



THE PHILOSOPHICAL FOUNDATION OF MAINSTREAM MACROECONOMICS

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Abstract

The purpose here is to explore the philosophy implicit in mainstream macroeconomics in terms of how real economic systems are understood and how knowledge about them is built and assessed. Mainstream macroeconomics has evolved in response to policy demands in the wake of the financial crisis. But this evolution has been constrained by the internal methodological requirements of its dominant theoretical approach which are often incompatible with the external requirements of evidence and policy application. The core theoretical approach has persisted, particularly with its emphasis on microfoundations. Yet the notion of internal consistency by which the microfoundations project is justified is challenged by a broader, philosophical, notion of consistency. The long-running expression of opposition in mainstream macroeconomics between logical coherence and empirical coherence (or between rigour and realism) accordingly requires examination at the philosophical level. The case is made on philosophical grounds for considering approaches to macroeconomics which avoid this kind of opposition.

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Introduction

Macroeconomics poses particular methodological challenges in the pursuit of understanding causal mechanisms. Because it operates at a high level of aggregation issues arise as to the meaning and causal significance of aggregate variables. How are the relationships between the macro level and the micro level, as well as the intermediate meso level, to be analysed? Such issues take on immediacy when macroeconomics is used for advising governments and central banks on pressing policy decisions, requiring some capacity to inform about the likely effects of policy. While different views prevail as to the scope for quantitative macroeconomic forecasting, engagement in some form with macroeconomic data is a necessary aspect of policy advice. As a result methodological attention has tended to centre on the relationship between theory and data, as well as the procedures for analysing data using econometric methods. But the purpose here is to discuss the mainstream approach to macroeconomic methodology in a broader philosophical sense than specific methods.

The term ‘methodology’ itself is often ambiguous in that it is sometimes used interchangeably with ‘philosophy’. In mainstream economics the norm is for methodology to refer to theory/model design and application, while philosophy is reserved for ontology and epistemology (a distinction drawn for example by Hoover, 2001a, in discussing causality in macroeconomics). In non-mainstream economics where discussion of ontology and epistemology is much more common in conjunction with the narrower sense of methodology the terms ‘methodology’ and ‘philosophy’ are often conflated, the content of each level being seen to entail the content of the other.

All macroeconomists use some set of methods or another and some methodological/philosophical approach or another. But a discussion of mainstream methodology, far less methodological approach, is hampered by the reluctance of most mainstream economists to discuss it themselves.¹ Even in the field of methodology itself the focus is more on microeconomics than macroeconomics (Hands 2015). Backhouse and Salanti (1999) argue that this may reflect a conflation between microeconomics and macroeconomics because of the emphasis on the latter’s microfoundations. They also point to the methodological compromises required of macroeconomists by the need for swift responses required by policy-makers.

The tendency to separate methodology from philosophy is reflected in the field of economic methodology. Following the demise of logical positivism in the philosophy of science, the analysis of economic methodology turned away from the traditional role of prescribing practice to focus instead on critical accounts of practice. Even though this development embodied an implicit philosophical position, it reflected an overt attempt to move away from philosophy. In its mainstream form methodological enquiry increasingly follows the naturalist approach which involves focusing on the application of methods employed in the physical sciences.

We start by considering mainstream macroeconomic methodology in these conventional mainstream terms of the relationship between theory and methods. This methodology has not stood still. Empirical methods, theories and the relationship between the two have evolved, as has the policy environment. But there is a deeper philosophical level at which we can consider mainstream methodology, which is the subject of the following section. How methodology

¹ This contrasts with the frequency with which non-mainstream economists discuss methodology. See Lawson (1994) for an exploration of (particularly mainstream) economists’ aversion to methodological discussion.

itself is considered is coloured by the ontology and epistemology which underpins it, however implicitly. We focus particularly on the role ascribed to formal modelling and the openness or closure of systems at different levels. This provides the basis for addressing the thorny issue of microfoundations.

The line of argument to be pursued is that, while it might seem that significant change has taken place in mainstream methodology, continuity is more apparent at the philosophical level. The discussion thus updates earlier analyses of mainstream methodology along these lines such as Dow (1997) and Arnsperger and Varoufakis (2006). And yet outstanding issues, especially with respect to microfoundations, remain unresolved which might be clarified by a more philosophical focus (a topic given critical in-depth treatment by King 2012).

