

A Most Peculiar Failure

On the dynamic mechanism by which the inescapable theoretical failures of neoclassical economics reinforce its dominance

Yanis Varoufakis

*UADPhilEcon
Department of Economics
University of Athens (Greece)*
yanisv@econ.uoa.gr

Abstract: This paper argues: (a) that neoclassical economics is well defined in terms of three meta-axioms (*methodological individualism*, *methodological instrumentalism*, and *methodological equilibration*); (b) that their adoption is the common practice which delineates mainstream economics; (c) that while the first two meta-axioms allow for rich depictions of socioeconomic phenomena, they lead to an unquenchable indeterminacy, and (d) that the spectre of this indeterminacy generates evolutionary and social forces within the economics profession which cause practitioners to introduce stringent variants of the third meta-axiom. Thus their models' sophisticated complexity is sacrificed in favour of a determinate framework within which not even a glimpse of contemporary capitalism is possible. Neoclassicism, we contend, owes its hegemonic position in the social sciences to this most peculiar, axiomatically inbuilt, theoretical failure.

1. The three meta-axioms underpinning neoclassical economics

Few, if any, economists would describe their work as neoclassical. As the term was coined much later, the 19th century pioneers of marginalism would not have even recognised it. As for contemporary economists, they seem ill disposed to the neoclassical label even when their work is demonstrably neoclassical.¹ But this disinclination, in itself, is immaterial: for if a particular body of economics can be *profitably* distinguished by means of some single epithet (e.g. 'neoclassical'), the deployment of such an epithet may be in order. After all, neither the inhabitants of the Eastern Roman Empire would have appreciated the label 'Byzantine' nor would late 19th century Britons have conceived of their society as 'Victorian'. Such epithets have analytical value analogous to their capacity to illuminate certain eras and mind frames.

In our quest for a useful definition, we take a second leaf out of the historians' book: Their terms 'Byzantine' or 'Victorian' may well be over-arching but, at the same time, are deployed carefully so that their use does not invalidate their subject-matter's *dynamic complexity*.² In the same vein, we too are keen to define neoclassical economics in a manner that respects the undisputed fact that its axioms and theoretical practices have been evolving, changing, and adapting from the very beginning. For that reason, we shall eschew any definition based on a fixed set of neoclassical axioms.³

We ask: Granted that neoclassicists' axioms and methods are in constant flux (inter-temporally but also across different models and fields), is there some analytical foundation which: (a) remains time and model invariant, and (b) typifies a distinct approach to economics? This is equivalent to searching for invariant *meta*-axioms: higher-order axioms about axioms which underpin *all* of neoclassical economics, irrespectively of the actual axioms' fluidity or the malleability of its focus. We propose three such meta-axioms as the foundation of all neoclassicism.

Meta-axiom 1: Methodological individualism

Consider the analytic-synthetic method of a watchmaker faced with a strange mechanical watch. First, she takes it carefully apart with a view to examining the properties and function of each of its tiny cogs and wheels. Then, she screws it back together. If a reassuring ticking sound ensues, this must surely mean that the fragments of knowledge imparted by the *separate* study of *each* of its parts were successfully synthesised into a macro-theory of the watch.

This parable of an ideal reductionist, analytic-synthetic economic approach has been implicit to neoclassical theorising since the first stirrings of marginalism. While the term *methodological individualism* came later with Schumpeter (1908), it featured well before its christening as the bedrock on which economics (in juxtaposition to classical political economy) was to be re-founded. To the economists who sought a break from the political economy of Smith, Ricardo and Marx, a new focus on the individual agent became the litmus test of 'scientific' economics (see Mirowski, 1989).

In this new, or neoclassical, mind frame, individuals are the equivalent of the watchmaker's cogs and wheels: parts of a whole to be understood *fully* (complete with determinate behavioural models) and *independently* of the

whole their actions help bring about. Thus, any socio-economic phenomenon under scrutiny is to be explained *via* a synthesis of partial knowledge derived at that individual level.

But there is a snag: Unlike the world of mechanical watches, society consists of 'parts' which are not readily separable. A pulley or a cog can be fully described in isolation to the other mechanical parts with which it was designed to work harmoniously. Indeed, the 'relations' between the watch's parts are straightforwardly revealed, to the trained eye, through close inspection of the parts' shape, size and other physical properties. In the social world, however, not only are the relations between its 'parts' not deducible from primitive data concerning these parts alone (e.g. from data on persons' means and ends) but, also, it is simply impossible to understand the parts' properties in isolation to one another. When Aristotle spoke of humans as political animals, or when Hegel narrated his master-slave paradox, they were dwelling on this radical difference between the constituents of society as opposed to the parts of mechanical systems (regardless of their complexity).

Hodgson (2007), drawing on Udéhn (2001,2002), relates the ambiguities in the methodological individualism espoused by leading neoclassicists and suggests that neoclassicism seems to oscillate between strong methodological individualism, which insists that all explanation must to be reducible to knowledge derived from isolated selves (an archipelago of Robinson Crusoes), and a weaker version which acknowledges that the individual is indefinable outside its social and relational context. Our explanation of this oscillation will be that, while thoughtful neoclassicists are mindful of the logical conundrum awaiting them if the analysis of persons excludes their relations to other persons (and, thus, to the surrounding institutions), they are *forced* inevitably to fall back on a strong version of methodological individualism.

Forced by what? By the ambition to 'close' their models, we suggest (see Lawson, 2003, for the predilection of mainstream economics for closed explanatory systems). Human relations are notorious for their resistance to determinate modelling. Put simply, the mathematics of defining a person in terms of her relations to others, in addition to her means and ends, is of an order higher than most economists would want to engage with and, worse, offer no determinate solution (i.e. behavioural prediction).⁴ Importantly, this is no mere technical difficulty awaiting a technical fix. Rather, it reflects the *impossibility* of a deductive methodological individualism which treats human relations as primitive data (see also Fine, 2008). It is for this reason that neoclassicism gravitates toward strong methodological individualism, while alluding to its weaker version when in a more philosophical mood.

To sum up, neoclassicism's first meta-axiom encompasses two main variants of methodological individualism one of which typify neoclassical economics of *all* types:

Strong Methodological Individualism – D: All explanations are to be synthesised from separate, autonomous, and prior explanations at the level of the individual. A *strict explanatory separation* of *structure* from *agency* is imposed, with an analytical trajectory that moves unidirectionally from full explanations of agency to derivative theories of structure. In this variant, agency feeds into structure (which is merely the crystallisation of agents' past acts) with no feedback effects from structure back into agency.

Weak Methodological Individualism – d: As above with the difference that feedback between structure and agency is permitted, even though the explanatory force remains in the realm of agency.

All textbook economics is founded on **D**, as are the foundational texts on the mainstream's main theorems: general equilibrium, game theory, new classical economics etc. However, in the last two decades or so, a new crop of highly interesting models appeared which turn on **d**.⁵ In following sections we shall be arguing that the interplay between **D** and **d**, rather than signifying a retreat from neoclassicism, is part of a complicated dynamic which reinforces its dominance and can be grasped only when all three meta-axioms are considered at once. Therefore, we now turn to the other two meta-axioms.

Meta-axiom 2: Methodological instrumentalism

Methodological individualism is vacuous without a theory of what motivates individuals. Contrary to the impression given by microeconomics textbooks, greed was never a foundational assumption of neoclassicism. While it is true that its models may have been traditionally populated by hyper-rational bargain-hunters, never able to resist an act which brings them the tiniest increase in expected net utility, the latter can just as readily result from bars of gold as from reductions in third world poverty.

Closer to the truth, regarding neoclassicism's foundations, is the claim that it relies on the axiom of *instrumental* (or means-end) *rationality*: Agents are rational to the extent that they deploy their means efficiently in the service of *current, pre-specified* and *sovereign ends*. However, we have already explained why we shun any definition of neoclassical economics which turns on some specific axiom. By the term *methodological instrumentalism* we signify a meta-axiom which encompasses all strands of motivation within neoclassical economics (from Jevons and Marshall to evolutionary game theory⁶).

Strict methodological instrumentalism – **S**: Behaviour is driven by some well defined function mapping the combination of all feasible agents' behaviours to some homogeneous index of individuated 'success'. The latter reflects agents' preferences which are given, current, fully determining, and strictly separable both from: (a) belief⁷ (which helps the agent evaluate the alternative future outcomes), and (b) the means employed.

Weak methodological instrumentalism – **s**: Behaviour is, again, explained in terms of an homogeneous index of 'success', onto which behaviours are mapped. However, the focus of study is no longer the decision maker but rather each element of her complete set of feasible actions (*aka* strategies). The models are, in this sense, populated by competing alternative strategies or behaviours (rather than decision makers) whose fortunes are determined not by instrumental rationality but by some 'replicator dynamic'; that is, by a difference or differential equation which 'selects' the strategy or behaviour that 'does better' than its 'competitors' in terms of some exogenously given set of individual 'welfare' criteria.⁸

Under both **S** and **s**, rationality loses its *substantive* meaning. **S** turns rationality into a capacity to achieve the highest possible level of preference-satisfaction, so much so that there is no longer any philosophical room for questioning whether the agent will/should act on her preferences.⁹ Bounded 'rationality' is also permitted, under both **S** and **s**, when the computation of optimal decisions is costly and/or time consuming. Lastly, under **s**, substantive rationality is wholly absent (since humans are not even the object of study in these models) and yet the analysis is fully instrumental as behaviour is selected (or abandoned) on the basis of fully specified exogenous goals.¹⁰

Before proceeding to neoclassicism's final meta-axiom, it may be of interest to note that both strands above, **S** and **s**, can be traced to David Hume (1739/40, 1888). The origins of **S** lay in his famous division of the human decision making process into three *distinct* modules: *Passions*, *Belief* and (instrumental) *Reason*. *Passions* provide the destination while *Reason* slavishly steers a course that attempts to get us there, drawing upon a given set of *Beliefs* regarding the external constraints and the likely consequences of alternative actions.¹¹ As for **s**, and neoclassicism's 'evolutionary turn', it too draws its energy from the *Treatise* and in particular from the argument that, when instrumental reason is given insufficient 'data' on which to base a firm decision (a case of 'multiple equilibria', in today's parlance), conventions or customs emerge that fill in the vacuum. Their evolution proceeds along the lines of an adaptation mechanism which selects practices according to their efficacy *viz.* the agents' pre-determined passions.¹² Where **s** diverges sharply from Hume is in its incompatibility with the one thing he cared greatly about: the (un-modellable) feedback effect between, on the one hand, forecast, action and, outcome and, on the other, the normative beliefs that are born endogenously¹³ and which fashion our view of that which we call our 'self-interest'.

