IERI Working paper
WP2018-001, November 2018

Systems of Innovation and Economic Theory – a Genealogical Approach

Mario Scerri
mario@ieri.org.za

Tshwane University of Technology (TUT)
Institute for Economic Research on Innovation (IERI), Tshwane, South Africa and
DST/NRF Centre of Excellence in Scientometrics and STI Policy

Abstract
This paper traces the development of thought on the economics of innovation from perspective of discourse formations in order to assess the placement of the system of innovation approach in economic theory. In order to do this, a genealogical approach is used in order to chart the development of the study of innovation within an evolutionary perspective, in relation to the evolution of liberal, neoclassical and neoliberal economics. This approach brings out the complementarities and contradictions in the relationship between the system of innovation approach and mainstream economic theory.

JEL Codes
B12, B13, B15, B15, B50, P16

Key words
Evolutionary Economics; Systems of Innovation; Neoclassical Economics; Neoliberal Economics

November 2018

Systems of Innovation and Economic Theory – a Genealogical Approach

If the system of innovation approach to economic dynamics were to be studied as an emerging discourse which alters the spaces of political economy, we will have to trace its genealogy and its various evolutionary paths. We will need to identify its common cause, its theme, and its counter-discourse against which it seeks its identity. We will have to chart its delineation lines, its criteria for the inclusion of what are defined as its legitimate objects of analysis. If, to use Lundvall's term, the system of innovation approach is a 'focussing device', we need to discern the direction of its lens and the outer limits of its focal range.

The system of innovation approach in the understanding of economic dynamics has a long provenance with numerous strands in the development of thought in the area eventually converging in its formulation in the 1980s between Chris Freeman and Bengt-Åke Lundvall. The introduction of a systems approach to the general political economy may be found in List's (1841) thesis on the 'national system of political economy', a harbinger of the national system of innovation. List had early on argued against the benefits of free trade advocated by Smith (1776) and Ricardo (1817). He maintained that the 'cosmopolitical' economy premised by Smith, as well as François Quesnay and Jean Baptiste Say, in their argument for the welfare benefits of free trade was a utopian idealised world which bore little relevance to the reality of the economies of nations and nation states whose economic fortunes were the result of historical lines of path dependence and cumulative development (List, 1841: Vol. II, Ch. 11). He termed the study of these national economies as political economy in contrast to the cosmopolitical economy based on an assumption of a unified global economy devoid of contending national interests.

Smith's argument was eventually mathematically formalised into mainstream neoclassical trade theory, mainly in the form of the Heckscher-Ohlin and the Stolper-Samuleson models while List is normally mentioned with reference to the 'infant industry' argument. While List is probably best known for the 'infant industry' argument for protectionism, echoed a century later in the Prebisch-Singer theorem (Prebisch, 1950; Singer, 1950), the lines of his argument which have significant implications for the study of political economy are less remarked on in the history of economic thought. His policy departure from the core school of economics at the time was the bringing to the fore the role of the state in altering the development trajectories of national economies, a normative injunction which was diametrically opposite to that the advocacy of intra- and inter-national free trade stemming from Smith. The contribution of List to economic thought

rests on three fundamental objections to what he terms the 'popular school'[1] of Smith, Quesnay and Say (List, ibid: 70):

> **firstly**, … boundless cosmopolitanism, which neither recognises the principle of nationality, nor takes into consideration the satisfaction of its interests; **secondly**, … a dead materialism, which everywhere regards chiefly the mere exchangeable value of things without taking into consideration the mental and political, the present and the future interests, and the productive powers of the nation; **thirdly**, … a disorganising particularism and individualism, which, ignoring the nature and character of social labour and the operation of the union of powers in their higher consequences, considers private industry only as it would develop itself under a state of free interchange with society (i.e. with the whole human race) were that race not divided into separate national societies. (bold added)

