Critical thinking, curriculum mapping, and economic education: an essay

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Abstract: This essay argues that the economics profession must better define what critical thinking is, how it is embedded in our teaching, and how that teaching incorporates both the breadth and depth with which those topics are covered. Doing so will allow economists to: 1) identify and remediate gaps in the depth or breadth of students' critical thinking skills as they are used in economics; 2) more effectively convey economic concepts to students in the classroom; 3) promote greater understanding and appreciation for different schools of economic thought.

Keywords: critical thinking; teaching; curriculum mapping; prerequisites.

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1 Introduction

As a social science, economics uses critical thinking as a tool to conceptualise economic concepts, and subsequently apply those concepts to policy issues. The economics education literature focusing on the use of critical thinking in economics courses is both broad, (e.g., Borg and Borg, 2001; McCannon (2007; Beckman and Stirling, 2000) and deep, (e.g., McEachern, 1994; Jones, 2007; Underwood, 2013). This literature spans all levels of education – from high school through doctoral work – with most focusing on undergraduate education, especially at the principles level.

Critical in the interpretation and evaluation of this literature is the distinction between the development, and the use, of critical thinking skills. Jones (2007) and Barnett (1997) posit that critical thinking is comprised of three dimensions:

- *Logical reasoning* as it is formally taught within the context of a philosophy course. The emphasis here is on the taxonomy and use of a full range of skills that are used to evaluate the merits and detriments of any type of argument.
- *Critical thought* which focuses on evaluating arguments made within the context of a specific discipline.
- *Critique or meta-criticism* which entails the evaluation of arguments that are inter-disciplinary in nature.

While other taxonomies are available in the literature, we adopt that of Jones (2007) and Barnett (1997), who found that most economics courses, especially those taught at an undergraduate level, make extensive use of critical thought and critique. Courses taught from a purely neoclassical perspective likely engage primarily in critical thought; for example, characterising and assessing the benefits/costs of a change in the minimum wage, or evaluating the benefits/costs of changing Federal Reserve policy (open market operations, reserve requirements, etc.). Courses taught from a pluralistic perspective emphasise the evaluation of economic policies within a larger process of social provisioning, and thereby likely engage in both critical thought and critique (Underwood, 2013). Very few undergraduate economics courses formally and comprehensively address formal logical reasoning, the first and most fundamental dimension of critical thinking, in their courses.

2 The challenge

To illustrate the challenge of teaching critical thinking (and more specifically, the logical reasoning dimension of critical thinking) discussed in this manuscript, consider the context of teaching principles of microeconomics and macroeconomics at the undergraduate level. We choose this context because it represents many students first (and perhaps only) introduction to the economics discipline. Additionally, as Knoedler and Underwood (2003) note, principles courses are crucial in generating and retaining economics majors, and by extension, future economists.

As an analogy, consider the foundational tool of algebra, as it is used in principles of economics courses. Based on our experience, most principles instructors do not teach the fundamentals of algebra in their courses. Rather, they *use* it as a means to an end, and

they expect students to be sufficiently knowledgeable about algebraic principles *before* they enter the course and/or *before* they cover economic concepts that rely on the use of algebra. Their rationale is that algebra is taught in high school, often as a requirement for graduation. For students who did not receive sufficient training in algebra in high school, algebra is taught extensively at the undergraduate level, and a college-level algebra course may serve a co-requisite (or perhaps more often, a pre-requisite) for principles of economics courses. Economics instructors are therefore assured that their students have the depth and breadth of algebraic principles, as well as an introduction to higher order learning in algebraic principles – especially analysis and synthesis, as defined by Bloom's Taxonomy – before learning economic concepts. This gives instructors full liberty to introduce economics concepts within the context of algebraic expressions with the full expectation that students can grasp both the explicit aspects of an economic concept, as well as those aspects derived implicitly through the use of algebraic reasoning. As an example drawn from neoclassical economics (NCE), instructors typically introduce the concept of an own-price elasticity by explaining the explicit economic intuition underlying this concept. Instructors subsequently (and implicitly) use algebra to establish a formal relationship between an own-price elasticity and slope of the demand curve for a given product.