Meta-axiom 3: Methodological equilibration

All economics revolves around the search for equilibrium states or paths, ranging from the theories of Ricardo, Marx and Sraffa to the neoclassicists.¹⁴ What distinguishes neoclassicism, in this regard, is that equilibration is usually imposed axiomatically even in the absence of any plausible explanation of how the system under study is supposed to edge closer to equilibrium. This practice is best described as a meta-axiom since it takes many different axiomatic forms which, nonetheless, are consistent with the definition of strong methodological equilibration below:

Strong methodological equilibration – E: Once the set of equilibria is deduced from the available primitive data (e.g. motivation, constraints, production possibilities, adaptation mechanisms, etc.), the focus of study is restricted (usually by some hidden axiom) to that set and only behaviour consistent with it is admitted. Sensitivity analysis is then introduced to discern the equilibria at which small, random perturbations are incapable of creating centrifugal forces able to dislodge behaviour from that state or path.¹⁵

Weak methodological equilibration – e: The set of equilibria is arrived at through a process that unfolds either in logical or historical time by means of a pre-specified selection mechanism which forms part of the analysis' primitive data.

The classical economists, also beholden to equilibration, traditionally espoused *e*.¹⁶ Pre-1950 neoclassical models too, also refrained from *E*, investing their skills in devising logical explanations of the path to equilibrium.¹⁷ However, the slide from *e* to *E* began in earnest first with John Nash's approach (1950, 1951), to the bargaining problem in particular and to strategic action in general, and then with Debreu and Arrow (see Debreu, 1959, and Arrow and Debreu, 1954) who, following a presentation by Nash at the Cowles Commission in October 1950, abandoned *e* in favour of *E*.¹⁸ The outcome of this radical shift was the celebrated proof of the existence of general equilibrium prices; a proof purchased at the cost of historical time (and, thus, of any logical argument regarding how that general equilibrium might emerge in time).¹⁹

2. The Dance of the Meta-axioms

Models are an open invitation to meddle with assumptions, and neoclassical models have been no exception. After several decades of such meddling, and with new empirical and computational techniques increasingly being pressed into service, many economists, including some who have been critical of the mainstream,²⁰ began to discern a fundamental shift from neoclassical formalism and toward a new methodological pluralism. In evidence, they cite the noteworthy makeover that *Homo Economicus* seems to have undergone²¹ and, more generally, the observation that the traditional neoclassical core (e.g. general equilibrium, the neoclassical macroeconomics synthesis) seems eclipsed, immersed in the shadows of game theory, nonlinear models, experimental economics, simulations, neuroeconomics, evolutionary models etc.

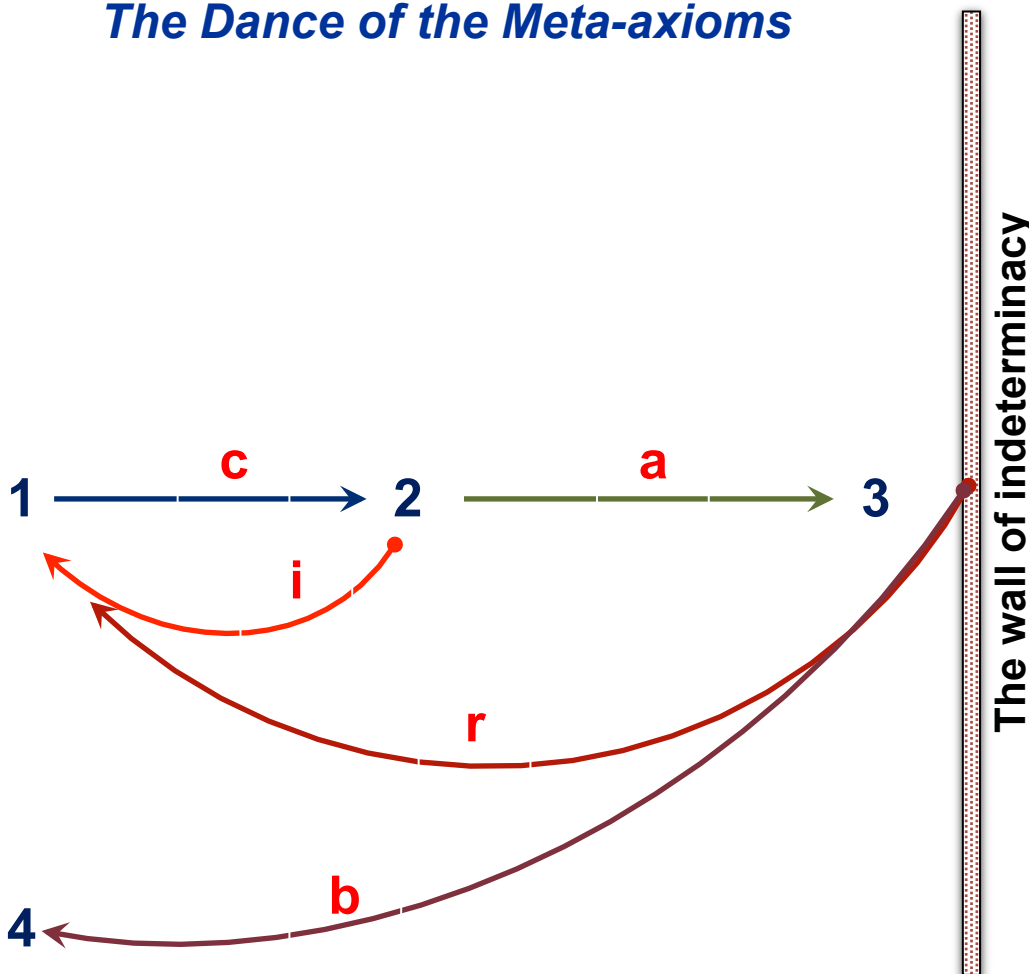
This section cautions against such a conclusion. It suggests that, at close inspection, the centrifugal forces occasioned by dissatisfaction with the original formalist neoclassical position, after initially pushing the mainstream away from the neoclassical nucleus, eventually subside, turning centripetal. Thus, they return the offered analysis either to the original neoclassical position or, even worse, to a position at a higher plane of neoclassical abstraction on which the original 'problem' not only remains unsolved but is, indeed, *amplified*.

The dynamic mechanism at work is outlined below in diagrammatic form. We term it the 'dance of the meta-axioms' featuring the following simple 'steps': Starting from **1**, the *original formalist neoclassical position*, some theoretical *challenge c* is issued (either from within neoclassicism or from without). In some cases, the challenge is *ignored* outright (arrow **i**) while in others it is *addressed* (arrow **a**) via a relaxation that occurs within one or both of the first two meta-axioms. At that stage, we argue, radical indeterminacy sets in and the profession recoils: Either it *retreats* to the original position (**1**) or it *backslides* (arrow **b**), via a severe tightening of the third meta-axiom, to some new position **4**; a position where the original problem (that **c** sought to address) seems assuaged when, in truth, its intractability is greatly intensified.

The remainder of this section illustrates this hypothesised dynamic by evoking a number of challenges (**c**) to core neoclassical models and groups them under our three main trajectories. We begin with important challenges which were ignored outright (**i**). Next, we look at challenges of note which were addressed (**a**). From some, the profession retreated (**r**) while others occasioned a backslide (**b**) to a new, more complex neoclassical position even more theoretically problematic (but also discursively more powerful) than the original.

Essential to our hypothesis is the argument that: (i) none of these challenges could penetrate the resulting wall of indeterminacy while retaining their allegiance to the neoclassical meta-axioms, and (ii) the profession, after dallying with complications of its foundational neoclassical models, returns to a position (**1** or **4**) which, at the expense of explanatory power, remains as contained within the meta-axioms as ever.

The Dance of the Meta-axioms



NODES

1. The original formalist neoclassical position/model (e.g. Nash, Debreu, Savage etc.)
2. Debate following a challenge **c** to the formalist neoclassical position's (or model's) truth status
3. Amended neoclassical models in response to **c**
4. The original formalist neoclassical position under a different configuration of the meta-axioms, occasioned by severe tightening of the 3rd meta-axiom

MOVES

- c** challenge to the formalist neoclassical position's or model's truth status (e.g. the claim that *Homo Economicus* is too asocial)
- i** challenge **c** is ignored, at which point the debate ends and the profession stays at the original formalist, neoclassical position or model **1**
- a** challenge **c** is addressed, by relaxing the first two meta-axioms: **M**→**m** and/or **D**→**d**
- r** retreat to **1**, the original position or model

Five examples:

	c	Amendment in meta-axioms 1 and/or 2	Trajectory
Expected Utility Theory	Challenge to independence axiom	None	1 → 2 → 1 i : ignore c
Aggregate Physical Capital	Its magnitude depends on its price		
Impossibility Theorems	Convergence must be modelled	None	1 → 2 → 3 → 1 r : retreat from c
Psychology of <i>Homo Economicus</i>	Utility depends on perceived intentions	M → m (2nd order beliefs influence utility)	1 → 2 → 3 → 4 b : e→E
Evolving Behaviour	Strategies adapt and mutate	S → s (strategies compete for evolutionary fitness)	1 → 2 → 3 → 4 b : e→E

2.1 Ignored challenges: The 1→2→1 quickstep

In this subsection we look at challenges to the neoclassical method which, while poignant and valid, were unceremoniously ignored by the mainstream. We begin with the 1950s explosion of neoclassical decision and game theory that was founded on expected utility theory (as outlined by von Neumann and Morgenstern, 1944, and Savage, 1953). From a very early stage, its foundational assumptions were challenged both experimentally and logically. In particular, two separate but equally devastating critiques, by Allais (1953) and Ellsberg (1956, 1961), disproved the empirical validity of expected utility theory and challenged the logic of its foundational axioms. Since then a cottage industry of laboratory experiments has confirmed the former while a series of fascinating alternatives to expected utility theory have been published in the mainstream's top journals (for surveys see Sugden, 1991, and Starmer, 2000). And yet, to this day, expected utility theory reigns supreme both in the lecture theatres and in every form of neoclassical theorising, from rational expectations models to each and every application of game theory.