Levi-Faur (1997: 360) maintains that List may be seen as the 'founding father of economic nationalism', a school of political economy which has, until relatively recently been neglected in light of the dominance of the two contending economic schools of liberalism and socialism. List questioned Smith's focus on a theory of value, exchange value, as the explanation of the wealth of nations, proposing instead a theory of 'productive forces' based on the capacity of humans to work and innovate. Levi-Faur is correct in pointing this contribution out as the theoretical foundation of human capital theory which Foucault (2004) postulates as the cornerstone of American neoliberalism, pioneered in the works of Mincer (1958), Schultz (1961) and Becker (1962). However, List's elaboration of his theory of productive forces goes considerably beyond the individual as the subject. In its emphasis of the critical role of social relations, of ideology[2], of national power, and of history it opens the way for broader approaches to the role of the human in the fortunes of national economies, such as Sen's (1999) theory of human capabilities and to Marxian critiques of human capital theory (vide Bowles and Gintis, 1975). To fully appreciate the extent of List's theory of productive forces it is worth quoting at length a passage from his work (List, 1841, Vol II: 29-30):

> If we consider merely bodily labour as the cause of wealth, how can we then explain why modern nations are incomparably richer, more populous, more powerful, and more prosperous than the nations of ancient times? … In order to explain these phenomena, we must refer to the progress that has been made in the course of the last thousand years in sciences and arts, domestic and public regulations, cultivation of the mind and capabilities of production. The present state of nations is the accumulation of all discoveries, inventions, improvements,

[1] This refers to classical liberal economists who were advocates of free trade. Early critics such as Nicholson (1909) accused List of distorting Smith's position on trade policy, ignoring his acknowledgement of the relevance of nations and setting him up as a straw man. Later commentators (Levi-Faur, 1997; Shafaeddin, 2000; Soete et al, 2010; Jun et al, 2016), while acknowledging List's combative tone and his occasional glossing over of Smith's reservations on the reality of nations, generally accept as correct his depiction of the theoretical position of the 'school' and its policy implications. It should be noted that List's critique of Smith and other related economists lays the foundation of the modern critical appraisal of the neoclassical and neoliberal economics, and the Washington Consensus policy framework.

[2] In List's case 'The Christian religion, monogamy, abolition of slavery and vassalage, hereditability of the throne…' (op. cit.: 29)

> perfections, and exertions of all generations which have lived before us; they form the mental capital of the present human race, and every separate nation is productive only in proportion in which it has known how to appropriate these attainments of former generations and to increase them by its own acquirements, in which the natural capabilities of its territory, its extent and geographical position, its population and political power, have been able to develop as completely and symmetrically as possible all sources of wealth within its boundaries, and to extend moral, intellectual, commercial, and political influence over less advanced nations and especially over the affairs of the world.

This passage from List highlights the complex combination of various factors which combine in determining the developmental capabilities of national economy. More than that, and especially significant not only for the system of innovation approach in particular, but for evolutionary economics in general, this passage brings in the critical importance of historical streams of accumulation in the determination of the fortunes of national economies. In his comparisons of the historical paths of the development of a number of European economies, List introduces the concepts of specificity, path-dependency and cumulative development which were to become the cornerstones of the system of innovation approach to economic dynamics. The focus on technology and knowledge, which, as Soete et al (2010) point out, is virtually exogenous to the economic system conceived by the neoclassical school, is echoed less than two decades later in Karl Marx's *Grundrisse*:

> to the degree that large industry develops, the creation of real wealth comes to depend less on labour time and on the amount of labour employed than on the power of the agencies set in motion during labour time, whose 'powerful effectiveness' is itself in turn out of all proportion to the direct labour time spent on their production, but depends rather on the general state of science and on the progress of technology, or the application of this science to production. (The development of this science, especially natural science, and all others with the latter, is itself in turn related to the development of material production.) Agriculture, e.g., becomes merely the application of the science of material metabolism, its regulation for the greatest advantage of the entire body of society. (Marx, 1993: 706)

List particularly objected to the equivalence of the private family economy and the national economy postulated by Smith. This proposed equivalence provides the theoretical basis for the 'invisible hand' theory which argues that the unfettered single minded pursuit of individual gain assures the maximisation of societal welfare, an outcome which is guaranteed by the forces of competition. This argument was then extended to the global economy in the advocacy for free trade policy. List's counter arguments formed the basis, not only for the case for protectionist policy in the case of unequal trading partners (the infant industry argument), but also for the critique against the school of economic individualism (Hayek, 1948; von Mises, 1949) which laid the foundation for the Chicago School version of neoliberalism. Soete et al (2010) unequivocally identify List as the progenitor of the national system of innovation concept with his emphasis on knowledge, broadly defined, accumulated over time as the outcome of linked interactive processes set within a framework of social and power relations, as

the prime determining factor in the evolution of the fortunes of national economies. They see him as being the pioneer in the development of a systemic approach to the understanding of political economy, spanning economic and non-economic sectors from an institutional perspective.

