

WHY DOES NO-ONE TEACH UNDERGRADUATE MACROECONOMICS USING THE DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM MODEL?

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Abstract

This paper argues that the reason that the DSGE model, which has proved so successful in convincing academic economists of its value, has made relatively few inroads into the undergraduate teaching sphere is that it fails to allow for the development of higher order educational objectives in students. The qualities which make it attractive to academics, such as the purity of its assumptions and its sound microeconomic basis, have little resonance with undergraduate students. Instead, the qualities of the neo-Keynesian model, such as its ability to incorporate 'real-world' institutional features and the ease with which it can be used to develop higher order skills and applications, prove much more attractive.

Key Words: Macroeconomics, DSGE models, pedagogical approaches.

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Introduction

Since the award of the Nobel prize for economics to Finn Kydland and Edward Prescott in 2004, for their work on dynamic macroeconomics, there has been no shortage of papers praising their work and recognising the impact that it has had on the economics profession. Their 1982 *Econometrica* paper, "*Time to Build and Aggregate Fluctuations*", has been the focus of much of the attention. This paper proposed that aggregate fluctuations in economic activity could be adequately explained as the outcome of the decisions of individual agents operating in competitive markets in which prices were flexible and moved instantly to clear markets. This literature rapidly became known as Real Business Cycle (RBC) theory because of its emphasis on productivity shocks as the driving force behind movements in the aggregate economy. More recently however, the preferred descriptor has become Dynamic Stochastic General Equilibrium (DSGE) theory. This has reflected the reintegration of a monetary sector into these models and, to a limited extent, the introduction of some degree of stickiness in wages and prices.

The central role of the Kydland and Prescott paper is recognised in a recent survey paper by Rebelo (2005) who states that "*It is not surprising that a paper with so many new ideas has shaped the macroeconomics research agenda of the last two decades*". The sense that this is a seminal piece of work which continues to influence the direction of current research in macroeconomics is enhanced by a further statement from Rebelo that "*..the best way to celebrate RBC models is not to revel in their past, but to consider their future*".

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Rebello's statements are indicative of the direction in which research in macroeconomics has gone since the early 1980s. It would not be too far from the truth to say that macroeconomics research which is not based on the analysis of optimising agents with rational expectations operating in competitive markets, is simply no longer taken seriously by mainstream macroeconomics researchers. This reflects a remarkable shift in paradigm for the discipline. Even in the early 1980s the dominant paradigm was that of the neo-classical – Keynesian synthesis (henceforward, the neo-Keynesian model). Innovations, such as the assumption of rational expectations, had left their mark, but there remained the idea that the behaviour of the macroeconomy could not be captured fully by the tools of microeconomics and that a separate macroeconomics discipline was necessary.

Despite the triumph of the DSGE paradigm among academic economists, it has however, had surprisingly little impact among policy makers and in the teaching of economics. In a recent paper Mankiw (2006) argues that "*The sad truth is that the macroeconomic research of the past three decades has had only minor impact on the practical analysis of monetary or fiscal policy*". Similarly, with reference to the teaching of economics, Mankiw argues that "*..the basic framework that modern students learn to make sense of the business cycle is one that would be familiar to an early generation of Keynesians*". This argument is based on the treatment of macroeconomic issues in the textbooks used for undergraduate economics programmes, which remains, overwhelmingly Neo-Keynesian. The only exception to this treatment in mainstream textbooks is that of Barro (1984)², who attempts to provide a treatment of the DSGE at a level suitable for undergraduates. However, Mankiw goes on to argue that "*..the new classical revolution in pedagogy that Barro hoped to inspire never took off, and the Barro text did not offer significant competition to the dominant textbooks of the time*".

The purpose of this paper is to argue that the failure of the new classical approach (and even more so the DSGE model) to achieve the same dominance in the teaching of macroeconomics as it has in macroeconomics research is no accident. Essentially the argument of this paper is that DSGE theory has little or nothing to offer undergraduate students or their instructors. The features that make it attractive to graduate students – its mathematical complexity and its consistency with the axioms of rationality and price flexibility – render it deeply unattractive to undergraduate students, who generally prefer models which are richer in policy implications and less reliant on extreme assumptions. In pedagogical terms the DSGE is a sterile approach which can never rival the much criticised, but ultimately more fruitful, approach of the neo-Keynesian model.