In game theory itself, questions were raised about the plausibility of presuming that rational agents must always select behaviour consistent with Nash's (1951) equilibrium. In the context of static games it became apparent that *disequilibrium* behaviour could be fully rationalised and rendered consistent with infinite order common knowledge rationality.²² Similarly, it transpired that out-of-equilibrium behaviour could be just as rational in finite dynamic games as the equilibrium path proposed by Nash and his disciples.²³ As for indefinite horizon games, the devastating force of indeterminacy was felt in the form of the so-called *Folk Theorem* which shows that, in interactions that last for an unspecified period, *anything goes*.²⁴ And yet, *all* applications of game theory, from theories of Central Bank behaviour to industrial organisation, labour economics and voting models, ignore these challenges, assuming that behaviour will remain on *the* equilibrium path.²⁵

Perhaps the best known case of a challenge ignored is the debate known as the capital controversies. Neoclassicism traditionally insisted that, with price taking agents, returns to capital reflect capital's marginal productivity. The challenge to this notion came from Cambridge economists Piero Sraffa, Joan Robinson and Luigi Pasinetti who pointed out a highly damaging reflexivity: While it is possible to speak meaningfully of homogeneous apple juice, even of homogenous 'abstract' labour, it is impossible to treat capital goods as homogenous (in view of their different types and vintages) and, consequently, to measure an economy's capital stock independently of its price. But then, if physical capital's magnitude depends on its price, how can its price be explained by its magnitude? This challenge prompted a series of exchanges (see Harcourt, 1972) which petered out once the neoclassical corner effectively threw in the towel.²⁶ And yet, today, no trace of this debate is to be found in any mainstream economics curriculum. The challenge has been ignored and the mainstream has continued to assume that the profit rate (i.e. capital's price) is explained, unidirectionally, by the revenues due to the last morsel of an aggregate physical capital whose magnitude is independent of that return. All the developments

in the 1970s and beyond (rational expectations, new classical and recursive macroeconomics etc.) proceeded as if this debate never took place.²⁷

2.2 Retreat: The 1→2→3→1 move

Not all valid and poignant challenges came from critics of neoclassicism. Some of the strongest ones emanated endogenously and, perhaps for this reason, were taken seriously by the profession. The best example relates to the theorem by which a general equilibrium was proven to exist: Arrow and Debreu (1954) arrived at their celebrated proof by first taking a leaf out of Nash's proof of the existence of a unique solution to the bargaining problem (see Nash 1950). The key idea that they borrowed from Nash was *to abstract fully from the equilibration process*.²⁸ Adopting the strong version (**E**) of the third meta-axiom, Nash and Arrow and Debreu established their unique equilibria only *by purposely ignoring the movements leading to it*. The profession was, understandably, dazzled by these remarkable existence proofs. Nevertheless, it was not too long before questions were being asked about how the equilibrium obtains in real time (either in bargaining or in some multi-sector neoclassical economy).

While Nash and Debreu had no qualms to admit that it was part of their proof *not* to have an answer to this,²⁹ neoclassicism could not avoid such questions, especially in the lecture theatres. Teachers found themselves almost compelled to rely on deeply unsatisfactory heuristics. In the case of bargaining, stories were told that involved positing a bargaining process with stages in which concessions were motivated by different amounts of fear of disagreement.³⁰ Similarly, in the case of the competitive price mechanism, tales of equilibration were allowed to linger on the basis of an analytically untested belief that prices must adjust until excess demand vanishes.

While these equilibration narratives had (and could have had) no basis in the axiomatics of Nash or Arrow-Debreu, they *seemed* ever so obviously correct to students as to silence all dissenting voices. Except, of course, those of the *leading* neo-classicists, who understood only too well the analytical folly intrinsic to these. Nevertheless, with one exception (namely, Debreu³¹) they craved some demonstration of convergence to their axiomatically derived, and thus inherently static, equilibria; a demonstration with which to replace the incongruous lecture theatre tales. Thus, a challenge was issued, from *within* neoclassicism, to model convergence explicitly, both in the context of general equilibrium and in bargaining. Indeed, in a world of disequilibrium, flux, persistent unemployment, periodic price wars, painful industrial disputes etc., an inability to say something meaningful on out-of-equilibrium prices, or on costly delay before reaching agreements, would have been tantamount to a declaration of theoretical failure.

In the case of Nash's bargaining theorem, Rubinstein (1982) rose to the challenge: Nash's solution, he argued, could be shown to be the limiting case of a bargaining process in which rational bargainers issued alternating demands.³² As for costly delays in reaching agreement, they could be explained by asymmetrical information on each other's eagerness to settle (see Rubinstein, 1985). In general equilibrium theory, some promising preliminary work hinted at ways in which the groping process toward an equilibrium price vector could be modelled (for an early attempt see Arrow,

1959). However, it was not long before it transpired that both projects were doomed. The bad news for the neoclassical project, in both cases, came from Hugo Sonnenschein and his collaborators.

Starting with general equilibrium, Sonnenschein (1972, 1973) demonstrated (confirming Debreu's stance – see note 31) that excess demand for some commodity could never guarantee that its price would rise; that even if individual excess demand functions were well defined, aggregate demand was not. The implication was startling and its poignancy confirmed by Mantel (1974) and Debreu (1974). The combined meaning of what has become known as the *Sonnenschein-Mantel-Debreu theorem* (SMD thereafter) was: (a) that convergence to general equilibrium is *impossible* to model, and (b) that it is no longer possible to guarantee the general equilibrium's uniqueness. Moving on to bargaining theory, the idea that delay in reaching agreement could be explained by asymmetrical information, within the context of the Nash-Rubinstein approach to bargaining, was dispelled by Gul and Sonnenschein (1988). In conjunction with the aforementioned devastating critique of the logical coherence of subgame perfection in dynamic contexts,³³ the literature reached a simple conclusion: Rationality (of whatever order, breadth, extent or commonality) could *never* ensure that a bargaining process between rational agents is amenable to the mathematical modelling of some stochastic equilibrium path.³⁴

Taken together, these two contributions had a single, inescapable, implication for the grand neoclassical project of the 1950s: *The highest form of neoclassicism had nothing meaningful to say about price and contract formation*. Intriguingly, it was neoclassicism which challenged itself to come up with a response to the convergence issue and it was neoclassicism which procured these two impossibility theorems which *prove* that it could not meet its own challenges. In terms of the previous section's meta-axioms, the point here is that the best and brightest challenged themselves to shift the highest form of neoclassical theory away from a reliance on version **E** of the third meta-axiom and toward its weaker version **e**. Alas, all such efforts crashed against a wall of indeterminacy.

The crucial question is: What happened next? The answer is: A multifarious retreat (arrow **r**) back to position **1** in our diagram! Just as in the case of the Cambridge controversies, the challenge came to naught, even if it was an endogenously generated one which neoclassicists valiantly tried to rise to. The actual retreat (arrow **r**) took various forms. Most common is the retreat behind single sector or representative agent models in which the weak third meta-axiom (**e**) suffices. What is, however, of great interest is the *repeated* deployment of the **1→2→3→1** move: When facing questions about the determination of value in a world of many agents and sectors, the profession responds by showcasing the original Nash-Debreu-Arrow analysis, complete with the strong version of the third meta-axiom (**E**). If fresh questions follow regarding convergence, dynamics, growth etc., the weaker version (**e**) comes into play and the emphasis shifts silently from Nash-Debreu-Arrow to representative agent and/or single sector models. And if anyone, at this point, impertinently protests that the world comprises multiple agents and sectors, her neoclassical interlocutor dusts off Nash-Debreu-Arrow once more and brings on **E**. And so on.

This continual *move* back and forth between **e** and **E** keeps out of sight the theoretical failure to rise to the original challenge **c**. In fact, which of the two versions of the third meta-axiom is deployed depends on the question the neoclassicist feels compelled to answer: If she is put on the spot to explain action (e.g. moves, offers) in real time, she will deploy **e**. But if she needs to articulate a theory of prices (competitive or bargained, e.g. in neoclassical macroeconomics, labour economics, industrial organisation), she returns to **E** and the glittery existence proofs founded upon it. Above all, the surreptitious, never ending move from **e** to **E** to **e** to... *ad infinitum* keeps out of sight the neoclassical failure to rise to its own challenges, and thus out of the mainstream economists' agenda.

Dow (1995) correctly writes that, in juxtaposition to the Keynesian method which she favours, "mainstream methodology limits economic theory to those elements of the economic process which can, in practice, be represented by a closed, formal system." However, when adding that "a high degree of certainty can be achieved within those limits", she is conceding too much. As we have shown above (and in the next subsection), the said 'certainty' is attained only by logically illegitimate moves involving the covert re-switching between the strong and the weak versions of the third meta-axiom.

2.3 Backslide: The 1→2→3→4 shuffle

This subsection discusses two examples of what we call the *backslide* (arrow **b** in the diagram) which, following a failed foray into greater plausibility and sophistication, returns the theory not to its original position (node **1**) but to a state once removed from it (node **4**) where the original position's weaknesses are both *better hidden* and *much amplified*. Our two examples concern, first, the attempts to give *Homo Economicus* a (much needed) richer psychology and, secondly, neoclassicism's so-called *evolutionary turn*.

Let us begin with the major breakthrough in economic psychology marked by two classic papers: Geanakoplos et al (1989) and Rabin (1993). Jill is now psychologically sophisticated in her interactions with Jack and cares not only about what he will do but also about his motives. To illustrate, suppose that, in a static prisoner's dilemma, and under commonly known rationality (CKR), Jill predicts that Jack will defect. In standard neoclassical analysis, there is nothing more to say: They will both defect and their payoffs will be those that correspond to mutual defection. However, in the psychologically enhanced version, intentions matter. Consider two different thoughts which might be underlying Jill's prediction that Jack will defect:

(A) "Jack is defecting *because* he is expecting me to defect too"

(B) "Jack is defecting *even though* he is expecting me to cooperate"

The point here is that Jill may have a legitimate reason to feel worse under (B).³⁵ For under (B) she thinks that, by defecting himself, Jack is shunning a 'kind gesture' of hers.³⁶ In contrast, under (A) his defection is deemed psychologically neutral.³⁷

The analytical significance of the above is (a) that it enhances the analysis' realism (by restoring the motivational role of perceived intentions) and (b) that it allows us to rationalise cooperative outcomes unceremoniously dismissed by standard neoclassical theory.³⁸ There are two morals to this

story. First, neoclassicists are right when arguing that *Homo Economicus* can be 'trained' better to resemble a real person through a relaxation of their first two meta-axioms.³⁹ The second moral, however, is more sobering: Indeterminacy kicks in with a vengeance causing a backslide to an even less defensible position than the original. The reason is that the attempt to civilise the neoclassical agent threatened to wreck the very fabric of the analytical framework. What we term 'the backslide' is merely a reaction to this threat.