If Smith's classical economic liberalism was so very explicitly List's *bête noire*, it is not immediately obvious to discern the focus of Joseph Schumpeter's critical thought. The recurrent engagement throughout most of his work, culminating in his *Capitalism, Socialism and Democracy* (1943), with Marxian economics was an ongoing critique of various facets of Marx's work. However, read properly most of Schumpeter's critique of Marx was against a vulgar utopian and totalising version of Marxism.[3] Substantively, there are numerous significant commonalities between Schumpeter and Marx in their analysis of capitalism. Both see capitalism as historically and spatially specific and both view the bourgeoisie as the font of innovation and human progress.[4] Both authors also predict the eventual collapse of capitalism through processes which, while different, are inevitable and propose strikingly similar views on the dynamic (r)evolutionary nature of capitalism.[5] However, Hodgson (2002) argues that, in spite of Marx's insistence on historical and locational specificity, Marxian economics cannot avoid the ahistorical, transcendental universality of its key concepts such as use-value and labour. Ironically, this places Marxian economics alongside neoclassical economics as universal meta-accounts of the general (political) economy[6] and this perhaps is where Schumpeterian and Marxian economics part ways.

More fundamentally, it was the Lausanne school of general equilibrium economics, established in the late nineteenth century by Léon Walras (1899) and Vilfredo Pareto (1897), which constituted the emerging dominant school against which Schumpeterian

[3] Schumpeter (1943: 385) is harshly dismissive in his first footnote: "The religious quality of Marxism also explains a characteristic attitude of the orthodox Marxist toward opponents. To him, as to any believer in a Faith, the opponent is not merely in error but in sin. Dissent is disapproved of not only intellectually but also morally. There cannot be any excuse for this once the Message has been received." This reservation was also expressed by several Marxist academics, as for example in Jessop (2002: 22) who "…raises questions about the conditions under which accumulation can become the dominant principle of societal organization (societalization). For there are always interstitial, residual, marginal, irrelevant, recalcitrant and plain contradictory elements that escape subordination to any given principle of societalization and, indeed, serve as reservoirs of flexibility and innovation as well as actual and potential sources of disorder."

[4] 'The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together' (Marx and Engels, 1848: 7).

[5] 'There is more "Schumpeter" in Marx's writings than many Marxists are willing to accept, and more "Marx" in Schumpeter's analysis than even Schumpeter was willing to recognize.' (Elliot, 1980: 45-46)

[6] 'Neoclassical economists attempt to construct a universal framework of socio-economic analysis but end up viewing the universe through the distorting lenses of a specific type of economic system. The universality of their alleged universal principles is thus questioned. Marx, on the other hand, knowingly reacts from this kind of approach and attempts to site his analysis of specific systems on specific concepts appropriate to that system. Yet, contrary to his own arguments he ends up relying on theories and concepts that are in fact universal. Neoclassical economics aspires to universality but ends up being specific; Marxism aspires to specificity but ends up relying on the general.' (Hodgson, 2002: 211)

economics is set. The high level of abstraction of neoclassical economics, divesting economic agents of historical, spatial and cultural contexts, combined with the extremely restrictive assumptions of full and perfect information puts the neoclassical paradigm as diametrically opposite as one can get to Schumpeter's understanding of economic dynamics. Schumpeter was probably the first consistently critical anti-equilibrium economists who implicitly discarded comparative static analysis and Paretian welfare prescriptions. It is therefore ironic that Schumpeter's work was still strongly anchored in the neoclassical paradigm which, especially since Alfred Marshall's *Principles of Economics* (1890), had already become the dominant language of economics. The first section of *The Theory of Economic Development* is basically a general equilibrium depiction of a static economy. His critique of Marx's labour theory of value (Schumpeter, 1943: 21) states that it would only work under conditions of perfect competition, i.e. where the value of the marginal product of labour is identical to its marginal revenue product and equal to is marginal cost which under the neoclassical construct of perfect competition is a constant. Schumpeter also states that labour would have to be the only factor of production and it would have to be uniform for the labour theory of value to hold.

