonstrably situates the economy within a complex reality of which economics on its own can at best provide a partial understanding. Some of the complacency in the subject that troubled Krugman in 2009 is thereby implicitly addressed by this sequencing. The first such empirical case study in CORE examines the vast and rapid rise in income in some countries from the late 18th century onwards after an extremely long period of relative stagnation, the inequality that this surge in income produced within and between countries, and also the impact on carbon dioxide emissions. Many questions follow from these empirical examples, such as what causes economies to boom, why are the rewards so unevenly distributed, why is it so hard to regulate the production of climate change gases? An additional benefit of this inverted sequence is that it mirrors the process of much empirical research which is usually motivated by the need to explain a feature of empirical reality that has thus far escaped explanation. An online platform is a natural environment in which to encourage intellectual exploration and discovery, particularly in the context of a data-based subject and many of CORE's exercises encourage Internet-based exploration.

A further 'inversion' that the CORE approach encourages is the increasingly popular method of classroom 'flipping' in which lecture time becomes oriented towards active problem solving. The relationship between the sequencing of the material and the opportunities for classroom organization are complex but the problem-oriented approach to economics that CORE encourages lends itself to the use of class time for working on problems that were motivated by questions raised in the empirical case studies. Together with the datasets, classroom games and the quizzes in the online resources, CORE situates itself as a text that very well complements a flipped approach to learning.

The success of a flipped approach depends on whether students engage with the material before class time. Understanding student motivations to engage with pre-class tasks is difficult but part of this motivation is likely to rest in whether the material itself is engaging and strikes curiosity in students. CORE's case studies and narratives, and some of the videos, have been developed in such a way that they are likely to interest most students who have decided to study economics. They cover a variety of topics such as equality on pirate ships, the fortunes of truck drivers in the US as the natural resource boom ended and the difficulties of obtaining credit for poor farmers in Pakistan. However, the narratives are intended to pique a student's interest with questions that need answers (why are pirate ships so equal? How can we measure inequality? What effect does credit availability have on the economy? Why do industries disappear and what is the effect of this?) so that the relevant analysis can be developed in class. Experience with the beta versions of CORE suggests that students engage with the CORE material more readily than material used in previous introductory courses. Some universities that have adopted CORE have successfully used multimedia group projects based on some of the case studies to kick-start the pre-reading process.

In September 2017 the first production-ready version of CORE (version 1.0) was released and it was closely followed by the print version published by Oxford University Press. Through the pilot and beta phases of the project it became clear that moving introductory economics online had also potentially changed the way that teaching was being configured in the classroom. There were a series of UK-based workshops in 2016 which introduced the new content and teaching possibilities to interested departments of economics. The experience of the pilot universities has been that CORE's pedagogic potential will be best realized through a training programme that equips instructors and teaching

[5] In line with cognitive goal-setting psychological theories of motivation, such as those which derive from the work of Maslow (1954), explaining these real-world issues provide a challenge towards which the rest of the chapter is devoted.

assistants to depart from a traditional mode of teaching in economics that has long consisted of lectures and supporting tutorial classes in which exercises are solved and discussions take place.

To facilitate this, CORE, together with the UK-based Economics Network, is currently planning a series of training workshops aimed specifically at training staff to teach in more active ways and exploring how the new content, its sequencing and the multimedia and online modes in which it is delivered can complement a blended teaching strategy that makes full use of enquiry-based and participatory learning. The workshops will aim to provide a holistic view of course delivery such that the taught content, preparatory student work and the use of class time are mutually complementary. In this way, CORE will have effected a number of innovations which spread from the make-up and functioning of an international authorial community, the unique publishing process, the new approach to and sequencing of economics content, the modularity and the innovations in classroom practice.

Most recently, a new CORE project has developed from the original. This is funded by the Nuffield Foundation and entitled CORE for the Quantitative Social Sciences. This new project involves a refashioning of the CORE material to make it suitable as a course in data literacy and the economy for non-economists. It is likely that the first courses that will use this new material (at the University of Bristol) will begin in September 2018. As with the original CORE this is an extremely rapid production schedule facilitated by the online production process that CORE has developed.

To conclude, there are a number of emerging lessons from the CORE experience that might inform other disciplines in the move towards effective online pedagogies. First, a bold approach to content may be needed to challenge the linearity of conception that often inhabits instructional texts arising from print medium and the delivery of face-to-face lectures. Second, online technologies can be fruitfully used by authorial teams in the distributed production of new educational resources and such an authorship model can benefit greatly, both in terms of expediting production and in creating a coherent overall style and vision, from a strong central coordinating leadership together with regular face-to-face contact. Third, that disciplines which have traditionally used a step by step logical approach to the development of the taught material may benefit from inverting the traditional sequence so as to begin with complex phenomena rooted in the real-world experiences of students. This not only spurs student motivation, which may be more important where face-to-face contact is reduced, but also has the benefit of allowing a more modular approach to content because theoretical and foundational material can come later and can be selectively used by instructors and students. Such modularity is particularly well suited to online delivery. Finally, the CORE project and its positive reception by students demonstrate that a combination of technologically simple interactive tools like graphs which build up sequentially with explanatory notes, videos and multiple choice questions with detailed feedback, can be powerful when used together in complementary ways.

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