To see this, we first note that the standard analysis (featuring psychologically unsophisticated players) requires no more than the weak version (**e**) of the third meta-axiom to yield a unique equilibrium.⁴⁰ In contrast, Jill's and Jack's newfound complicated psychology gave rise to a novel, and particularly, sinister type of indeterminacy: the prisoner's dilemma ceases to be a well defined game!⁴¹ Indeed, when motives 'infect' utilities directly, the only way of writing down the game's payoffs is if we know the players' beliefs *a priori*. But we can only know them *a priori* if we make the *a priori* assumption that their (first and second order) beliefs are aligned! Therefore, to help retrieve the prisoner's dilemma as a well defined game (i.e. to be able to specify the utilities from each of the interaction's four potential outcomes⁴²), the hapless theorist is forced to backslide to the strongest imaginable version of the third meta-axiom. To an **E** on... steroids.⁴³

The above illustrates nicely the backslide (**b**) in the preceding diagram: A fascinating challenge (**c**), emanating from another field (psychology, in this example), was taken on gallantly by the profession (arrow **a**) but the ensuing indeterminacy defeated its best intentions and forced it on the back foot. The indeterminacy proved so radical that it jeopardised not merely the model's 'closure' (i.e. whether a unique solution can be found) but, indeed, the model's very structural coherence.⁴⁴ A major tightening of the third meta-axiom saved the day, *via* a logically indefensible leap of faith,⁴⁵ returning the analysis not to its original position (**1**) but to another position (**4**) once removed from it. Interestingly, at that new position (**4**), the theory is rationally less defensible than before but, simultaneously, possesses more discursive power!⁴⁶

The evolutionary turn of neoclassical economics is our second example of a major *backslide*. Evolutionary biologists⁴⁷ demonstrated that, in a hypothesised world of insects and birds, behaviour converges automatically onto neoclassical equilibria; seemingly with no need for the third meta-axiom. Understandably, the mainstream was thrilled by this discovery which vindicated neoclassicism,⁴⁸ sharpened its predictions,⁴⁹ and allowed for the deployment of the weak version of its third meta-axiom⁵⁰ on the basis of an intuitively appealing Darwinian rationale. For a moment, neoclassicism's triumph seemed complete; even critics of the mainstream came to see the evolutionary turn as a sign that the mainstream was no longer neoclassical.⁵¹

Were matters allowed to rest there, the inevitable conclusion would have been that the neoclassical mainstream had been on the right track all along (regarding the substance of its hunches) and that, following its evolutionary turn, it reached a stage of development at which it could afford to stop being neoclassical (that is, to drop the third meta-axiom's strong version) and evolve itself into a quasi-Darwinian, technical albeit pluralist, complexity-friendly and, ultimately, more scientific socio-economic discipline.⁵² Alas, matters could not rest there. For at closer inspection it soon becomes clear that the Darwinian mechanism at the heart of neoclassicism's evolutionary

turn is methodologically equivalent to the third meta-axiom and a brake on any substantive venture beyond the neoclassical meta-axiomatic straitjacket.

Recall that all evolutionary models turn on two mechanisms: an *adaptation mechanism*, which is responsible for convergence *via* some type of natural selection (or *replicator dynamic*), and a *mutation generating mechanism* which produces a constant inflow of variety. The aforementioned evolutionary dynamic is based on a joint assumption: (A) that the two mechanisms are independent of each other, and (B) that mutations are identically and independently distributed (*iid*) random events. While this may be a suitable assumption in biology, it is certainly not so in the social sciences. Humans have the curious habit of combining conformity (i.e. of individually copying the relatively successful behaviour of others) with: (i) individual acts of subversion caused by some theory regarding the rules that govern their society (i.e. an ideology) and (ii) collective or coordinated acts of subversion intended clearly to undermine established social conventions and norms (e.g. confronting patriarchal notions of propriety, bourgeois norms of property rights). The conjunction of (i) and (ii) constitutes, in evolutionary terms, behavioural patterns consistent with highly correlated mutations linked inextricably to the adaptation mechanism.

In short, (i) and (ii) disestablishes the joint assumption (A)&(B) without which the much prized evolutionary economic models break down. Put differently, while humanity is typified by both *natural* and *social selection*, economics' evolutionary turn can only deal with the former. To the extent that human history is influenced systematically by our capacity for reflection, dialogue and political action (a capacity antithetical to the assumption of mutations as exclusively random *iid* events), evolutionary economics is insufficiently... evolutionary.⁵³ To their credit, a number of evolutionary theorists have understood this well and tried to respond analytically.⁵⁴ However, they quickly reached the conclusion⁵⁵ that allowing the mutation probabilities to be cointegrated with the social adaptation mechanism yields a new type of *Folk Theorem*: i.e. almost *any* conventional behaviour can become disestablished and any alternative may take its place if 'subversives' co-ordinate their mutation probabilities appropriately and in response to the currently dominant behavioural conventions.

The wall of indeterminacy has, once again, defeated neoclassicism's efforts to rise to a new level of sophistication: Its attempt to infuse some realism into its models by borrowing heavily from evolutionary biology caused the set of (evolutionary) equilibria to divide and multiply *ad infinitum*.⁵⁶ In the face of such infectious indeterminacy, the mainstream recoiled, yet again, behind the strong version of its third meta-axiom (by insisting that mutations *are* random *iid* events⁵⁷). This is unsurprising since its only other alternative would be to drop theoretical modelling and to concentrate either on simulations or on empirical work (or both). While some gallant evolutionary economists *did* focus on simulations (see Patokos, 2005), they soon realised that the mainstream left them behind, preferring to perform the **1→2→3→4 shuffle** which took it back to a neoclassical position that is just as unsophisticated as the original (since the insistence that humans are incapable of coordinating their 'mutations' effectively returns us to a world of pseudo-rational fools). Interestingly, in this case too, the theoretical failure

enhanced greatly neoclassicism's discursive power courtesy of the new claim that its theorems can now be supported by an evolutionary narrative.⁵⁸

3. Behind neoclassicism's undiminished dominance

Neoclassicists are an exceptionally open-minded people, willing to countenance *any* proposition, however farfetched, weird or even... leftwing.⁵⁹ All they ask in return is that the said proposition is *embedded within their three meta-axioms*. This 'openness' is made all the more significant by the fact that, undoubtedly, *any* conceivable 'story' can be told by tinkering with neoclassicism's first two meta-axioms (see Dasgupta, 2002). Lured by the prospect of unbounded theoretical possibility, the aspiring young economist delights in tinkering her way into the infinite vistas of potential neoclassical narratives; she even revels in sailing the oceans of indeterminacy stirred up by her tinkering.

At some point, however, the fun must give way to publications, appointments and full induction into the profession. At *that* point, the lurking gatekeepers (supervisor, referees etc.) present her with a fresh condition: To be allowed into the priesthood, her models must have first achieved 'closure' (i.e. a restricted set of equilibria); she must, in effect, submit them to the merciless tightening of the third meta-axiom's fist, thus tracing the **r** or **b** trajectories (see the previous section's diagram) away from indeterminacy's *cul-de-sac*. At that juncture, having already invested great energy and hope in her modelling, it takes a brave and tragic theorist to desist and call it quits.

A tiny minority 'close' their models reluctantly, tucking critical comments away in their papers' footnotes, biding their time and, once tenured, turn into resident critics. Some 'close' their models and steer clear of any controversy but, nonetheless, manage to retain the memory of how determinacy's imperatives whipped them back, from a complex and rewarding inquiry, to a paradigm devised for arid pure-exchange economies in which a sophisticated theory of agency, not to mention a left-of-centre political agenda, is as viable as a fire under a mighty waterfall (see Varoufakis, 2002, for the 'postmodern' aspect of this). Meanwhile, the vast majority not only leave no stone unturned to 'close' their models, often with moral enthusiasm, but also sweep under the emotional carpet any memory of how their models' 'closure' was bought at the price of returning *homo economicus* to strict isolation from his brethren, of relinquishing meaningful social norms, and of losing social and historical contingency.

Having performed the *Dance's* moves *once* (with the **r** and/or **b** 'moves' back to positions **1** or **4**) in order to gain entry into the mainstream, the new recruits (reluctant and the enthusiastic alike) soon discover that they must perform them again and again and again. For once they are called upon to impart their wisdom in the amphitheatres, or to 'advise' government, business etc., their audiences *demand* a nuanced story of how their 'closed' models apply to the real world. Telling them that you can have *either* such a nuanced narrative *or* determinate models *but never both* requires the combination of intellectual honesty, mathematical acumen, and secure academic employment that only exceedingly rare birds, like Nash or Debreu, possessed (see note 29). In their absence, the vast majority sustain the illusion of a nuanced, determinate theory by keeping the *Dance* going; by shifting backwards and

forwards between 'closed' oversimplifications and complex-yet-indeterminate models; and, last but not least, by (sub-intentionally) hiding all this under a rhetorical cloak which gives (even to themselves) the impression of a serene, unchallenged scientific authority.⁶⁰

It is of course true that the very sight of a system of equations inspires a natural urge to solve it (and a feeling of disappointment when it proves overdetermined). Non-neoclassicists (e.g. von Neumann, Sraffa, Goodwin, Robinson) are also subject to that urge but, unlike the neoclassicists, did not *have* to sacrifice their theories' logical integrity in order to do so. Even the most mathematical amongst them (e.g. von Neumann), were relaxed with the idea of admitting exogenously determined variables into their analysis and introduced restrictive assumptions solely in order to solve their equations; not to 'close' their models shut.⁶¹

Neoclassicists, in contrast, are hell bent on the endogenous determination of *all* variables (prices, quantities, wages, profits, but even social norms, moral entitlements, psychological utilities) *exclusively on the basis of the initial, primitive data*. In short, they want to 'go it alone'; to reap the rewards of (social scientific) monopoly; to produce 'closed' theories packing historical, psychological, biological and anthropological relevance but with no input from meddling historians, uppity psychologists, boisterous biologists or doubting anthropologists. The three meta-axioms, in this sense, are enforced by the invisible hand of *academic rent seeking*; the same dynamic that motivates their *Dance* as a device for maintaining the illusion of pluralist open-mindedness.

The question, however, remains: How does mainstream economics get away with this? Even if Kirman (1989) and Coase (1994) and are right that professional economists have long stopped caring about the truth-status of their wares, does the world not notice their grand failure? We contend that it does. Students are abandoning economics majors in droves; the number of critical voices within the profession grows,⁶² as for the public, official economic 'wisdom' causes derision or merriment. And yet, while academic economics is shrinking, the neoclassical stranglehold over the mainstream is as strong as ever. Why? We have already sketched out an explanation of what goes on *within* the discipline (our *Dance of the Meta-axioms*). But there is a second reason relating to neoclassicism's immense ideological utility *viz.* the current socio-economic order: Put simply, neoclassicism rules out *any* systemic analysis of capitalism.

Capitalism's champions have traditionally claimed that it is a *natural*, not a particular, *system*. Its critics (i.e. the Left) have objected that there is nothing natural about capitalism; that it is predicated upon a *particular* grid of political, legal and coercive power which could have been otherwise. Methodologically, this disagreement translates, simply, into whether really existing capitalism can be fruitfully theorised by models that keep structure separate from agency. Any economist who wants to breach the structure-agency separation⁶³ within neoclassicism's first two meta-axioms soon discovers that her models generate more equilibria than she could count. Thus, to continue a critical approach to capitalism she must either abandon the first two meta-axioms or accept indeterminacy. Either way, her papers will remain outside the mainstream.