It is almost as if Schumpeter is not fully aware of the enormity of the promise of a rupture with established thought on economics held out by his theory of economic dynamics. Schumpeter's contribution can still be read, using neoclassical language, as endogenizing factors which were previously thought of as exogenous causes for an outward shift in the production possibilities frontier, rather than an outright dismissal of the conceptual framework behind it. It is worth noting that when Schumpeter lists the sources (types) of innovation he almost always refers to them as 'new combinations'[7] adhering to the language of choice under conditions of scarcity rather than opening up to the possibility of discarding scarcity as a meaningful consideration in the understanding of the limits to development.

Schumpeter's classification of 'new combinations' (innovation) is worth reproducing in its entirety (ibid: 66):

> (1) The introduction of a new good – that is one with which consumers are not yet familiar – or a new quality of a good. (2) The introduction of a new method of production, that is one not yet tested by experience in the branch of manufacture concerned, which need by no means be founded upon a discovery scientifically new, and can also exist in a new way of handling a

[7] Schumpeter (1934: 65-66) anticipates the classification of innovations between incremental and radical, at least, and opens the possibility for the consideration of techno-economic paradigm shifts (Freeman and Perez, 1988) when he states that 'To produce means to combine materials and resources within our reach. To produce other things, or the same things with a different method, means to combine these materials and forces differently. In so far as the "new combination" may grow out of the old by continuous adjustment in small steps, there is certainly change, possibly growth, but neither a new phenomenon nor development in our sense. In so far as this is not the case, and the new combinations appear discontinuously, then the phenomenon characterising development emerges.'

> commodity commercially. (3) The opening up of a new market, that is a market into which the particular branch of manufacture of the country in question has not previously entered, whether or not this market has existed before. (4) The conquest of a new source of supply of raw materials or half manufactured goods, again irrespective of whether this source already exists or whether it has first to be created. (5) The carrying out of the new organisation of an industry, like the creation of a monopoly position (for example through trustification) or the breaking up of a monopoly position.

There are three critical aspects of Schumpeter's thought on innovation which arise from this excerpt. In the first place, the introduction of disruptive innovations as the source of creative destruction and development marks a radical theoretical break with the static and comparative static analysis of neoclassical economics. Secondly, the site of innovation as the source of economic development is confined to private enterprises, affirming capital as the engine of progress and development (vide Nelson, 1990). In this regard it is worth noting Paul Sweezy's (1943) commentary on *Capitalism, Socialism and Democracy*, where he concludes that Schumpter's "… selection of the entrepreneur, a special sociological type, as the *primum mobile* of change can be called into question. We may instead regard the typical innovator as the tool of the social relations in which he is enmeshed and which *force* him to innovate on pain of elimination" (ibid: 96). Thirdly, within the context of private enterprise Schumpeter's understanding of innovation is remarkably comprehensive. Schumpeter's first two types of innovation refer directly to technological innovations (product and process), although the second one also opens up the consideration of marketing strategy as innovation. The other three categories refer specifically to non-technological innovations, dealing with various aspects of business strategy. It is interesting that the flow of theoretical work on the economics of innovation which emerged from Schumpeter's contribution focussed almost entirely on technological innovations. Only with the introduction of the system of innovation concept in the 1980s and the broad version of the concept (Lundvall, 1992) was a comprehensive version of the national system of innovation introduced in a theoretically systematic manner.

The focus on technology as the sole or the most significant type of innovation pulled the study of economies away from political economy, as exemplified in List, Marx and Schumpeter, to economics, specifically neoclassical economics. Essentially the study of innovation by mainstream economists languished until, ironically enough, it was brought back to the core of economic theory by Solow (1956; 1957) in his estimation of the aggregate production function for the USA. With that shift, and in the four decades long hiatus until the flurry of new contra-neoclassical work on innovation in the eighties, the economic analysis of innovation was construed as the analysis of a sub-sector of the economy. In the process considerable ground was lost in developing innovation studies within a political economy theoretical framework. More than that, the rapidly growing focus on research into innovation within the neoclassical body of work delayed the development of evolutionary economics until the seminal volume by Nelson and Winter (1982). This new concept marked perhaps one of the most coherent and rapidly expanding

critique of the neoclassical paradigm which had dominated the discipline of economics since the late 1950s. The theoretical foundations of this approach, which Lundvall (1992) and Edquist (1997) hesitate to call a theory, lie in the evolutionary approach to institutional economics, harking back to Veblen (1898) and to Schumpeter's (1934 and 1943) rejection of the explanatory and normative value of equilibrium economics. The critique of neoclassical economics from within the internal logic of this paradigm was comprehensively developed in the work of Nelson and Winter (1982) and formed the rationale for the seminal collection of contributions in Dosi et al (1988) on the relationship between technical change and economic theory.