The evolution of mainstream macroeconomic methodology

Methodological discussion within mainstream economics has focused primarily on the relations between theory and empirical analysis (see e.g. Backhouse and Salanti 1999 and Hoover 2001b). Macroeconomics in its modern form emerged in the 1930s out of twin developments: the pioneering building of large-scale datasets by the NBER on the one hand and Keynes's new analysis at the macroeconomic level which had strong policy implications and data requirements on the other. The neoclassical synthesis which then emerged developed within a methodological approach quite different from that of Keynes (Dow 2010). New structural macroeconomic models came to be synonymous with theory, rather than Keynes's view of models as aids to thought, and empirical work developed within the new field of econometrics. Data were employed both to test theory and to predict policy outcomes using the newly-emerging econometric techniques which relied on unchanging macroeconomic structure.²

But empirical testing was unable to settle debates in macroeconomics. This was particularly evident in the Monetarist/Keynesian debates of the 1970s. There was further a growing sense of unease with theorising at an aggregative level. One response was to retreat into pure theory. Neoclassical economists had developed formal Walrasian macroeconomic models which were claimed to encompass the contributions of Keynes's *General Theory* macroeconomics, but as a special case of what was regarded as a more general macroeconomics. This agenda was then pursued along Arrow-Debreu deductivist lines with attention to microfoundations specified in the form of the rationality axioms. Macroeconomic theory was thus increasingly bound up with microeconomics, no longer seen as a separate field. As Hahn (1981) argued, empirical testing was precluded by the inability to identify a real situation as corresponding to general equilibrium; theoretical concepts lacked empirical counterparts.

However rational expectations theory justified empirical testing by defining all real situations as being in general equilibrium on the grounds that all agents continuously optimise on the basis of full information. While it was a key feature of this approach that agents' expectations thus coincided with model forecasts, the large New Classical models developed in the 1970s and 1980s were not clearly successful predictors (see e.g. Clements and Hendry 1995). New Keynesian macroeconomics therefore pursued an alternative modelling strategy based on

² See Keynes's debate with Tinbergen over his misgivings with the scope for application of econometric techniques (Garrone and Marchionatti 2009).

DSGE models which nevertheless retained the assumption of rational expectations, on the part of a representative agent.³ The predictive failure of New Classical models presuming perfectly competitive markets was to be explained by a range of market imperfections, notably asymmetric information. The resulting New Consensus macroeconomics prevailed during the Great Moderation period up to the financial crisis. DSGE models therefore provided the benchmark on which to build a response to the crisis, perpetuating what Haldane and Turrell (2018) describe as a monoculture within macroeconomics.

One route in responding to the crisis was to treat it as the result of a shock to a naturally-equilibrating system. This approach allowed apparently-Keynesian concepts such as uncertainty and animal spirits to enter the analysis as a source of shocks (see e.g. Bloom 2009; Farmer 2013). But then there was the question as to why and how deviations from equilibrium then persisted. Thus a substantial body of work has been building up on learning as a means of explaining within a rational expectations framework the delay in markets returning to equilibrium following a shock (see Eusepi and Preston 2018). An alternative route has been to pursue a more heterogeneous micro-level analysis of deviations from equilibrium, as in the agent-based modelling approach of Haldane and Turrell (2018).

The focus therefore has been to identify where standard DSGE models had gone wrong and therefore how they should be amended, drawing on aspects of reality from which they had abstracted. The dominant explanations for the crisis challenged the assumption of market efficiency. The crisis could then be understood as the outcome of market imperfections, or frictions, at the meso level which had impeded or distorted market incentives. Since DSGE models had abstracted from financial institutions, the emphasis has therefore moved on to endogenising financial frictions themselves. This is a particular focus of New Monetarists like Wright (2018) who argues that it was this lack and a corresponding inadequate grounding of both financial behaviour and institutions in rationality axioms which accounted for the failure to predict the crisis. As Vines and Wills (2018, p. 18) put it: ‘For Wright, none of the frictions which we discuss ... can be allowed into a paper on macroeconomics unless they are properly microfounded as interactions between self-interested and selfish individuals’. This theoretical development is therefore consistent with the decades-long project of building macroeconomics on microfoundations.