In this sense, the profession's ostracism of *any* analysis that ventures beyond the three meta-axioms is tantamount to *a decree that every single mainstream economist accepts capitalism as a 'natural' system*.⁶⁴ Consequently, what we are left with is a profession churning out technical studies of fictitious markets which act as mere *diversions* from the real task of studying capitalism. Of course, the utility of this feat, for those who have an interest to keep capitalism out of serious theoretical scrutiny, is immense. Capitalism appears in the public's eyes as a complex entity no less natural than the physical universe; it is, we are told, an entity to be analysed with the clinical impartiality of a social physicist,⁶⁵ exploited by financial engineers,⁶⁶ tamed by 'independent' Central Bankers, and only occasionally criticised by a few superannuated mainstream economists.

Recent neoclassicism and contemporary capitalism have given rise to a similar ontological claim: According to influential commentators, neither any longer exists! They are portrayed as gradually transcending into something altogether 'different'; of having, in fact, 'transformed' themselves out of existence.⁶⁷ Though this debate is well outside our paper's scope, it is tempting to note that the 'capitalism-has-disappeared' line of argument is jointly functional both to capitalism *and* to the dominance of neoclassical economics. It is functional to capitalism because it helps it remain invisible, shielding it from systematic criticism. And it is functional to neoclassicism because it justifies its insistence on the three meta-axioms.

While the world is currently struggling to make sense of the tumult visited upon it by a *particular* strand of globalising capitalism, the latter's best defence comes in the form of thousands of young economists being quickmarched headlong into academic obscurantism and socio-economic irrelevance. Instead of acting as the *avant guard* that will prise out the truth about the causes and nature of the current crisis, they are conscripted to this perpetual feedback mechanism which mutually reinforces (a) the current economic order and (b) the neoclassical core of mainstream economics. Future historians, we suspect, will mark this out as our era's most fascinating, *and* most tragic, evolutionary social dynamic.

Concluding remark

Neoclassical economics draws its immense narrative power from an audaciously circular process of mutual reinforcement: faithful to its constitutive meta-axioms, which it juggles continuously in a manner that hides their implications (and, often, their logical incoherence), neoclassicism retains its hold over the economics mainstream *and* rules itself out of engagement with the logic of really existing capitalism. The latter, supra-intentionally, rewards neoclassicism with institutional power which helps it maintain a strict embargo on any serious scrutiny of its own foundations.

It seems almost indelicate to point out that, while this feedback mechanism remains opaque and unexamined by the mainstream's critics, contemporary economic reality and mainstream economics will remain strangers who reinforce each other's dominance as long as (a) *mainstream economics remains, courtesy of its meta-axioms, innocent of the logic of capitalism* and (b) *the logic of contemporary capitalism spreads faster and deeper when economics' meta-axioms help it remain invisible*.

Quite possibly, never before has intellectual history fashioned an ideological triumph of this magnitude out of a sequence of sorry, yet powerfully motivated, theoretical failures.

Notes

¹ For they think of what they do as scientific economics. The history of the term 'neoclassical' is discussed in Aspromourgos (1986). It should not be confused with the related term 'neoclassical synthesis' employed by Don Patinkin and Paul Samuelson to describe a reinterpretation of Keynes.

² Victorian values and practices evolved through time and meant different things in different sub-periods; e.g. the late Byzantine era resembled its earlier more 'Roman' phase very little indeed. This dynamic complexity, however, does not detract from the usefulness of an overarching characterisation such as 'Byzantine' or 'Victorian'.

³ A good example of such axiom-based definitions are Becker (1976), Blaug (1992), Vilks (1992), Hodgson (1999) and Colander (2005a). They define neoclassicism in terms of their *assumptions*. To take the most recent attempt to do so, Colander (2005a) defines neoclassicism *viz.* the 'holy trinity' of rationality, greed and equilibrium. Notice that, in terms of his definition, all it takes for a theory to step outside neoclassicism is a minor relaxation of any of these axioms (a relaxation that every self respecting graduate student can perform in her spare time). It was, therefore, inevitable that Colander (2005b) would conclude that neoclassical economics is dissolving. In contrast, our meta-axiomatic definition accommodates evolving axioms which, while in flux, remain within what we think is a particular and highly distinctive method; one that not only 'survives' these relaxations, but in fact one that strengthens its stranglehold over the profession as it evolves. In this sense, our line of argument is more in tune with Dow (1995) and Fine (2008). But more on this in the next two sections.

⁴ Geanakoplos *et al* (1989) offer an excellent case in point. By allowing an agent's utility to depend directly on her second order beliefs regarding her own choice, as is the case more often than not for all of us (e.g. Jill's utility from passing an examination differs depending on whether she thought that Jack thought that she would pass or not), they enrich the model of individual agency. However, this enrichment comes at the price of indeterminacy even when the agent acts alone and under perfect information *viz.* all relevant data (e.g. Jill's decision may belong to violently different equilibria; in one she studies hard expecting that Jack thinks he will pass, an expectation that she wants to fulfil; in another she thinks he is not expecting her to pass, a thought that makes her less eager to want to invest in this examination).

⁵ To mention a few, social norms have been allowed to 'infect' a worker's preferences in a manner that explains wage rigidity and even the decision to join a strike (see Akerlof, 1980, and Varoufakis, 1989); preferences are formed endogenously (see Bowles, 1998); macroeconomic events influence individual motives (see Akerlof, 1982, 2007); social evolution determines private actions (see Weibull, 1995), what others think has a direct impact on what we want (see Rabin, 1993) etc.

⁶ Some non-neoclassical readers will protest that evolutionary game theory is not neoclassical. While we understand the hope this theory has given to many non-neoclassicists, and at the risk of wrecking it, we shall be arguing in the next section that evolutionary game theory remains firmly neoclassical (at least given the present section's definition of neoclassicism).

⁷ The strict separation of belief from preference relaxed, as in the case of psychological game theory - see Hargreaves-Heap and Varoufakis, 2004, Chapter 7. Weak methodological instrumentalism, see **s** below, accommodates such departures from **S**.

⁸ See Hargreaves-Heap and Varoufakis (2004), Chapter 6, for more.

⁹ Once upon a time, we could have instead talked of *methodological rationalism* as the dominant narrative centred on agents acting rationally. But since ordinal utilitarianism took over, there is no sense in narrating behaviour in terms of agents acting rationally. Instead, rationality is reduced to the consistency of one's preference ordering which, by definition, determines that which agents will do. See Arrow (1994) and Varoufakis (1998, Chapter 4).

¹⁰ See Varoufakis (2008) for the argument that such models are, essentially, ahistorical.

¹¹ However, while **S**'s roots are Humean, Hume would have objected strongly to it. Our Reason, he would have thought, is too timid to tell us what is best in a social context, while

our Passions are too unruly to fit neatly into some ordinal or expected utility function. It took the combined efforts of the late 19th Century neoclassicists to build upon Jeremy Bentham's reduction of all the Passions to a single one (the passion for utility) before they tamed it sufficiently, bleached it of all psychology and sociality, thus reducing it to a unidimensional index of preference-ordering which is expressible as a smooth, double differentiable ordinal utility function.

¹² In this sense, rather than being explained as the result of some complex calculus of the locals' desires, the logic of driving on the left in Gloucestershire, or on the right in South Maine, is to be found in some adaptation mechanism that followed on from a random event (or mutation), whose trace is often lost in the past, and which yielded a dominant evolutionary equilibrium.

¹³ "In every system of morality which I have hitherto met with, ...I am surprised to find, that instead of the usual copulations of propositions, *is* and *is not*, I meet with no proposition that is not connected with an *ought* or an *ought not*. This change is imperceptible; but is, however, of the last consequence." Hume (1739/40,1888; III,i,1]

¹⁴ The obvious exception here is Keynes, who stands alone as a theorist committed to complete explanations of the workings of capitalism which are consistent with disequilibrium. See Leijonhufvud (1968).

¹⁵ While the neoclassicists' technical sophistication has taken off since the time of Cournot (and even of Arrow and Debreu), one truth remains: stability analysis is a fig leaf to cover up the dearth of any consistent theory of how a market equilibrium might emerge on the basis of historically situated acts of self interested buyers and sellers. In fact, as Mantel, 1974, and Sonnenschein, 1973,1973, have famously shown, such a demonstration is impossible. Analogously, in game theory, the theorists' favourite equilibrium concept (subgame perfection) is also impossible to rationalise logically except under very special, atypical, circumstances (see Varoufakis, 1991, 1993).

¹⁶ Consider, for example, von Neumann's input-output analysis (von Neumann, 1937; a model that fits nicely in the classical economics tradition; see Kurz and Salvatori, 1993), the standard Sraffian model of determining prices in the context of joint production (Sraffa, 1975), Goodwin's dynamic equilibrium yielding a stable pattern of oscillating inflation and unemployment (Goodwin, 1967), Marxist schemas of reproduction (Halevi, 1998) etc. They all 'discover' the equilibrium state or path on the basis of their primitive data and some pre-specified selection mechanism (e.g. the assumption that profit rates will equalise across sectors).

¹⁷ For example, von Neumann's game theory (see von Neumann, 1928, and von Neumann and Morgenstern, 1944), while fully neoclassical, invariantly contained complete explanations of the reasoning that would lead players to equilibrium. Similarly with Marshall (1891), for whom equilibration was a process that required a comprehensive exegesis that is best attempted at a partial equilibrium level of abstraction.

¹⁸ For a complete account of how Nash's Cowles October 1950 presentation was the catalyst for Debreu's and Arrow's descent into formalism, and the ensuing static general equilibrium theory, see Varoufakis (2009).

¹⁹ General equilibrium theory's divorce from convergence analysis is well understood (see also note 15). Less appreciated is that a similar problem has been afflicting game theory ever since the Nash equilibrium became its foundational stone: While the simple, static Cournot-Nash oligopoly equilibrium requires no more than **e** to be arrived at, the moment the interaction acquires a more realistic structure (e.g. consists of a sequence of moves or is repeated) **e** does not suffice and **E** must be introduced urgently (and usually through the back door). See Hargreaves-Heap and Varoufakis, 2004, Chapters 2&3.

²⁰ See Davis (2006), Colander (2005a,2005b) and Colander et al (2004a,2004b).

²¹ Once upon a time, *Homo Economicus* was a simple lad (yes, a lad – see England 1993 and Hewitson, 1999). He liked what he bought and bought what he liked, loathed work, knew all he wanted to know (given the price of information), and cared not an iota either for his neighbours or for what they thought of him. As for the sort of economics built upon him, neoclassicism was typified by a familiar melange of theoretical practices: labour markets which would return to equilibrium if the troublesome unions and the meddling government let them; a habitual recourse to Say's Law; interest rates which never fail to equalise investment and savings; a constant array of Cobb-Douglas or CES production and utility functions; etc.