Given that the foundation of the new approach to the understanding of innovation and economic change was set as a counter to the mainstream neoclassical paradigm, it is important at this stage to examine certain core aspects of the dominant discourse in economics. If the ideal of scientific probity in the social sciences was linked to the natural sciences, the epitome of scientific endeavour for economics towards the end of the nineteenth century was to be found in Newtonian physics, which had at that time before the scientific revolution stemming from the work of Max Planck and Albert Einstein reached a level of explanation where physicists were concerned that there was nothing left to discover in the universe. The ambition to achieve a scientific equivalence in economics was fulfilled in the formulation of the general equilibrium model of the economy developed by Leon Walras and the Lausanne school, with the underlying general optimality conditions provided by Vilfredo Pareto. This enterprise required the shedding of all but the simplest behavioural assumption guiding economic agents classified as consumers, firms and labourers. Action, for every category of agent, is determined by the same marginal cost-benefit principles. This general model, consisting of sets of simultaneous equations for consumption, production, and consumption and production combined, is used to derive a unique solution which represents the economy-wide optimal allocation of resources to reach the maximum level of welfare, given resources and technical knowledge, all of which are exogenous to the system. Hayek (1942) was disdainful of neoclassical economics, viewing it as yet another example of the lamentable creep of scienticism[8] over the social sciences and, in the specific case of the neoclassical general equilibrium model, a monumental tautology. This he succinctly explains in a brief paragraph:

[8] 'the tyranny commenced which the methods and technique of the Sciences in the narrow sense of the term have ever since exercised over other subjects. These became increasingly concerned to vindicate their equal status by showing that their methods were the same as those of their brilliantly successful sisters rather than by adapting their methods more and more to their own particular problems. And although in the hundred and twenty years or so, during which this ambition to imitate Science in its methods rather than its spirit has now dominated social studies, it has contributed scarcely anything to our understanding of social phenomena, not only does it continue to confuse and discredit the work of the social disciplines, but demands for further attempts in this direction are presented to us as the latest revolutionary innovations which, if adopted, will secure rapid undreamed of progress' (Hayek, 1942: 268).

> What is the problem we wish to solve when we try to construct a rational economic order? On certain familiar assumptions the answer is simple enough. If we possess all the relevant information, if we can start out from a given system of preferences, and if we command complete knowledge of available means, the problem which remains is purely one of logic. That is, the answer to the question of what is the best use of the available means is implicit in our assumptions. The conditions which the solution of this optimum problem must satisfy have been fully worked out and can be stated best in mathematical form: put at their briefest, they are that the marginal rates of substitution between any two commodities or factors must be the same in all their different uses. (Hayek, 1945: 519)

This dismissive attitude has not critically entered the mainstream of debates on the neoclassical model and the consequence of this is a confusion which has grown over generations of economists trained under the auspices of the neoclassical paradigm about the theoretical core of equilibrium theory in general. Mittermaier (1986: 56) clearly outlines the lines of this confusion when he says that

> Some economists treat equilibrium theory as an ideal conception with the normative meaning and others treat it as a description in some attenuated sense and yet others distinguish very poorly between the two. Some see it as an ideal system worth examining because it is taken, perhaps mistaken, to be the system economic liberalism advocates; others see it as one element in a projected though as yet unexplained series of successive approximations to the working of actual economies. Some treat equilibrium theory as a study of the conditions for one or other kind of economic efficiency, such as the optimum allocation of resources or simply market clearing; others treat it as a handy framework for explanations and predictions of what actually goes on, perhaps on the grounds that people never fail to meet the efficiency conditions, or fail in a predetermined way.