The plan of the paper is as follows. In the next section, I contrast the DSGE model and the neo-Keynesian model in pedagogical terms using Bloom's taxonomy of educational objectives. My argument is that the DSGE is limited to the lower levels of the cognitive domain. A teaching strategy based on the DSGE model necessarily emphasises knowledge and comprehension but leaves little or no room for application, analysis, synthesis and evaluation. In contrast, the neo-Keynesian approach allows for the full range of cognitive functions to be considered. Section Three argues that, not only does the DSGE model limit what can be taught in specific macroeconomics classes, it also fails to generate the valuable linkages into other subject areas such as econometrics, which are characteristic of the neo-

² More recently Barro (2007) has produced a new textbook which embodies the DSGE approach. In a review in the Times Higher Educational Supplement (March 2008), Nicolas Rau argues that "this is a book which will revolutionise the teaching of macroeconomics". The cynic might argue that, since Barro's first attempt had nearly 25 years to do this and failed, the chances of the second attempt succeeding are rather less than certain.

Keynesian approach. The final section gives conclusions and some speculation about how undergraduate macroeconomics may evolve in the future.

Teaching Macroeconomics with the DSGE Model

Bloom's (1956) taxonomy of educational objectives provides a framework within which we can assess alternative pedagogical strategies in macroeconomics. Bloom divides educational objectives into three domains: these are the affective, the psychomotor and the cognitive domains. The affective domain is concerned with emotions and values, the psychomotor domain is concerned with physical coordination and the manipulation of objects while the cognitive domain is concerned with the knowledge and understanding of a particular topic. Most academic economists would naturally think of themselves as operating primarily in the cognitive domain though, as I will argue later, there are important parts of teaching economics that fall into the territory of the affective domain.

Within the cognitive domain there is a hierarchical set of skills which the teacher seeks to transmit to the student. These start with knowledge of the topic, then proceeds to comprehension and then finally, to a series of interrelated skills in which the student uses the knowledge he/she has acquired. These higher level skills include the ability to apply the knowledge to new situations, the ability to analyze and synthesize the knowledge in new ways and the ability to critically evaluate the topic under consideration. These skills are hierarchical in the sense that it is necessary to acquire the lower level skills before proceeding to the higher level skills.

Consider the 'traditional', or neo-Keynesian, treatment of aggregate demand which, as Mankiw has noted, still provides the underpinning for most intermediate level teaching in macroeconomics. In the simplest version of this model, with no government and no overseas trade, the goods market finds an equilibrium when planned savings and planned investment are equal. In developing this model, the instructor normally emphasises that savings and investment decisions are taken by separate groups of agents. Decisions on savings are taken by households with income (and possibly the interest rate) acting as the main determinants. Investment decisions are taken by firms who are influenced by the rate of interest and expectations of future profits, with current income having a relatively minor influence. The main equilibrating force is the income level with the interest rate playing a secondary role (in contrast with the Classical model in which the interest rate equilibrates the market for loanable funds at the full employment level of income).

The account of the goods market given above may appear excessively simple, or even just plain wrong, to the modern economic theorist. However, it emphasises an important feature of real world markets which is obscured by the DSGE approach. Because savings and investment decisions are taken by different groups of agents, there is an important coordination problem. The DGSE model blurs the distinction between savings and investment by making it a simultaneous decision taken by a representative household. By giving firms an explicit role in the process, the neo-Keynesian model marks an important step towards 'realism' in the underlying assumptions of the model. Of course, as Friedman (1953) has argued, realism is not, in itself, a pre-requisite for a model to be useful. In this case however, the separation of savings and investment decisions makes a radical difference to the behaviour of the model and is therefore a key assumption. The neo-Keynesian model also enables the instructor to discuss the important aspects of the institutional structure of the economy with students as the macroeconomic framework is developed. This contrasts with the DSGE model in which all the institutional structure is assumed away in favour of an intertemporal optimising procedure which gives rise to an Euler equation.

Next, consider the way in which these two approaches can be used to develop higher order skills. The neo-Keynesian approach can be extended quickly and easily to bring in complicating factors such as the government and the overseas sector. In fact, such extensions are commonly used as tutorial exercises which allow students to develop the higher order 'application' skill in Bloom's cognitive domain. Such extensions are much more difficult with the DSGE model in which both the objective function and the budget constraint must be modified in order for the model to be generalised.