²² See Benrheim (1984) and Pearce (1984).

²³ See Binmore (1989), Pettit and Sugden (1989) and Varoufakis (1993)

²⁴ Take, for example, the standard prisoner's dilemma and suppose it is repeated indefinitely between the same players. The Folk Theorem shows that *anything* may happen as time goes by. Players may cooperate, they may defect, or they may oscillate between cooperation and defection in patterns of infinite complexity. By extension, this means that microeconomic theory has nothing to say regarding the formation or otherwise of cartels in oligopolistic markets: they may form, break down, reform at will and in ways that no neoclassical model can pin down analytically. See Hargeaves-Heap and Varoufakis (2004), Chapter 5.

²⁵ The sheer convenience (for the modeller) of sticking to the assumption that rational agents must remain on the equilibrium path is aided and abetted by the fascinating, provocative, but ultimately deeply flawed, argument in Aumann (1976).

²⁶ One such acknowledgment came from Levhari and Samuelson who in 1966 published a paper beginning with the admission that the neoclassical position was false: "We wish to make it clear for the record that the nonreswitching theorem associated with us is definitely false. We are grateful to Dr. Pasinetti..." quoted in Burmeister (2000).

²⁷ See Cohen and Harcourt (2003). See also Bliss (2005) for an illustration not only of the neoclassicists' readiness to ignore perfectly good scientific challenges but to take pleasure in taunting the challengers as well. He writes: "If one asks the question: what new idea has come out of Anglo-Italian thinking in the past 20 years, one creates an embarrassing social situation. This is because it is not clear that anything new has come out of the old, bitter debates. Meanwhile mainstream theorizing has taken different directions. Interest has shifted from general equilibrium style (high-dimension) models to simple, mainly one-good models." In one paragraph, Bliss depicts the challengers' incredulity that their perfectly valid challenge had no impact on the profession which recoiled shamelessly behind the original, discredited neoclassical position.

²⁸ Varoufakis (2009) argues that Nash's existence theorem in the context of games was the impetus which led Debreu and Arrow to their own proof of the existence of a vector of general equilibrium prices. This piece of 'speculation' was more recently confirmed by Kenneth Arrow himself who wrote: "The [Nash] paper, however, supplied a firm basis by providing an existence theorem..." (Arrow, 2009).

²⁹ Debreu's background in the French Bourbaki mathematical tradition is consistent with a radical absence of any concern for the realism of his models (for an excellent account see Mirowski and Weintraub, 1994). Nash's bargaining theory can be seen as a precursor in this regard too in the sense of Nash's commitment to delivering a solution to the bargaining problem as long as he did not have to answer questions such as: "How will they arrive at that bargain?"

³⁰ See Bishop (1964) who tried to breathe a bargaining process, borrowed from Zeuthen (1930), into Nash's axiomatics. However, such attempts had the same basic flaw as that of Cournot's original, *circa* 1838, oligopoly dynamics: they assumed that agents would make assumptions which required a deep misconception of the model itself.

³¹ Debreu was always clear in his mind that out-of-equilibrium formalism is impossible. So much so that he, in fact, also rejected stability analysis: "(W)hen you are out of equilibrium, in economics you cannot assume that every commodity has a unique price because that is already an equilibrium determination." (in Weintraub 2002). Nash, on the other hand, harboured hope that his formalism would be vindicated by some form of evolutionary analysis. In his PhD thesis he inserted a famous footnote in which he alluded to the idea of confirming his axiomatic derivation of equilibrium by positing players (drawn from a large population) who interact repeatedly (against a different opponent each time) without assuming that they "...have full knowledge of the total structure of the game, or the ability and inclination to go through any complex reasoning process".

³² Assuming that delays in reaching agreement was costly to both bargainers.

³³ For references see note 23.

³⁴ In a nutshell, rational agents have no reason not to stray from 'the' equilibrium path (be it deterministic or stochastic) in a bid to subvert the expectations of their opponent for their own potential benefit. See Varoufakis (1991), Sugden (2000) and Chapter 6 of Hargeaves-Heap and Varoufakis (2004) for the complete argument.

³⁵ A feeling that may be ameliorated better by defecting, rather than by cooperating.

³⁶ She thinks that Jack expects her to cooperate. But since Jill knows that he knows, courtesy of CKR, that she is rational, she knows that he must also know that her decision to cooperate

entails some sacrifice. Why would she sacrifice utility? The only explanation consistent with CKR is that she is *choosing* to forego some benefits in order to benefit him. Thus, if he responds by defecting, his choice reveals a degree of malevolence in the sense that it flies in the face of her 'kindness'.

³⁷ Under (A) he is defecting on the common understanding that she will be doing likewise.

³⁸ Suppose Jill predicts that Jack will cooperate. Under CKR, her only rational explanation is that Jack is prepared to sacrifice utility in order to benefit her. Her expectation that he is being kind to her puts her in a new type of dilemma: For if she defects, she will be profiting by trampling upon his kindness; a thought that may incur psychological costs for her. And if these costs are high enough, her best reply to his cooperative move is to cooperate too. On the occasion that both players hold similar beliefs, they may well find themselves in a new type of psychologically supported cooperative equilibrium which operates at three levels: actions, first order beliefs *and* second order beliefs.

³⁹ Note that the direct reliance of players' utility function on second order beliefs represents a switch to the weaker version of the first two meta-axioms.

⁴⁰ All that is necessary in a standard static prisoner's dilemma to prove convergence to the mutual defection unique Nash equilibrium is the cast-iron logic of dominance reasoning: Whatever Jill (Jack) expects Jack (Jill) to do, she (he) is better off defecting. *QED* This convergence mechanism falls within the ambit of version **e** of the third meta-axiom.

⁴¹ Note that the players' motivation (i.e. payoffs) can no longer be defined *a priori* as they depend on a combination of first and second order beliefs. Before Jill knows the utility value of mutual defection for her (in utility terms), she must know what to expect that Jack expects of her (and what she expects of him).

⁴² Mutual defection, mutual cooperation, Jill defects while Jack cooperates, and the latter's opposite.

⁴³ We call it that because **E** must now impose equilibrium not only between acts and first order beliefs but also between acts, first *and* second order beliefs. And it does this before the players get a chance to peruse the interaction! Thus the label **E** on steroids... *Methodological equilibration*, in this context, is no longer *prior* to *methodological individualism and instrumentalism* (as is the case in standard consumer theory, game theory or rational expectations macroeconomics); the axiomatic imposition of equilibrium is now necessary not just in order to predict the interaction's outcome but also *in order to define the instrumentally rational agents' preferences!* (See Chapter 7 of Hargreaves-Heap and Varoufakis, 2004, and Fehr and Gächter, 2000).

⁴⁴ Notice how even this ultra-strong version of **E** has not defeated all the indeterminacy caused by the added psychological sophistication: In the end, the prisoner's dilemma, even after *a priori* assuming full alignment of actions, first and second order beliefs, now possesses two equilibria: One is the standard mutual defection outcome while the other is the cooperative outcome corresponding to mutually kind intentions (Jill expects Jack to cooperate in order to benefit her, thinking that she wants to do likewise; a thought which she is happy to confirm by cooperating herself).

⁴⁵ The said leap is none other than the assumption that 1st and 2nd order beliefs are aligned *a priori*. It is, arguably, impossible to rationalise such an assumption as there is no logical explanation of how such alignment would ever come about (with commonly known certainty) in a static game.

⁴⁶ It is less defensible because the version of the third meta-axiom it relies on stretches credulity beyond the limits of even the most impressionable neoclassicist. At the same time, it gains unprecedented discursive power due to the combination of: (a) the claims that neoclassicism no longer needs to posit psychologically unsophisticated agents, and (b) the immense complexity (which is necessary to model equilibrium behaviour in this type of analysis) which makes it *impossible* for anyone other than 'experts' even to understand the mathematical structure of the new type of model. The 'exclusion' of 'outsiders' lends power to the 'insiders' and evokes feelings of awe among the 'outsiders', including some who were hitherto critical of neoclassicism.

⁴⁷ See Maynard Smith and Price (1974) and Dawkins (1976,1980).

⁴⁸ The vindication came from the demonstration that populations of mindless agents (who simply copy the more successful behaviour in their midst) converge onto equilibria that neoclassicists can only axiomatically impose on populations of hyper-rational agents. Nothing

pleases the theorist more than the demonstration of a result's generality; especially when the same result is reached *via* wholly new paths.

⁴⁹ We are referring here to the fact that the 'evolutionary turn' in fact produced greater accuracy by restricting the so-called 'equilibrium selection' problem. For example, it was demonstrated that evolutionary dynamics *always* lead to some Nash equilibrium but that, at the same time, not all Nash equilibria are consistent with evolutionary dynamics. In effect, the evolutionary turn has discarded some Nash equilibria, therefore restricting the 'equilibrium selection' problem and, in this manner, sharpening the theory's predictive accuracy.

⁵⁰ More precisely, the **E** (strong) version of the third meta-axiom (i.e. simultaneously assuming CKR and common priors of belief) gave its place to weaker version **e** (i.e. a replicator dynamic 'copied' from Maynard Smith and Price, 1974).

⁵¹ Non-neoclassicists were seduced not only by the dropping of instrumental rationality and its extensions but primarily by the demonstration evolutionary adaptation mechanisms can yield hierarchies and discrimination on the basis of nothing more than *arbitrary* differences between agents. It took a small leap of the imagination to recognise this approach's potential for constructing a theory of institutionalised discrimination, even exploitation, within human society. See Hargreaves-Heap and Varoufakis (2002) for more on the joint evolution of conventions and discrimination.

⁵² Indeed, this is the view of, among others, Colander et al (2004a), (2004b), Colander, (2005a), (2005b), and Davis, (2003), (2006).

⁵³ One of the authors wishes to acknowledge useful discussions on this matter with Geoff Hodgson. He is, of course, not responsible for the resulting viewpoint.

⁵⁴ To mention two relevant papers, Foster and Young (1990) acknowledge that politics is what happens when mutations are co-ordinated into aggregate shocks which test the established conventions while Kandori, Mailath and Rob (1993) examine the impact of rational experimentation in finite and discrete populations.

⁵⁵ See Bergin and Lipman (1996).

⁵⁶ For a fuller account see Hargreaves-Heap and Varoufakis, 2004, Chapter 6.

⁵⁷ It did this in practice by focusing exclusively on evolutionary models where the mutation mechanism is utterly independent of the adaptation mechanism and agents are not allowed to attempt to pattern their mutations (either at the individual or the social level). This is equivalent to the Harsanyi-Aumann doctrine in game theory, to neglecting the SMD theorem in General Equilibrium, to turning to representative agent models in macroeconomics and so on. In short, it is another form of aggressively imposing version **E** of the third meta-axiom.