The policy challenge posed by the crisis was for mainstream macroeconomics to engage more directly with the real economy beyond the conventional focus on interest-rate setting. While not questioning the value of improving the microfoundations of DSGE modelling as a long-term strategy, Blanchard (2017) and Wren-Lewis (2018) argue that different types of model which are not micro-founded are also required in order to provide useful and timely policy advice which is informed by the data. Structural econometric models are required alongside pure theory in what Wren-Lewis calls an eclectic approach. Their championing of these models implies in addition a shift in favour of applied macroeconomics.

Casual observation of mainstream journals suggests that such a shift has been taking place, even to the extent of economics merging with applied statistics. Backhouse and Cherrier (2018) confirm that there has been a substantial change in the relationship between theory and data in the 21st century literature, partly on account of policy requirements. This development includes greater attention to empirical issues and the increased prestige of applied economics relative to pure theory, where the term ‘applied’ encompasses both application of theory and greater

³ See Wren-Lewis (2018) for an account of this methodological evolution.

policy engagement among empirical economists. Backhouse and Cherrier (2018, p. 1) quote Angus Deaton's comment on typical PhD research: 'the typical thesis of today uses little or no theory, much simpler econometrics, and hundreds of thousands of observations'. Reflecting this development, such macroeconomic methodology discourse as there is has focused on modelling strategy with a view to empirical application, and increasingly on substantive practical issues surrounding econometric methods and the relations between theory and data (see e.g. Backhouse and Salanti, eds, 2000).

It is clear that mainstream macroeconomic methodology has evolved in the sense of methods of theory construction, its relations with data and the empirical methods employed. But the debate continues regarding conflicts between deductivist theory and empirical application, often put as a conflict between rigour and realism. But pure deduction is not feasible or policy-useful without *any* reference to reality. The same applies to pure induction – inevitably theoretical presumptions guide the selection and interpretation of data and some understanding of causal mechanisms is required for policy application. Is dichotomising pure theory and its application in this way a further example in mainstream methodology of dualism, whereby theory and application are regarded as mutually-exclusive and all-encompassing? In order to pursue this question we need to explore explicitly the philosophical underpinnings of mainstream macroeconomics.

The ontological and epistemological foundations of mainstream macroeconomic methodology

The dominant philosophical grounding for mainstream macroeconomics, when professed, derives from the period in which modern macroeconomics first emerged. Economists' espousal of logical positivist methodology reflected the state of philosophy of science in that era. Philosophy of science has since moved on but typically any statements of the principles of mainstream methodology (e.g. in the introductions textbooks such as Mankiw and Taylor 2006) have continued to be couched in terms of building models on a set of foundational assumptions and testing them against data. This methodology has encountered well-documented obstacles in practice, notably the Duhem-Quine problem that it is very difficult to identify which aspect of a model (or indeed the data) is responsible for any contrary evidence. The prevalent practice therefore resorted to using data to confirm theory rather than to weed out theory that was falsified by the data (a situation deplored by Blaug 1980).

There is only rare discussion of the ontological and epistemological foundations of mainstream macroeconomics, i.e. statements regarding how real socio-economic systems are understood and therefore how knowledge about them should be built. These philosophical foundations must be teased out as being implicit in economics practice. We take as our starting point the role of models in mainstream macroeconomics, not least because, particularly in macroeconomics, models are conventionally conflated with theories.⁴ We explore how this attitude to mathematical modelling in macroeconomics implies a particular ontology and epistemology, focusing on what we can glean from the discussion among macroeconomists themselves.

⁴ See Morgan and Masterman (1999) for an analysis of the history, nature and use of economic models.

In the 1980s it was clear that the general equilibrium model had become the benchmark, providing a unifying framework for economics.⁵ In particular this deductivist logical approach to modelling required derivation from microfoundations in the form of axioms with respect to the behavior of a representative agent. Since then much has been made of the fragmentation of mainstream economics, including macroeconomics. Some go so far as to characterise this state of affairs as pluralistic. But there is a critical difference between a plurality of theories within a common methodological approach on the one hand and a plurality of methodological approaches, i.e. between theoretical pluralism and methodological pluralism.