Logical reasoning, as defined by Jones (2007) and Barnett (1997) is a broad set of formal, foundational tools (much like algebra and statistics) that are used to evaluate an argument's merits/demerits. Within economics, logical reasoning is applied to evaluate the merits/demerits that attempt to explain or evaluate social provisioning processes. However, no such broad, pre/co-requisite course is taught on logical reasoning. Even in Catholic colleges and universities – where logical reasoning courses historically formed a core component of classical, liberal arts/general education – traditional, formal logic courses have been supplanted by courses emphasising other learning outcomes (Jaspers and Seuren, 2016). As examples, many college and university general education requirements have de-emphasised formal logical reasoning in favour of other learning outcomes, including but not limited to using and understanding technology, understanding and appreciating diversity, and understanding and promoting personal wellness. While these other learning outcomes are very important, and may introduce students to other dimensions of critical thinking, pressure to minimise general education requirements often leads to a prioritisation of these outcomes over the development of formal logical reasoning skills. As a result, student background in formal logical reasoning may be lacking (Kennedy and Swetland, 2010; Jaspers and Seuren, 2016).[1] In the absence of a formal logical reasoning course, economics instructors must *assume* students have exposure to a broad set of logical reasoning skills. This assumption is not supported by recent academic trends or the academic literature, as demonstrated by the plethora of faculty development programs aimed to remediate and enhance critical thinking skills, as well as a general lack of understanding about *when*, *where*, and *how* students acquire logical reasoning skills in college (Haynes et al., 2016; Huber and Kuncel, 2016). This becomes especially problematic when economics instructors not only *assume* that students have sufficient mastery over some or all of these logical reasoning skills, but *immediately* attempt to apply these logical reasoning tools within the contexts of critical thought and the critique of economic policy. Without formal logical reasoning skills, students may not fully grasp the intricacies of policy argument. This may lead to a superficial understanding of the attributes and detriments of a particular economic policy,

or perhaps worse, the acceptance of a fundamentally flawed policy analysis as true or correct.

The aforementioned problem is exacerbated by faculty who focus on the development of critical thinking skills as a whole, rather than on the development of specific dimensions of critical thinking. Faculty teaching principles level economics courses may, quite correctly, emphasise content that makes use of critical thought and/or critique. They may also focus on specific cognitive biases that may contribute to poor logical reasoning, and more specifically poor critical thought and critiques of economic policies (Underwood, 2013). These are certainly valid dimensions of critical thinking as it is defined in the vernacular (Lai, 2011). When engaged in larger pedagogical discussions with other faculty, such instructors may claim that they teach critical thinking. These claims may be partly true, but are incorrect in their entirety, because they fail to address all three dimensions with sufficient depth and breadth (Mok and Yuen, 2016). Such claims are, in fact, violations of sound logical reasoning (i.e., errors of generalisation)! Perhaps more insidious is that such claims pre-empt a discussion of what logical reasoning skills are foundational to principles-level economics courses; and the subsequent use of logical reasoning within those economics courses.

Should a discussion of this nature occur, it is necessary to address how the various dimensions of critical thinking, and especially formal logical reasoning, not only influence our understanding of economic phenomena, and but also the framework in which economists teach the subject to their students. This critique is especially relevant when teaching (or using) economics using a purely NCE framework. In its purest form, NCE claims to present the field of economics as an objectively posited field of human decision-making, frequently modelled using mathematics and statistics, and in doing so completely ignores and/or misuses major areas of logical reasoning.

NCE generates a number of adverse consequences, one of which is a conflation of inductive versus deductive reasoning (Johnson, 1996). As a social science, economics is (or should be) fundamentally empirical in nature. Economists observe social processes as they occur, and use those observations to draw more general conclusions about them. This is inductive reasoning, which comports with statistical inference and generally accepted scientific methods. NCE claims to be highly empirical. In making this claim, NCE also claims to makes extensive use of inductive reasoning, as all inferential statistical arguments are inductive in nature. The fundamental issue in the evaluation of this claim is *how one generates testable hypotheses concerning economic phenomena*. Generally speaking, NCE uses two possible approaches, both of which may contravene logical reasoning.

One approach used by NCE is to derive hypotheses iteratively through empirical observation. Take, for example, labour market theory, and a simple chart showing supply and demand for labour. Seemingly, this is a straight-forward proposition. However, the elements underpinning the chart began as repeated empirical observations that formed the basis of any inference or inductive supporting argument. The inductive argument will find its way to logic as a major premise in a syllogism. The caveat is: *the strength and validity of the major premise is based totally on the quality of the inductive argument, which is in turn reliant upon the validity of the empirical observations*. But most economists do not generate their own data, especially within the context of an appropriate experimental design. Without a structure to ensure data quality and consistency, one must rely on increasingly complex econometrics (which contains its own set of assumptions, which may or may not be appropriate given the data collection process at hand) to correct

the biases inherent in observational data drawn from disparate sources (Stock and Watson, 2007). In essence, without carefully and appropriately collecting the data upon which an inductive argument is built, an economic proposition can be a logical house of cards.[2] Students require basic epistemological logical tools to appropriately evaluate economic concepts as applied to concrete circumstances.