⁵⁸ The discursive power emanating from claims to having established the evolutionary foundations of neoclassical equilibria would, of course, crumble under the weight of critiques like the one we presented above. However, neoclassicism is shielded from the force of such arguments due to their complexity. By elevating its failures at a higher level of abstraction, neoclassicism hides them from the eyes of all but a small minority who are keen (and able) to dwell into the hidden axioms. Sugden (2001) is one of that small minority. He coins the term 'slash-and-burn strategy' to describe the manner in which economists approach non-neoclassical lines of inquiry, transplanting into economics ideas and concepts which were developed elsewhere, e.g. in biology, on the back of backbreaking empirical work. While proclaiming a profound interest in the work of biologists and others, in truth they have not a smidgeon of an interest in doing themselves any of the empirical work which would have been required to make the transplantation intellectually viable. For Sugden that is equivalent to slashing and burning a nearby forest by those who sing its praises

⁵⁹ See Elster (1982) and Roemer (1985,1986) for some famous attempts to enlist neoclassicism to a leftwing cause.

⁶⁰ McCloskey (1995) is the obvious source for insights into the mainstream's rhetorical strategies. Sugden (2001), in contrast, describes these practices more angrily: he calls it (recall note 58) a *slash-and-burn* strategy.

⁶¹ E.g. the level of wages in Sraffa are exogenously varied, as they are in von Neumann's (1937,1945) growth model. The latter, interestingly, was behind almost all facets of contemporary mathematical economics (from game theory to general equilibrium growth models to the use of fixed point theorems as tools for proving the existence of equilibria). Nevertheless, his economics is not, according to the definition in our paper, neoclassical (see Kurz and Salvatori, 1993, Mirowski, 2002, and Varoufakis, 2009).

⁶² See Blaug (1992), Stiglitz (2002) and Fulbrook (2003,2004) for a small sample.

⁶³ E.g. to allow for preferences not only to be endogenous but also contingent on expectations and social norms that are themselves comprised of higher order expectations and beliefs

⁶⁴ Consider, for example, the politically and philosophically charged notion of 'solidarity' and suppose one wants to examine it in a neoclassical light. In Arnsperger and Varoufakis (2003) we show that this is possible at the level of the individual (under the weak meta-axioms **d** and **s**) as long as neoclassical 'closure' (i.e. the **E** version of the third meta-axiom) is *not imposed*. The moment **E** is imposed, any meaningful conception of solidarity vanishes. Other examples are legion: Neoclassical sociology demonstrates the scope for neoclassical explanations of non-market 'social exchanges' within the family, the decision of a revolutionary group to refrain from blowing up a railroad bridge, the allocation of time to religious ceremonies within farming communities, and so on (see Becker, 1976, and Coleman, 1990). The formation of social institutions is modelled game theoretically with social norms sustaining gift exchange in traditional and modern industrial societies alike (see Akerlof, 1982 and Fehr and Gächter, 2000). However, all the interesting psychology, anthropology and sociology, built in these models upon the weak versions of the first two meta-axioms, is razed to the ground the moment we sneak in the strong version of the third meta-axiom for the purposes of yielding determinate equilibrium solutions. The latter are bought at the expense of assuming away all that is theoretically interesting *viz.* the psychology of the persons involved and the nature of the social norms within their community. The feedback effects between preferences and norms, between predictions and motives, between actions and beliefs etc. are all sacrificed in pursuit of prediction. The special bond between parents and children, or revolutionaries, workers, NGO volunteers etc. is reduced to the type of bonds linking colluding oligopolists. In effect, such theories begin with great expectations, which they nourish in models relying on the first two meta-axioms, which are then set aside as we get down to the serious business of 'closing' the models by means of the third meta-axiom. The resulting theory is, thus, rendered methodologically consistent (within the ambit of the three meta-axioms of neoclassicism) by the same process that guarantees that they become (courtesy of the imposition of equilibrium conditions) well and truly *anthropologically inconsistent*.

⁶⁵ Debreu, toeing a familiar neoclassical line (see Mirowski, 1989), declared himself proud that his Bourbakist mathematics liberated economics from ideology. In a recent interview he said: "Moi, j'adopte simplement l'attitude suivante: que les hypothèses qui portent à des conclusions on peut en faire ce qu'on veut: si cela satisfait les économistes libéraux et les marxissants, parfait! Je ne peux rien demander de mieux. Intellectuellement vous êtes 25 emporté par le courant des idées et vous allez dans la direction où il vous porte." (see Bini and Bruni, 1998). In Debreu (1986) he wrote: "Foes of state intervention read in those two [welfare] theorems a mathematical demonstration of the unqualified superiority of market economies, while advocates of state intervention welcome the same theorems because the explicitness of their assumptions emphasizes discrepancies between the theoretic model and the economies that they observe." However, what the above neglects is that, while the welfare theorems can, indeed, be interpreted differently by readers of different political persuasion, Debreu's method blinds all you adopt it to capitalism's particularities. And this is perhaps the greatest ideological interference *any* method could ever aspire to.

⁶⁶ Where did the finance theorists behind the infamous credit default swaps (to mention one example) find the confidence to assume that default correlations would be low enough to stave off catastrophe? Varoufakis (2009, Section 4.3) argues that they found it in the same place where neoclassicists derived the confidence to impose the third meta-axiom (see subsection 4.3) every time they needed to 'close' one of their models.

⁶⁷ Colander (2005b), for example, writes: "...previous views considered heterodox are moving into the mainstream, as the analytic and computing technology is allowing young researchers to develop these ideas in ways that will lead to institutional advancement... Because of these changes, today one would no longer describe modern economics as neoclassical economics." (For more references along these lines see note 52.) Turning to capitalism, the respective line has for a while been that, due to technological change, the traditional analytical categories 'capital' and 'labour' have evolved to such an extent that it no longer makes sense to define capitalism in the traditional manner.

References

- Akerlof, G. (1980). 'A theory of social custom of which unemployment may be one consequence', *Quarterly Journal of Economics*, XCIV, 749-75.
- Akerlof, G. (1982). 'Labor Contracts as Partial Gift Exchange', *Quarterly Journal of Economics*, 97, 543-69.
- Akerlof, G. (2007). 'The missing motivation of macroeconomics'. *American Economic Review*, 97, 5-36.
- Allais, M. (1953). 'Le comportement de l'homme rationnel devant le risque, critique des postulats et axiomes de l'ecole americaine'. *Econometrica*, 21, 503-46.
- Arnsperger, C. and Y. Varoufakis (2003). 'Toward a Theory of Solidarity', *Erkenntnis*, 59, 157-188.
- Arrow, K. (1959). 'Towards a theory of price adjustment', in M. Abramovitz (ed.), *Allocation of Economic Resources*. Stanford: Stanford University Press.
- Arrow, K. (1994) 'Methodological Individualism and Social Knowledge', *American Economic Review (Papers and Proceedings)*, 84, 1-9
- Arrow, K. (2009). 'Some Developments in Economic Theory since 1940: An eyewitness account', *Annual Review of Economics*, 1:18.1-1-18.16 (see www.econ.annualreviews.org)
- Arrow, K. and G. Debreu (1954). 'Existence of an Equilibrium for a Competitive Economy', *Econometrica*, 22, 265-90.
- Aspromourgos, T. (1986). 'On the Origins of the Term Neoclassical', *Cambridge Journal of Economics*, 10, 265-70.
- Aumann, R. (1976). 'Agreeing to disagree'. *Annals of Statistics*, 4, 1236-9.
- Becker, G. (1976). *The Economic Approach to Human Behavior*, Chicago: University of Chicago Press.
- Bergin, J. and B. L. Lipman (1996). 'Evolution with state-dependent mutations', *Econometrica*, 64, 943-56.
- Bernheim, D. (1984). 'Rationalisable strategic behaviour'. *Econometrica*, 52, 1007-28.
- Bini, P. and L. Bruni (1998). 'Intervista a Gerard Debreu', *Storia del Pensiero Economico*, 35, 3-29.
- Binmore, K. (1987/1988). 'Modelling rational players: Parts I and II'. *Economics and Philosophy*, 3, 179-214 and 4, 9-55.
- Bishop, R.L. (1984). 'A Hicks-Zeuthen theory of bargaining', *Econometrica*, 52, 410-17.
- Blaug, M. (1997). 'Ugly currents in modern economics', Plenary Sessions Presentation at a Conference entitled *Fact or Fiction? Perspectives on Realism and Economics*, Rotterdam 14-15 November
- Blaug, Mark (1992). *The Methodology of Economics: Or How Economists Explain*, 2nd ed. (Cambridge: Cambridge University Press).
- Bliss, C. (2005). 'Introduction, The Theory of Capital: A Personal Overview', in C. Bliss, A. Cohen and G.C. Harcourt (eds.) *Capital Theory, Vol.1*, Cheltenham: Edward Elgar.
- Bowles, S. (1998). 'Endogenous Preferences: The cultural consequences of markets and other economic institutions', *Journal of Economic Literature*, 36, 75-111.

-
- Burmeister, E. (2000). 'The Capital Theory Controversy', in H. Kurz (ed), *Critical Essays on Piero Sraffa's Legacy in Economics*, Cambridge: Cambridge University Press.
- Coase, R. (1994). *Essays on Economics and Economists*. Chicago: Chicago University Press.
- Cohen, A. and G. Harcourt (2003). 'Whatever Happened to the Cambridge Capital Theory Controversies?,' *Journal of Economic Perspectives*, 17, 199–214.
- Colander, D. (2005a). 'The Making of an Economist Redux', *Journal of Economic Perspectives*, 19, 175-98.
- Colander, D. (2005b). 'The Future of Economics: The Appropriately Educated in Pursuit of the Knowable', *Cambridge Journal of Economics*, 29, 927-41.
- Colander, D., R. Holt, and J. Rosser Jr. (2004a). *The Changing Face of Economics: Interviews with Cutting Edge Economists*, Ann Arbor, MI: University of Michigan Press.
- Colander, D., R. Holt, and J. Rosser Jr. (2004b). 'The Changing Face of Economics', *Review of Political Economy*, 16, 485-499.
- Coleman, J. (1990). *Foundations of Social Theory*, Cambridge: Harvard University Press.
- Dasgupta, P. (2002). 'Modern Economics and Its Critics', in U. Mäki (ed.) *Fact and Fiction in Economics: Models, Realism and Social Construction*, Cambridge: Cambridge University Press.
- Davis, J. (2003). *The Theory of the Individual in Economics: Identity and Value*, London and New York: Routledge.
- Davis, J. (2006). 'The Turn in Economics: Neoclassical Dominance to Mainstream Pluralism?', *Journal of Institutional Economics*, 2, 1-20.
- Dawkins, R. (1976). *The Selfish Gene*. Oxford: Oxford University Press.
- Dawkins, R. (1980). 'Good strategy or evolutionarily stable strategy?', in G. W. Barlow and J. Silverberg (eds.), *Sociobiology: Beyond Nature/Nurture?* Boulder: Westview Press.
- Debreu, G. (1959). *Theory of Value: An Axiomatic Study of Economic Equilibrium*, New York: Wiley.
- Debreu, G. (1974). 'Excess demand functions'. *Journal of Mathematical Economics*, 1, 15–21
- Debreu, G. (1986). 'Theoretic Models: Mathematical Form and Economic Content', *Econometrica*, 54, 1259-1270.
- Dow, Sheila C. (1995). 'The Appeal of Neoclassical Economics: Some Insights from Keynes's Epistemology', *Cambridge Journal of Economics*, 19, 715-33.
- Ellsberg, D. (1956). 'Theory of the reluctant duellist', *American Economic Review*, 46, 909-23.
- Ellsberg, D. (1961). 'Risk, ambiguity and the Savage axioms', *The Economic Journal*, 64, 643-69
- Elster, J. (1982). 'Marxism, functionalism and game theory', *Theory and Society*, 11, 453-82.
- England, Paula (1993) 'The Separative Self: Androcentric Bias in Neoclassical Assumptions', in Ferber, Marianne A. and Nelson, Julie A. (eds) (1993)