While there is a range of mainstream macroeconomic theories/models, it is evident that there is an understanding that there is, or should be, one benchmark model.⁶ This was the focus of the Rebuilding Macroeconomic Theory Project as explained by Vines and Wills (2018). Recounting the history of mainstream macroeconomics, Kuorikoski and Lehtinen (2018: 254) argue that:

there is a fundamental sense in which the core model has remained the same: what some call the ‘Ramsey model’ of intertemporal optimization has been a key ingredient of all these models. The core model has thus been extensively supplemented with various components so as to obtain a better fit with the data.

The work that emerged from the Rebuilding Macroeconomic Theory Project in the 2018 issue of the *Oxford Review of Economic Policy* was addressed to perceived shortcomings with the DSGE model as the benchmark. A range of new developments was considered, from extending microfoundations to endogenise market frictions at one extreme to parallel development of DSGE models and simpler policy-oriented models at the other. There was some difference of opinion as to how far DSGE models might develop sufficiently to obviate the need for different data-driven models. But Vines and Wills concluded that none of the developments being considered would constitute a paradigm shift, i.e. they should be discussed in terms of theoretical pluralism rather than methodological pluralism.

So we can consider what this benchmark model implies both about ontology and about epistemology. We can infer even more, using the concept of closed and open systems, from the view that macroeconomics can be represented by one benchmark model.⁷ Any formal mathematical model is a closed system, so if theory and model coincide then the theoretical system is inevitably closed.

The conditions for the closure of a theoretical system are that all the relevant variables can be identified, the system boundaries are specified such that these variables can be classified dualistically as endogenous or exogenous, and structures and relationships within the system are either knowable or known to be stochastic.⁸ A mainstream theoretical system couched in terms of general equilibrium fits this template well. It is constructed along deductivist lines

⁵ See Weintraub (1985) for a full specification in Lakatosian terms.

⁶ See Lawson (2009) for a critique of seeing the solution to the crisis in replacing the old failed benchmark model with a new one.

⁷ This analysis draws particularly on Dow (2002: 139-40), Chick (2004) and Chick and Dow (2005).

⁸ A more detailed specification of the conditions is set out in Chick and Dow (2005: 367).

which prioritise internal consistency in terms of classical logic⁹ and the core role of equilibrium as a basis for identifying model outcomes. Weintraub (1985) had identified this role as a positive heuristic of mainstream theory, something that still persists even if it has evolved to encompass multiple equilibria and deviations from equilibrium. To the extent that mainstream macroeconomic theory is characterised by DSGE models it is therefore a closed epistemological system.

Lawson (1997) argues that a closed theoretical system inevitably entails a closed-system ontology. His understanding of closure in econometric terms as event regularity is particularly apposite to macroeconomics. The implication is that a naturally-ordered understanding of real social systems (as of natural systems) is implicit in the mainstream approach. Physics has been held up as a methodological role model for economics (Mirowski 1989). Indeed we identified in the previous section the naturalist approach to economic methodology which has focused the attention of many methodologists on economics practice against the standard of methods in the physical sciences. While presented as a move away from philosophy this is nevertheless a philosophical position.¹⁰

The meaning and significance of system closure at the ontological and epistemological levels may be clarified by considering approaches to macroeconomics which are explicitly based instead on open systems at both levels. There is scope for a range of open theoretical systems since it only requires any one condition for closure not to be met in a particular way for the system to be open - hence the range of non-mainstream schools of thought with their own sources of openness which follow from their particular open-system ontologies.¹¹

Post-Keynesian macroeconomics, which is arguably the leading contender to the mainstream approach in macroeconomics, is built on a particular open-system ontology and consequent open-system epistemology (Dow forthcoming). A pluralistic approach to reasoning is employed whereby formal mathematical models constitute only partial arguments. Models are combined with other (incommensurate) forms of reasoning within an open theoretical system in order to arrive at a considered conclusion. Models are aids to thought for the purpose of identifying causal tendencies rather than generating concrete predictions; this includes empirical application as a means of identifying stylised facts as an input to a broader analysis.

⁹ This is only one of the possible senses of consistency; see further below and Dow (2016).

¹⁰ There is of course debate over the degree to which the natural world is ordered/closed, particularly in the context of climate science. See Dow (2020) for a discussion of this in relation to economics.