The role of the realism of the underlying assumptions of the models used in teaching deserves further comment. Since Friedman's classic 1953 essay, it has been widely accepted that realism is not, in itself, a defining requirement for a good model. What is important is that a model be 'fit for use', in the sense that it generates useful predictions which conform to real world experience. As an example, Friedman discusses the assumption of perfect competition in the market for cigarettes. The assumption of perfect competition arguably generates usable results when analysing the impact of a sales tax. Thus, as a simplifying assumption it is useful, even though it is clearly unrealistic in the traditional sense. However, if the objective is to analyze the impact of wartime price controls, then the assumption of perfect competition generates misleading results and is therefore no longer a useful assumption. The fact that an unrealistic assumption may be useful in one context, but not in another, is one of the hardest things to communicate to undergraduate students.

Now, the assumptions of the DSGE are clearly unrealistic but the question is whether or not this lack of realism matters. Given Friedman's discussion, we can only judge this on the basis of the uses to which the models generated will be put. Here the differences between a teaching model and a research model could not be more stark. For teaching, we wish to develop models which describe the operation of the macroeconomy and allow qualitative predictions to be made. We also wish to present models which enable students to develop higher order skills such as application, analysis and synthesis. The neo-Keynesian assumptions clearly satisfy these criteria but the DSGE assumptions do not. In contrast, the objective of research models is to generate models with predictive power that satisfy a set of axioms which are consistent with the tacitly accepted rules of the profession. Since the profession now seems to have accepted the new classical agenda that all models should be based on the assumptions of intertemporal maximisation by atomistic agents operating in competitive markets, it follows that DSGE assumptions fit the criteria well but the neo-Keynesian assumptions place these models immediately outside the pale.

Krugman (2000) has an interesting discussion of the use of simple (neo-Keynesian) models in both an educational setting and by professional economists. His view is that the flexibility of the simple models more than compensates for the crudity of some of their assumptions and it is for this reason that they have survived. Krugman's view of models is as vehicles for 'thought experiments'. The more complex the model, then the more difficult it becomes for it to act in such a way. His conclusion is that the *ad-hoc* neo-Keynesian models will continue to survive until the DSGE framework can generate working models which perform this function. It is interesting to note that Krugman's assessment of the value of simple models extends to their use by professional economists as well as in a purely educational setting.

Although the DSGE may not have achieved the inroads into the teaching of undergraduate economics which its proponents would have hoped for, it is true that it is increasingly taught as a key part of postgraduate programmes, both at Masters level and in

those institutions which put on taught PhD modules³. This reflects the dominance of the approach in the academic journals and the need to prepare graduate students with the skills necessary to publish in the journals which are important for their careers. However, even here it is possible to argue that the chief gains of the approach have not been in the development of higher order skills in the cognitive domain, but rather in terms of the affective domain. Much of the time and energy devoted to the DSGE in graduate programmes goes into the lower order cognitive skills of knowledge and understanding, along with a determined effort to convince graduate students that this is the only way to think seriously about macroeconomics. In other words, the teaching of the DSGE model at graduate level is often focussed on the affective domain in that one of its primary objectives is to convince students that this is the only game in town⁴.

There is an extended discussion of the targeting of the affective domain by advocates of the DSGE approach in a recent book by Colander (2007) that documents how this approach has become dominant in US graduate schools. Elsewhere, Colander (2008) argues that the dominance of the DSGE model in academic circles lies more in its facility for generating papers which lend themselves to mechanical assessment through the peer review process, and which contribute to the career advancement of young economists, rather than in any genuine superiority of insight or empirical performance. He claims that the neo-Keynesian framework and the LSE approach to econometrics (see next section) suffer in comparison with the DSGE model in terms of the ‘replicator dynamics’ of the economics profession. This is similar to the reasons given by Johnson (1971) for the success of the monetarist revolution of the 1970s who argued that one of the key elements in this success was the ability of the monetarist model to generate empirically testable hypotheses which could be investigated by graduate students as the basis of a PhD thesis.