Apart from this confusion of the meaning of equilibrium theory, the extreme restrictiveness of the assumption that it requires, especially that of full information in all the varieties of this notion, renders it utterly useless for the understanding of the source and effects of innovation. It is therefore quite legitimate to set a theory of innovation within the fold of evolutionary economics, starting off with an explicit refutation of the suitability of neoclassical economics for this task. Moreover, as the understanding of innovation in the 1980s came to match that of the classical economists of the nineteenth and early twentieth centuries, innovation theory progressed from a dissident analysis of a sector of industrialised economies to a more generic attack on mainstream theory. However, it is at this stage that confusion again arises, this time as to the exact nature of the countervailing discourse and it is here that the conflation of neoclassical and neoliberal economics becomes deeply problematic.

There have been numerous accounts of the development of neoliberal economics, but most of these accounts boil down to a description of the basic tenets of this school. These are mostly in terms of its assumption of the primacy of the invisible hand in assuring the optimal coordinating mechanism for the general economy, with a restriction of the role of the state to the safeguarding of property rights and the correction of infrequent cases of

'market failure'. Most accounts also focus on the historical development of neoliberalism and its eventual hegemonic position over global economic policy formulation. The various trajectories of the evolution of neoliberal economics are also often traced with variations of interpretation across space and time. Rarely however is the distinction between liberal and neoliberal economics explored in detail. This is to some extent due to the blurring of the demarcation lines between the general policy advocacies of these two schools. The distinction between ordo-liberalism and anarcho-liberalism discussed by Foucault (2004), among others, points out a major distinction between the liberal and neoliberal schools, both in the theoretical positioning of state vis-à-vis market and their contextual location through the middle to late twentieth century history. [9]

There is however another fundamental distinguishing factor which has not as yet been sufficiently explored. We may discern this distinction by contrasting Hayek's (1942, 1943, 1944, and 1945) treatise on the encroachment of scienticism in the study of society and the theoretical and analytical emptiness of the neoclassical paradigm with the emergence of the standard microeconomics textbook in the 1960s. This text which has come to be the undisputed and totally exclusive tome in the teaching of undergraduate economics contains the whole array of neoclassical models drawn into the service of a neoliberal advocacy of free markets, in disregard of the fundamental theoretical incompatibility between the neoclassical and liberal theoretical bases. This incompatibility is evident in every aspect of the neoclassical text, especially in the corruption of language evident in the word 'competition'. McNulty (1968) points out that the neoclassical models of perfect competition, monopoly and variations of oligopoly exclude, through assumption, any vestige of competitive behaviour. In fact, these models exclude any vestige of the entrepreneur since in a perfectly known world all that is needed for optimal decision making is the computer. This is in contrast to Stigler (1957) who, in the same vein as Machlup's (1967) defence of marginalism in the depiction of the profit-maximising firm, argues that perfect competition is at the same time the most rigorous and most tractable model of competitive markets available to the economist. Machlup's almost casual brushing aside of critical contributions which introduced behavioural and organisational theories of firm behaviour [10] and consumer behaviour [11] as essentially cumbersome in comparison to the single objective/full information neoclassical theory of the firm. This insistence on the translation of equilibrium theory into an analytical

[9] See Foucault's (2004) tracing of the bifurcation of the evolution of liberal economics into ordo-liberalism which was at the core of Germany's post-war economic restructuring and subsequent policy and anarcho-liberalism which was the neoliberalism emerging from the Chicago school. See also Streeck and Yamamura (2001) for an exhaustive distinction between the two main varieties of capitalism which emerged in the post-war era.

[10] See Simon (1959), Cyert and March (1963), March and Simon (1993), and Williamson (1985) for behavioural, managerial and organisational theories of the firm. Nelson (1991) laments the side-lining of these theories of firm behaviour from the core of economics.

[11] See Stigler and Becker (1977) for the rationale for the theoretical dismissal of tastes and preferences as given in the analysis of consumer and other human behaviour.

portrayal of actual competitive behaviour and consumer decisions is disingenuous, and it can therefore only be read as an opportunistic claim for the scientific integrity conferred by the mathematics of neoclassical economics to validate libertarian ideology. This anomaly is most evident in the obvious normative implication of the full information general equilibrium model that the optimal coordination mechanism should be a centrally planned economy where the optimal allocation of resources would never be subject to the vagaries of markets and human agency. Instead, the perfect competition model has been used as the 'scientific' rationale for the support of free markets and the minimal state by the parvenu Chicago school led by Milton Friedman and Gary Becker who would eventually extend marginalist theory to explain all of human behaviour, thus laying claim to the status of an 'imperial science' (Stigler, 1984; Becker, 1996) for the hybrid.