¹¹ Chick and Dow (2005: 366) set out a list of possible sources of real-world openness as follows:

1. The system is not atomistic; therefore at least one of the following holds:
 - a. outcomes of actions cannot be inferred from individual actions (because of interactions);
 - b. agents and their interactions may change (for example agents may learn).
2. Structure and agency are interdependent.
3. Boundaries around and within the social or economic system are mutable; for at least one of the following reasons:
 - a. social structures may evolve;
 - b. connections between structures may change;
 - c. the structure-agent relation may change.
4. Identifiable social structures are embedded in larger structures; these may mutually interact, for the boundaries of a social system are in general partial or semi-permeable.

Thus for example Minsky (1976, 1986) developed a formal macroeconomic model which depicted some key features of his financial instability hypothesis at an aggregative level; the model has been applied in empirical attempts to establish relevant stylised facts, such as cyclical patterns of debt. But, like Keynes, Minsky chose not to encapsulate his hypothesis in a comprehensive formal model on the grounds of an open-system ontology. Financial relationships evolve over the cycle due to financial innovation, and market psychology may shift discretely and unpredictably, sometimes in response to the exercise of agency (such as a high-profile speech pointing to a particular source of market vulnerability). The financial/economic system is thus open due to developments at the meso and micro levels which are not determinate, but about which knowledge can nevertheless be gathered using a range of methods other than formal modelling, e.g. to understand new financial innovations and to tease out changes in market sentiment. Minsky's hypothesis points to the systemic cyclical forces which create market vulnerability, but cannot predict exactly what will puncture confidence or when as the system becomes increasingly fragile. The theory was thus developed in a way that derived from ontological understanding at the micro level, as well as the meso level of institutions and the macro level of markets, but where evolution and complexity precluded the scope for formal microfoundations and thus for capturing the theory in a deductivist formal model.

In contrast the microfoundations imperative lies at the heart of theorising within mainstream macroeconomics. It is an important intrinsic feature of a closed-system methodological approach, requiring macroeconomic relations and structures to be specified with respect to atomistic agents. Arnsberger and Varoufakis (2006) identify methodological individualism and methodological instrumentalism (in addition to methodological equilibration) as particular characteristics of the ontology and epistemology implicit in mainstream economics. They argue that these characteristics have persisted in spite of significant new developments such as game theory. The nature of the socio-economic system is understood as determined by its microfoundation in the choice behaviour of individual agents based on their instrumental rationality. This follows from the requirement for internal logical consistency within the theory/model; it is taken for granted that macroeconomic theory should have consistent microfoundations. From a classical-logic perspective model-specification shortcuts sidestepping microfoundations are only deemed acceptable for pragmatic reasons of providing timely policy advice pending the satisfactory completion of the microfoundations project.

This is an area of discussion in mainstream macroeconomics which suffers particularly from inattention to ontology and epistemology – unless it is agreed that closed-system accounts of both have been satisfactorily established, justifying the microfoundations imperative in terms of consistency in classical logic. But there are other types of consistency, notably logical and philosophical consistency (as explained by King 2012; see also Dow 2016). The internal-consistency criterion of the microfoundations project may conflict with these other principles of consistency.

The classical logic of closed deductive systems rests on the (contested) truth-value of the rationality axioms. But an open-system ontology challenges the scope for identifying true axioms as the basis for all theorising. Where knowledge of complex evolving systems is in general uncertain a deductivist logical structure is weak; it is only as strong as its axioms. An alternative basis for consistency is human logic (Gerrard 1992), which involves multiple incommensurate strands of reasoning justified as a more robust approach to building knowledge about a complex evolving system, i.e. an open-system epistemology for an open-system ontology. The abstraction involved in each strand of reasoning involves simplification

rather than idealisation, thus avoiding conflict with ontology.

Thus for example a Minskyan analysis of financial instability might employ a formal macro model which abstracts from indeterminate processes of financial innovation and changes in market sentiment. Non-modelling analyses of these two important contributors to financial instability may then be combined with insights from the formal model in order to build a more full account. Comparing this exercise of human logic with the classical logic of mainstream macroeconomic theory, Chick and Dow (2005: 369-70) point out that:

[t]he key is how far the theoretical system is identified with its models. Within an open theoretical system, there is scope for changing the assumptions, boundaries or *ceteris paribus* conditions to suit the theorist's immediate purpose, as for example assuming that long-term expectations are fixed in one model but not in another. Discussion surrounding these models extends beyond the models in order to take account of what has been 'kept at the back of one's head'. A closed theoretical system on the other hand tends to be identified with its models (Chick and Dow 2005: 369-70).