Linkages with Other Areas of Economics

As someone who has taught intermediate econometrics for some years, I have reason to be grateful for the neo-Keynesian model. Simple relationships such as the consumption function, the accelerator model of investment and the demand for imports, provide useful examples for the instructor which can easily be investigated using national accounts data. The fact that the DSGE model does not generate such examples so easily is not an argument against the validity of that model, however, it may help explain the reluctance of those responsible for the design of undergraduate economics programmes to abandon the neo-Keynesian alternative.

The DSGE model has certainly generated some interesting quantitative work. Both the calibration of models and the methods used to solve complex non-linear models have

³ Even at the graduate level, there remains a core of traditional macroeconomics which many instructors continue to teach as a vital part of the toolbox of techniques for economists. For example, Paul Krugman (2000) provides a spirited defence of traditional macroeconomics where he argues that “we need small, ad-hoc models as part of our intellectual tool-box”. Similarly, Blanchard and Fisher (1989) include a chapter entitled ‘Some Useful Models’ which covers much of this material but discretely relegates this to the latter part of their text.

⁴ Lucas (1980) argued the following “One cannot find good, under-forty economists who identify their work as ‘Keynesian’. Indeed, people take offence if referred to as ‘Keynesians’. At research seminars, people don’t take Keynesian theorizing seriously anymore; the audience starts to whisper and giggle to one another”. This statement is indicative of a rhetorical tactic rather than a scientific argument. Lucas is here seeking to embarrass into silence those who would take a contrary position to his own. In other words he is seeking to generate changes in the affective domain for his readers. By ridiculing even the thought that an alternative approach might be useful he is seeking to establish the dominant position of the new orthodoxy.

proved exciting new areas for graduate students. One only has to see the collection of essays in Marimon and Scott (1999) to see how this approach is attractive to those working at the cutting edge of the discipline. However, these methods offer little to the teacher of intermediate econometrics. This reflects partly an explicit rejection of traditional econometric methods by practitioners in this field.

The rejection of traditional econometric methods by the DSGE research programme derives from its emphasis on the use of ‘deep’ parameters reflecting the tastes of agents and the production technologies available to industry. The implicit argument in much of the DSGE literature is that the parameters estimated by traditional econometric methods are necessarily reduced form parameters which are inherently unstable as outlined by the Lucas (1976) critique⁵. Given this instability, it is argued that there is little point in building models based on unstable foundations, and it is therefore better to construct models in which the ‘deep’ parameters are imposed on the basis of microeconomic studies of individual household or firm behaviour. While there is some logic to this argument, it is also inherently dangerous because it removes DSGE from the set of testable models. If the parameters are imposed then the only option available to the investigator is to compare the performance of the model with real world data i.e. compare the real-world sample moments with those generated by the model. However, since other models are not considered, it is difficult to see how the DSGE can be rejected, other than by the grossest of inconsistencies with real-world observations. While it is possible to imagine the DSGE being rejected by such a process, I have yet to see this happen. Instead, any deficiencies of the model are classified as ‘puzzles’ which can, in principle, be solved in a more complete model or else are patched-up by appropriate ad-hoc adjustments, such as the assumption of serially correlated technology shocks.

Another remarkable feature of the DSGE research programme has been the way in which it has effectively sidelined the serious scientific approach to applied econometrics developed by David Hendry and various co-workers. Since the early 1970s, the ‘LSE school’, as it became known, pioneered the systematic investigation of econometric relationships using a combination of economic theory for the specification of long-run relationships and data driven short-run dynamics. The central idea is that economic theory is a useful guide to the determination of long-run equilibrium relationships, but that it tells us little about short-run adjustment, which is driven by costs of adjustment, rule of thumb behaviour and a variety of other factors. Equations estimated using a tightly defined economic theory are almost always misspecified. Therefore the LSE approach recommends estimating a general unrestricted model and then testing restricted versions against this to obtain a ‘parsimonious specification’.