-
- Beyond Economic Man: Feminist Theory and Economics* (Chicago: University of Chicago Press).
- Fehr, E. and S. Gächter (2000). 'Fairness and Retaliation: The Economics of Reciprocity', *Journal of Economic Perspectives*, 14, 159-81.
- Fine, B. (2008). 'The General Impossibility of Neoclassical Economics: Or Does Bertrand Russell Deserve a Nobel Prize for Economics?', *mimeo*.
- Foster, D. and H. P. Young (1990). 'Stochastic Evolutionary Game Dynamics', *Theoretical Population Biology*, 38, 219-32.
- Fullbrook, E. (2003). *The Crisis in Economics. The Post-Autistic Economics Movement: The First 600 Days*, London: Routledge.
- Fullbrook, E. (2004). *A Guide to What's Wrong with Economics*, London: Anthem Press.
- Geanakoplos, J., D. Pearce and E. Stacchetti (1989). 'Psychological games and sequential rationality'. *Games and Economic Behaviour*, 1, 60-79
- Goodwin, R. (1967). 'A Growth Cycle', in C. Feinstein (ed), *Socialism, Capitalism and Economic Growth*, Cambridge: Cambridge University Press
- Gul, G. and H. Sonnenschein (1988). 'On delay in bargaining with one sided uncertainty', *Econometrica*, 56, 601-11
- Halevi, J. (1998). 'Capital and growth: its relevance as a critique of neo-classical and classical economic theories', *Indian Journal of Applied Economics*, 7, 79-98.
- Harcourt, G. (1972). *Some Cambridge Controversies in the Theory of Capital*. Cambridge: Cambridge University Press.
- Hargreaves-Heap, S. and Y. Varoufakis (2002). 'Some experimental results on the evolution of discrimination, co-operation and perceptions of fairness', *The Economic Journal*, 112, 678-702
- Hargreaves-Heap, S. and Y. Varoufakis (2004). *Game Theory: A Critical Text*, London and New York: Routledge.
- Hewitson, G. (1999). *Feminist Economics: Interrogating the masculinity of Rational Economic Man*, Cheltenham: Edward Elgar, 1999
- Hodgson, G. (1999). *Evolution and Institutions: On Evolutionary Economics and the Evolution of Economics*, Cheltenham: Edward Elgar.
- Hodgson, G. (2007). 'Meanings of Methodological Individualism', *Journal of Economic Methodology* 14, 211-26.
- Hume, D. (1739/40, 1888). *Treatise of Human Nature*, (ed. L.A. Selby-Bigge). Oxford: Oxford University Press.
- Kandori, M., G. Mailath, and R. Rob (1993). 'Learning, Mutation, and Longrun Equilibria in Games', *Econometrica*, 61, 29-56.
- Kirman, A. (1989). 'The Intrinsic Limits of Modern Economic Theory: The Emperor Has No Clothes', *The Economic Journal*, 99, 126-39
- Kurz, H. and N. Salvadori (1993). 'Von Neumann's growth model and the 'classical' tradition', *The European Journal of the History of Economic Thought*, 1, 130-60.
- Lawson, T. (1997). *Economics and Reality*, London and New York: Routledge.
- Lawson, T. (2003). *Reorienting Economics*, London and New York: Routledge.
- Leijonhufvud, A. (1968). *Keynesian Economics and the Economics of Keynes*, Cambridge: Cambridge University Press.

-
- McCloskey, D. (1985). *The Rhetoric of Economics*, Madison: University of Wisconsin Press.
- Mantel, R. (1974). 'On the characterization of aggregate excess demand', *Journal of Economic Theory*, 7, 348–353.
- Marshall, A. (1891). *Principles of Economics*, London: McMillan.
- Maynard Smith, J. and G. Price (1974) 'The theory of games and the evolution of animal conflict'. *Journal of Theoretical Biology*, 47, 209-21.
- Mirowski, P. and E. R. Weintraub (1994). 'The Pure and the Applied: Bourbakism comes to mathematical economics', *Science in Context*, 7, 245-272.
- Mirowski, Philip (1989). *More Heat Than Light: Economics as Social Physics, Physics as Nature's Economics* (Cambridge: Cambridge University Press).
- Nash, J. (1950). 'The bargaining problem'. *Econometrica*, 18, 155-62.
- Nash, J. (1951). 'Non-cooperative games'. *Annals of Mathematics*, 54, 286-95.
- Patokos, T. (2005). 'On the evolutionary fitness of bounded rationality heterogeneous populations in antagonistic interactions', *American Journal of Applied Sciences*, 2, 61-72.
- Pettit, F. and R. Sugden (1989). 'The paradox of backward induction'. *Journal of Philosophy*, LXXXVI, 169-82.
- Rabin, M (1993). 'Incorporating fairness into economics and game theory', *American Economic Review*, 83, 1281–1302.
- Roemer, J. (1985). 'Rationalizing Revolutionary Ideology', *Econometrica*, 53, 85-108.
- Roemer, J. (ed.) (1986). *Analytical Marxism*, Cambridge: Cambridge University Press.
- Rubinstein, A. (1982). 'Perfect equilibrium in a bargaining model'. *Econometrica*, 50, 97-109.
- Rubinstein, A. (1985). 'A bargaining model with incomplete information about preferences'. *Econometrica*, 53, 1151-72.
- Savage, L. (1954). *The Foundations of Statistics*, New York: Wiley.
- Schumpeter, J. (1908). *Das Wesen und der Hauptinhalt der theoretischen Nationalökonomie*, Munich and Leipzig: Duncker and Humblot.
- Sonnenschein, H. (1972). 'Market excess demand functions', *Econometrica*, 40, 549–563.
- Sonnenschein, H. (1973). 'Do Walras' identity and continuity characterize the class of community excess demand functions?', *Journal of Economic Theory*, 6, 345–354.
- Sraffa, P. (1975). *The Production of Commodities by Means of Commodities: Prelude to a critique of political economy*, Cambridge University Press
- Starmer, C. (2000). 'Developments in Non-Expected Utility Theory: The hunt for a descriptive theory of choice under risk', *Journal of Economic Literature*, 38, 332-82.
- Stiglitz, J. (2002), *The Guardian*, Friday 20th December (newspaper article)
- Sugden, R. (1991) 'Rational choice: a survey of contributions from economics and philosophy. *The Economic Journal*, 101, 751-85

-
- Sugden, R. (2000). 'The motivating power of expectations.' In *Rationality, Rules and Structure* (eds. Nida-Rümelin, J. and Spöhn, W.), pp. 103-129, Amsterdam: Kluwer.
- Sugden, R. (2001). 'The evolutionary turn in game theory', *Journal of Economic Methodology*, 8, 113-30
- Udéhn, L. (2001). *Methodological Individualism: Background, History and Meaning*, London and New York: Routledge.
- Udéhn, L. (2002). 'The Changing Face of Methodological Individualism', *Annual Review of Sociology*, 28, 479-507.
- Varoufakis, Y. (1989). 'Worker solidarity and strikes', *Australian Economic Papers*, 28, 76-92
- Varoufakis, Y. (1991). *Rational Conflict*, Oxford: Blackwell
- Varoufakis, Y. (1993). 'Modern and Postmodern Challenges to Game Theory', *Erkenntnis*, 38,371-404.
- Varoufakis, Y. (1998). *Foundations of Economics: A Beginner's Companion*, London and New York: Routledge.
- Varoufakis, Y. (2002). 'Deconstructing *Homo Economicus*? Reflections on an Encounter Between Postmodernity and Neoclassical Economics', *Journal of Economic Methodology*, 9, 389-396.
- Varoufakis, Y. (2008). 'Capitalism according to evolutionary game theory: an essay on the impossibility of a sufficiently evolutionary model of historical change', *Science and Society*, 72, 63-94.
- Varoufakis, Y. (2009). 'Pristine Equations, Tainted Economics and the Postwar Order', presented on 10th April at the *Cold War and the Social Sciences* workshop, Heymann Centre for the Humanities, Columbia University.
- Vilks, A. (1992). 'A Set of Axioms for Neoclassical Economics and the Methodological Status of the Equilibrium Concept', *Economics and Philosophy*, 8, 51-82.
- von Neumann, J. (1928). 'Zur Theorie der Gesellschaftesspiele', *Mathematische Annalen*, 100, 295-320. Reprinted in 1959 as: 'On the theory of games of strategy', in A. Tucker and R. Luce (eds.) *Contributions to the theory of games, Vol. 4*, New Jersey: Princeton University Press.
- von Neumann, J. (1937). 'Über ein ökonomisches Gleichungssystem und eine Verallgemeinerung des Brouwerschen Fixpunktsatzes' (loosely translated as of an economic system of equations and a generalization of Brouwer's fixed point theorem) in K. Menger (ed.), *Ergebnisse eines mathematischen Kolloquiums, 1935-36*. In 1945 it was published in English under the title 'A Model of General Economic Equilibrium' in the *Review of Economic Studies*.
- von Neumann, J. and O. Morgenstern (1944). *Theory of Games and Economic Behaviour*. New Jersey: Princeton University Press.
- Weibull, J. (1995). *Evolutionary Game Theory*, Cambridge, Mass.: MIT Press
- Weintraub, R.E. (2002). *How Economics became a Mathematical Science*. Durham and London: Duke University Press.
- Zeuthen, F.(1930). *Problems of Monopoly and Economic Warfare*, London: George Routledge and Sons.