The thrust of the arguments for the enlisting of neoclassical economics in the service of a neoliberal agenda centres around the 'as if' argument[12] proposed in the analogies of Friedman's (1963) billiard player and Machlup's (1967) automobile driver. In Friedman's analogy a professional billiard player with no formal knowledge of applied mathematics consistently plays the game as if he were consciously solving the mathematical computations necessary to calculate the precision of the shots on the billiard table. This is used as the theoretical justification for applying the constrained optimisation model to human behaviour. Machlup's hypothetical automobile driver who consciously computes the speed of other automobiles and road conditions to determine when and at what speed she should overtake obviously cannot be found in real life, but Machlup's argument is that if in general automobile drivers behave as if they were carrying out these computations then the model offers a strong predictive tool. Both Friedman and Machlup take care to avoid what Machlup calls the 'fallacy of misplaced concreteness'[13] by arguing that optimisation models were never meant to correspond to real life but were, in Machlup's words, the outcome of the application of Occam's Razor where a high degree of abstraction trimmed off empirical considerations which were superfluous to the requirements of predictive models aimed at tracing the effects of exogenous changes such as taxes or interest rates on market behaviour. However, analogies, unlike examples, can be dangerously misleading when called up in the cause of theoretical reasoning. Both the billiard player and the automobile driver are, specifically in their respective roles, decision makers driven by a single objective and making decisions in a fully known universe. To use these examples as useful analogies representing real life agents who are driven by

[12] 'It is only a short step from these examples to the economic hypothesis that under a wide range of circumstances individual firm behave *as if* they were seeking rationally to maximize their expected returns (generally if misleadingly called "profits") 16 and had full knowledge of the data needed to succeed in this attempt; *as if,* that is, they knew the relevant cost and demand functions, calculated marginal cost and marginal revenue from all actions open to them, and pushed each line of action to the point at which the relevant marginal cost and marginal revenue were equal.' Friedman (1953: 13)

[13] "To confuse the firm as a theoretical construct with the firm as an empirical concept … is to commit the 'fallacy of misplaced concreteness'. This fallacy consists in using theoretical symbols as though they had a direct, observable, concrete meaning." (Machlup, 1967: 9)

multiple objectives, of different provenance and often contradictory, operating in a context which is marked by non-actuarial risk which grows along with ignorance as decisions and the envisaged consequences of those decisions stretch into the future, is deeply flawed. Reservations raised by the consideration of the actual object of study are brushed aside as essentially trivial specifics which do not affect the core principle of presumed behaviour on the basis of the 'as if' assumption or by the argument that, regardless of flaws, the neoclassical theory of the firm is the best approximation to real life entities.

The question that should be raised at this point is the level to which abstraction can be pushed before the distance from empirical reality fatally compromises not just the explanatory power but also the predictive capability of theoretical constructs. The neoclassical paradigm constitutes one of the more extreme examples of abstraction, offering as it does a fully determined closed logical construct of the economy which could provide unique optimisation solutions to the problem of the allocation of scarce resources. The critical issue here is whether neoclassical economics with the general equilibrium model at its core is amenable to adaptation and loose interpretation in the manner of neoliberal economists. The answer has to be unequivocally that it cannot. The neoclassical model is so completely specified and so dependent on this complete specification for its integrity that that any violation would negate the whole paradigm. Without full and perfect information (including probability values assigned to future possible outcomes) it would be impossible to derive continuous objective and constraint functions and thus say anything about allocation and constrained optimisation. The reason why the neoclassical model of the economy does not relate to empirical facts is fundamentally because it is not designed to do so. It is an extreme example of deductive reasoning, conceptually elegant in its mathematical rendition and useful as an exercise in logic, which cannot allow for approximations to its ideal state.