The human-logic type of consistency considered here is consistency with an ontology which entails an epistemology addressing the reality that knowledge is in general uncertain. Further if the source of ontological openness is intrinsic and evolving social interaction (and indeed identity) which does not arise from independent atomistic agency then methodological individualism would be inconsistent with that ontology (Hoover 2001b, 2009).

Using human logic, theory and application are not dichotomised but rather are complements with respect to a common ontology. On realist grounds, theory is designed for application. Rigour refers to robust capacity to address a particular ontology rather than internal classical-logic consistency. The rigour-realism dichotomy that has dogged mainstream macroeconomics does not apply to an open-system epistemology. Therefore combining different strands of reasoning according to human logic is not the same as an eclectic approach which retains deductivist theory (with its microfoundations imperative) alongside structural econometric models. The closed-system ontology implied by pure deductive theory requires consistency between models in the classical logic sense, i.e. complete compatibility within a formal deductive structure, but at the cost of inconsistency with an open-system ontology.

Nevertheless ontology has played a part in the evolution of mainstream macroeconomics in recent decades. Concern over inconsistency between models and experience (including experimental evidence with respect to rationality) has encouraged consideration of various features of the real world which might account for shortcomings with particular modelling strategies (see e.g. Stiglitz (2018)). Each of these features can be identified with one or other source of real-world openness identified by Chick and Dow (2005).

New Keynesian macroeconomic theory has paid particular attention to the market frictions caused by asymmetric information, notably in the credit market. A second development addresses the challenge of modelling social interactions, reflecting the evident issues of trust and herd behaviour arising from the crisis. Modifications to mainstream models have occurred particularly within the new behavioural economics which has drawn on psychology to explore cognitive limitations which limit rationality.¹² Akerlof (2002) has extended behavioural

¹² New behavioural economics is distinct from the very different methodological framework of old behavioural economics (see Sent 2004).

economics into macroeconomics by considering a range of ways in which the standard rationality framework does not apply in practice. He notes how behavioural macroeconomics incorporates ‘realistic assumptions grounded in psychological and sociological observation’ and presents behavioural macroeconomics as ‘rebuilding the microfoundations that were sacked by the New Classical economics’ (ibid.: 413). As echoed by Stiglitz (2018) there is an appeal to ontology in seeking more realistic assumptions. But the conventional mainstream epistemology continues in its appeal for microfoundations.

It is of course possible that there may be some semantic confusion over the term ‘microfoundations’ such that it is intended to mean empirical or philosophical consistency with ontology, i.e. it is not meant to entail a conventional closed-system mainstream epistemology but rather makes the case instead for an open-system epistemology and ontology (see Akerlof’s 2020 methodological analysis). But the deductivist microfoundations imperative has been more generally evident in the criticism of DSGE modelling that it has adapted to crisis circumstances by a series of ad hoc adjustments which take it further away from a coherent deductivist model. Kuorikoski and Lehtinen (2018: 255) point out that:

many of the most central assumptions, such as intertemporal optimization, never change in DSGE models: even if the modifications concern the behavioural assumptions, the core optimization model is never abandoned. In other words, altering this assumption to make it more realistic is only possible if the whole DSGE framework is abandoned.

Thus for example the methodological-individualistic core persists in the depiction of other-regarding behaviour as being atomistically rational with respect to expectations of reciprocity. Also evidence of the limits to which interpersonal preferences can be incorporated in the mainstream framework is found for example in Ashraf, Camerer and Loewenstein’s (2005) discussion of Adam Smith’s impartial spectator. Where for Smith the impartial spectator was the voice of conscience, for the behavioural economist the impartial spectator is instead the voice of reason.