As a second approach, NCE posits the use of mathematical models, whose solutions and comparative statics can be used to generate testable hypotheses. The challenge here is that many of the mathematical models built by economists are not inductive support arguments[3], but rather applications of deductive demonstrations (Johnson, 1996). While deductive and inductive logical processes may exhibit consistency, there is no guarantee that consistency exists between the assumptions of the model, the assumptions under which empirical methodology exists, and the assumptions under which the data are collected. Each of these activities may, when considered individually, be internally valid and consistent. However, they may not be consistent across the theory; data, and statistical methods.[4] Again, basic epistemological logical tools are required for students to appropriately evaluate the consistency of each component of the research process.

A second adverse consequence from the NCE approach is *Argumentum ad Verecundiam*, the argument from authority, a common and tempting logical fallacy. If a recognised expert has opined on a particular economic theory, the tendency is to treat this opinion as received wisdom. This is especially relevant when using mathematical or econometric models to either create or test economic hypotheses. Many of the underlying assumptions are posited as purely mathematical or statistical regularity conditions necessary to ensure a stable, optimal, unbiased, and/or efficient solution, often without an extensive explanation as to how those assumptions *actually relate to human behaviour and social provisioning*. Once a research study using such assumptions is accepted by the literature, (i.e., typically published in a peer-reviewed outlet), those conditions are assumed to be correct, without further critical analysis. This leads to the formation of 'epistemic communities' of thought, analysis, and policy making (Hirschman and Popp-Berman, 2014). Such modelling, when stripped of the discipline of logical argumentation, becomes simply polemics or persuasion. Put differently, mathematics is used *precisely* because it presents a simple solution and avoids logical analysis (including critical analysis) of the assumptions underlying the model (Jones, 2020). Pertaining to NCE, the use of mathematical modelling is often used to tacitly (yet authoritatively) impose a neoliberal belief system within economic analysis (Mudge, 2008; Henry, 2010; Nik-Khah and Van Horn, 2012; Ramey, 2015).

Two caveats should also be noted here. First, unlike NCE, heterodox economists rely extensively on a broader set of logical reasoning skills, including rhetoric, and avoid many of the aforementioned pitfalls. However, heterodox economics who shun mathematics (and/or applications of symbolic logic) altogether may also create gaps, albeit different ones, in their coverage of logical reasoning. As Lee (2010) notes, there is nothing inherently wrong with including mathematics as a fundamental tool to explain economic phenomena using a heterodox perspective. Moreover, if the logic underlying an economic concept is flawed, the use of mathematics 'will not save it' [Lee, (2010), p.207]. A pluralistic approach to understanding and teaching economics may provide a better avenue to address the use of logical reasoning in economics.

Second, while our critique is focused on the economics discipline, it is also important to note that other academic disciplines are also subject to this critique. Faculty in English

and communications may emphasise rhetoric and rhetorical fallacies at the expense of symbolic logic and truth-function logic. Physicists and engineers, like economists, all too frequently de-emphasise rhetoric in favour of symbolic logic and mathematics. A re-examination of the foundational logical reasoning skills for a particular discipline, as well as an assessment of the use of such skills in each of these disciplines, is a worthwhile endeavour.

3 Towards a solution

The ideal solution to improve critical thinking in economics education is to ensure a stronger, more accurate, and more precise link between economics and formal logical reasoning. At a minimum, the economics discipline must move away from the vernacular use of the term critical thinking, which is both vague and ambiguous. Instead, it must focus on the relationships between economic content and the specific dimensions of critical thinking (logical reasoning, critical thought, and critique). Economics must further adapt a generally accepted, precise, and comprehensive framework – including formal taxonomy, scope of application, and depth of application – to describe the formal tools used to evaluate arguments. While the Jones (2007) and Barnett (1997) taxonomy may be useful in this endeavour, it is neither exhaustive nor inherently superior to other taxonomies. We call for further research to address this issue.