Of course, the LSE approach is incompatible with the DSGE research programme. Firstly, and most importantly, the LSE approach allows for the possibility that the economic theory underlying the model being estimated may be rejected by the data. Whether one agrees fully with the LSE approach or not, it has to be recognised that this is an essentially scientific methodology. In this approach economic theories generate tentative hypotheses which may, or may not, be consistent with the data. This is incompatible with the DSGE research programme, in which theoretical relationships are treated as axioms rather than tentative hypotheses to be investigated. Secondly, the LSE approach concentrates on relationships

⁵ The empirical importance of the Lucas critique is also open to debate. The breakdown of econometric relationships following the OPEC shock of the mid-1970s is often quoted as evidence of the critique in action. However, it is difficult to see any models, including DSGE models, surviving a shock of this magnitude. In addition, Ericsson and Irons (1995) have found no practical evidence of parameter instability of the kind predicted by Lucas.

between observable empirical quantities rather than the latent variables which comprise the DSGE model. Finally, the LSE approach emphasizes the idea of ‘encompassing’ by which models are judged by their ability to explain the results of other models. Since consideration of alternative models is not part of the DSGE methodology, there is no basis for judging how well these models encompass alternative approaches which are ruled out on the basis of their underlying assumptions. The failure to engage with the LSE approach produces a curious vacuum in DSGE discussions of empirical methods. Recent textbooks by DeJong and Dave (2007) and Canova (2007) simply make no reference to the LSE school⁶.

What seems to have occurred is that there has not only been a division in theoretical approaches between the neo-Keynesian and DSGE schools, but there has also been a division in the empirical research methods they employ. This is dangerous because econometrics has traditionally played the role of a testing ground in which rival macroeconomic approaches can be compared on the basis of the data. This was certainly true of the monetarist-Keynesian debates of the 1970s and those between the Keynesian and the new classical school in the 1980s. If the DSGE really is untestable using standard econometric techniques, then it is difficult to see how it can qualify as a scientific theory. This may help to explain its lack of appeal to teachers of economics who, by and large, are sensitive to accusations from students that their subject matter lacks scientific credibility.

Conclusions

This paper has argued that it is no surprise that the DSGE model, which has proved so successful in convincing academic economists of its value, has made relatively few inroads into the teaching sphere. The qualities which make it attractive to academics, such as the purity of its assumptions and its sound microeconomic basis, have little resonance with undergraduate students. Instead, the qualities of the neo-Keynesian model, such as its ability to incorporate ‘real-world’ institutional features and the ease with which it can be used to develop higher order skills and applications, prove much more attractive. To some extent the neo-Keynesians can justifiably say “we told you so”. For example, James Tobin, writing in 1980, argues the following:

“One view, prevalent among mathematical theorists of general equilibrium, is that traditional macroeconomic theory suffers from its lack of firm microeconomic foundations. The behavioural relations of macro models, it is said, are not rigorously derived from optimization by individual agents and from the clearing of markets in which optimizing agents participate. In short, macro models do not look like general equilibrium models. Of course, it is hard to make them look like general equilibrium models without emptying the macro models of the aggregative simplicity, institutional content, and definiteness of conclusion which are their *raison d’être*.”

Tobin (1980) p. x.

The optimist in me hopes that the neo-Keynesian model will continue to dominate in the teaching sphere. This is because I feel that this model has significantly more to offer than the DSGE models which continue to suffer from the same array of problems that Tobin

⁶ I was surprised to find that neither of the two books (both in their own way, very interesting descriptions of DSGE methodology) do not reference Hendry in their bibliographies. The impact of Hendry on macroeconometric research is self-evident to any UK student of the last 30 years and is also evidenced by reference to his work in essays by two recent Nobel prize winners (Engle (2004) and Granger (2004)).

identifies above. However, the pessimist in me believes that the DSGE model may still succeed in the long-run through a simple process of attrition. As the older generation of macroeconomists retires and new generations, who have followed graduate programmes in which DSGE is the only macroeconomics on offer, take over, the programme will increasingly filter down into the undergraduate programme. If this happens then macroeconomics will rapidly lose any appeal it has to the mass of undergraduate students. In summary, this is a recipe for the marginalisation of the sub-discipline of macroeconomics within economics, and even the discipline of economics itself.

Ultimately the question is what do we want our students to get out of their study of macroeconomics? My own view is that, in the cognitive domain, we should equip our students with a flexible intellectual framework which will allow them to address a range of unfamiliar questions and issues. In the affective domain, we should encourage them to be sceptical but aware of the positive achievements of different schools of thought. The Neo-Keynesian model satisfies these requirements while, at least to me, the DSGE model fails on both counts.

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