Indeed we find explicit espousals of the deductivist approach to theory in new behavioural economics. For example, Camerer and his colleagues introduce their substantial behavioural economics reader as follows:

At the core of behavioral economics is the conviction that increasing the realism of the psychology underlying economic analysis will improve the field of economics *on its own terms*—generating theoretical insights, making better predictions of field phenomena, and suggesting better policy. This conviction does not imply a wholesale rejection of the neoclassical approach to economics based on utility maximization, equilibrium, and efficiency. The neoclassical approach is useful because it provides economists with a theoretical framework that can be applied to almost any form of economic (and even noneconomic) behavior, and it makes refutable predictions (Camerer, Loewenstein and Rabin 2004: 1, emphasis in the original).

Similarly Hong and Stein (2007: 126) spelt out the pressure for behavioural finance to fit into the standard mainstream approach as follows:

The enduring appeal of classical asset-pricing theory over the last several decades owes much to its success in forging a consensus around a foundational modelling platform. This platform consists of a core set of assumptions that have been widely-accepted by researchers working in the field as reasonable first-order descriptions of investor behaviour, and that—just as importantly—lend themselves to elegant, powerful, and tractable theorizing. If behavioural finance is ever to approach the stature of classical asset pricing, it will have to move beyond a large collection of empirical facts and competing one-off models, and ultimately reach a similar sort of consensus.

If however it is accepted instead that individual behaviour is not amenable to reductionist theorising, i.e. that it needs to be taken seriously that the economy is an open system, then there are strong implications for the type of theorising which is compatible with such an ontology. Chick and Dow (2005: 366) argue that identifying any of the conditions for system openness holds important implications for theorising such as the following:

1. There may be important omitted variables or relations and/or their effects on the system may be uncertain.
2. The classification into exogenous and endogenous variables may be neither fixed nor exhaustive.
3. Connections and/or boundaries between structures may be imperfectly known and/or may change.
4. There is imperfect knowledge of the relations between variables; relationships may not be stable.

Addressing these consequences of ontological openness requires an open theoretical system. The critical issue then is whether there is a new acceptance within mainstream macroeconomics that ontological openness warrants a new open-system theoretical approach or whether the agenda now is to incorporate these real-world features in a revised set of microfoundations for a closed theoretical system, preserving a closed-system ontology.

Conclusion

We have briefly traced here the evolution of macroeconomics as a struggle between theoretical and empirical coherence. While external policy demands have kept empirical application to the fore, the pressures on theorising have been internal, consistent with the requirements of closed deductive systems. Such systems in turn imply an understanding of social systems themselves as being closed. Yet this theoretical framework continues to provide the benchmark for empirical modelling and for policy application.

The crisis and the response of mainstream macroeconomics provide evidence for such an account. The failure of the New Consensus macroeconomic models to predict the crisis was seen as being due to particular model limitations rather than the overall theoretical approach. The models had abstracted from aspects of social systems which had proved to be central to the crisis, notably institutions ranging from banks to money itself on the one hand and behaviour which apparently did not conform to the basis for models in rational economic man on the other. A leading agenda now is to reformulate microfoundations to account for these lacks and yet preserve the deductivist structure of theory.

The microfoundations imperative follows from the internal consistency requirements of deductivist theory. Yet it conflicts with other philosophical consistency requirements. On the one hand there are alternatives to classical logic, notably human logic, which are more appropriate to knowledge about open social systems. By acknowledging the uncertainty about any knowledge of complex and evolving systems, human logic replaces reliance on one deductive structure (the benchmark model) with a plurality of strands of reasoning drawing out different aspects of the real subject matter and put together by the exercise of judgement. At the same time, if it is judged that social systems are not *in reality* built on atomistic agents but rather on an evolving complex of identities, interrelations and institutions, then the microfoundations project itself conflicts with such an ontology.

Much of this argument may well seem familiar to mainstream applied macroeconomists. But it is not an argument favouring one side of the theory-applied divide over the other. It is an argument for theory which does not create a divide with application, but rather aims to address and explain the features of real economic systems encountered by applied macroeconomists. It is an argument which justifies a range of different types of model and theory but not ones which enforce developments according to internal methodological criteria which are incompatible with ontology. The presumption tends to be that macroeconomic theory is independent of application, enjoys its own prestige and ideally is the appropriate guide for application. The examination of the philosophical foundations of mainstream macroeconomic theory offered here justifies instead considering other theoretical approaches which follow from understandings of reality in terms of open systems as replacements for a theoretical approach which does not.

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