Once this framework has been established, it is important for economists to create a detailed 'curriculum map' linking each learning outcome (a concept or skill, inclusive of the depth of learning of that concept or skill) in an economics course to the newly established framework (Al-Eyd et al., 2018). We argue that undergraduate principles of micro/macro economics courses are optimal starting points because they are, for most students, the first (and, for non-economics majors and minors) and only introduction to the discipline. Thus, mapping principles of economics courses is an extremely important and impactful endeavour. We note that curricular mapping can be conducted in a very straightforward manner at the level of the individual course. For each chapter in the instructor's principles course, list the learning objectives. For each learning objective, reflect upon the logical reasoning framework. As an example, under Jones' (2007) and Barnett's (1997) framework, what formal logical reasoning tools must students already know and use, (i.e., rhetoric, credibility, inductive versus deductive reasoning, etc.) to evaluate an economic argument? Does the evaluation require critical thought, critique, or both? Lastly, what depth of critical thought and/or critique is sufficient to ensure adequate student learning within the course? Compiling and integrating curricular maps across courses allows for a much larger map of a major or degree program.

Third, one must assess students' grasp of logical reasoning (as defined formally under the aforementioned framework) prior to beginning a principles course. Doing so allows the instructor to identify and possibly remediate deficiencies prior to introducing economic concepts that make use of those elements of a formal critical thinking framework. In doing so, the instructors embed a logical reasoning framework within their economics course. Assessing student learning throughout the course, given the pre-course assessment, may provide instructors with vital context about how to alter the course to improve student learning. We note in passing that course revisions are just as likely to gain efficiencies, (i.e., save time by allocating less time to material that students grasp intuitively because they understand the logic behind the economic concept being taught)

as inefficiencies (i.e., teaching the tools of logical reasoning, critical thought, and critique instead of teaching purely economic content). But in all cases, if students have a stronger understanding of the logical foundations of economics, they are more likely to not only improve their understanding of the course material, but also be more engaged in classroom activities because they are more prepared to undertake activities requiring critical thought and critique. On a related note, students with a stronger foundation in logical reasoning are also much more likely to grasp how (and why) differences in schools of economic thought generate very different policy recommendations. This will help promote pluralism in economic education by promoting a greater understanding and appreciation for different schools of economic thought.

Lastly, and perhaps most importantly, if students enter a program of study with deficiencies in logical reasoning, the previous activities, undertaken consistently throughout the economics discipline, create a compelling case for additional, standardised prerequisites for that program of study. Logical reasoning deficiencies should be assumed to be present in most cases. The only real question is the level of the deficiencies and, if they are small enough, the use of techniques during class to address the issue. Instructors have limited time and considerable expectations for content coverage. If gaps in logical reasoning are small and isolated, it is reasonable for faculty to teach a small set of purely logical reasoning techniques within the context of a single economics course, and to show how those techniques inform the evaluation of economic arguments. For example, during a labour theory presentation, abbreviated case studies could be introduced showing conflicting conclusions about the effects of minimum wage statutes. Survey data and survey design could be examined to illustrate possible reasons for conflicting results. However, if those gaps are extensive, it may be necessary to establish a prerequisite course on logical reasoning, similar to algebra requirements for principles of economics courses. Indeed, if such gaps in student logical reasoning abilities exist, they likely exist in other disciplines as well, and the logical reasoning course may be adopted by other majors. In this way, the burden for the course does not fall squarely on the shoulders of the economics discipline, but on all disciplines that derive from the liberal arts and sciences tradition.

4 Conclusions

This essay argues that the economics profession must, as a whole, more accurately and precisely define what critical thinking is, how it is embedded in our teaching (especially, but not limited to, teaching principles of economics courses), and how that teaching incorporates both breadth of critical thinking topics, as well as the depth at which those topics are used in our teaching. We call upon the economics profession to create curriculum maps describing the interrelationships between critical thinking (as a foundational skill set) and economics. Doing so will allow economists to identify and remediate gaps in the depth or breadth of students' critical thinking skills as they are used in economics. It will also allow economics instructors to more effectively convey economic concepts to students in the classroom and promote greater understanding and appreciation for different schools of economic thought.

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Notes

1 Formal logical reasoning courses may exist (especially as 'introductory logic' courses), but they are taught much less regularly at the undergraduate level and are not listed as pre or co-requisites for undergraduate principles of economics courses.

2 See Lee and Cronin (2016) for a discussion of how to appropriately collect data within the context of inductive inference.

3 One notable exception is the use of dynamic game theoretic models, which rely on principles of backward induction to generate solutions (Dixit and Skeath, 2004).

4 What is most curious about the use of inductive versus deductive logic in economics is that inductive arguments, being supportive in nature, can never be proven to be valid or invalid. As such, inductive reasoning is best suited towards the development of hypotheses. Deductive demonstrations can be proven valid or invalid, and thus are best suited to confirm or refute hypotheses. Johnson (1996, p.292) argues that the most appropriate method is 'inference to the best explanation', which incorporates elements of both forms of arguments and allows for both the positing and evaluation of hypotheses.