The mode of transmission of this 'unholy alliance' (Chang, 2001: 11) between neoclassical economics and free market ideals was the economics text which, in its exclusion of alternative schools, has over generations of scholars indoctrinated successive waves of graduates into a monolithic understanding of the discipline (Scerri, 2008). This fundamental intellectual dishonesty arising from the hybrid is therefore what can be used to distinguish between liberal and neoliberal economics. Liberal economics and Marxian economics, as opposed as they may be ideologically, can both be placed within the broad theoretical framework of evolutionary economics. This school, firmly placed within the political economy paradigm, draws on an understanding of history, sociology and anthropology, institutional theory, and political theory in its understanding of economic change. Change is assumed to be the permanent core feature of economic systems. Neoclassical economics is quite incompatible with political economy, presenting as it does a mathematical model of the national economy which is fully specified and designed

to contain solutions to the model in the predetermined fashion of Hayek's (1945) depiction. The 'as if' proposition of Friedman and Machlup is the *legerdemain* which implicitly justifies the neoclassical text as the basis for the understanding of economic life and the theoretical validation of a fundamentally libertarian normative position. This twinning of two incompatible theoretical corpuses is the hallmark of neoliberal economics, highly successful in its hegemony over the text and across policy environments across the world but fundamentally flawed as theory. This hegemony has constituted neoclassical economics as the discipline of economics, but the contradiction is that the neoliberal gambit which enabled this elevation violates, through its blurring of the demarcation lines between discursive formations, the primary requisite of exclusion as articulated by Foucault (1970) which specifies the limits of what can belong to a discipline.[14]

The theoretical problems of the neoliberal hybrid are immeasurably amplified with its consolidation as the mainstream of the discipline, as formative of its main discourse against which alternative accounts have to be measured. This is clearly evident with the emergence of the system of innovation approach as a potential alternative general account of the economy. There is hesitation in refuting the emerging neoliberal orthodox in its totality in Schumpeter's case as discussed earlier. Nelson and Winter (1982) still accord the orthodoxy central pace as far as static analysis is concerned. Lundvall has to repeatedly interrogate eligibility of the system of innovation approach for the status of theory, again measuring it up against the determinate mathematical articulation of the neoclassical paradigm and settling for the description of the approach as a 'focussing device' (Lundvall, 2010, Ch. 10).

Nelson and Winter (ibid) and Nelson (2007) propose that research in economics tends to run along two linked but distinct tracks which they term formal and appreciative theory.[15] Nelson (2007) emphasises the need for evolutionary approaches to innovation and development to be formalised into a body of formal theory which can act as an alternative reference point for a practice of appreciative theory which is more appropriate to rapidly changing economies. However, the very acceptance of the practice of appreciative theory has to be questioned on a number of points. The main issue of contention is the argument

[14] "a proposition must fulfil complex and heavy requirements to be able to belong to the grouping of a discipline; before it can be called true or false, it must be 'in the true', as Canguilhem would say … one is 'in the true' only by obeying the rules of discursive 'policing' which one has to reactivate in each of one's discourses … The discipline is a principle of control over the production of discourse. The discipline fixes limits for discourse by the action of an identity which takes the form of a permanent re-actuation of the rules." (Foucault, 1970: 60-61)

[15] Nelson points out the "difference between … 'appreciative' and 'formal' theory, with the former mostly expressed verbally, and much closer to the empirical details of the subject matter than the latter, and the latter articulated more abstractly, often in the form of a mathematical model, and more amenable to logical exploration and manipulation. While current use of the term 'theory' in economics has tended to identify with formal theory, … in economics most of the empirical research and interpretation of empirical phenomena, was structured by appreciative theory.' (Nelson, 2007: 20-21)

that neoclassical economics is so completely mathematically defined that it cannot be used to address economic change. The allowance that Schumpeter makes for neoclassical economics as suited for static or comparative static analysis should also be discarded. From an evolutionary perspective, economies are always in a state of flux with periods of apparent stability occasionally, and often briefly, emerging as a resultant of a temporary balance of the myriad of contending forces and tendencies which form the national and global political economy. The practice of appreciative theory is the vehicle for the usurpation of the mathematical validation of the neoclassical paradigm by neoliberal economists. The appeal to commonly perceived empirical reality as formative of research practice lays the discipline open to the dangers of adopting 'common sense' as a guiding principle.[16] Evidence-based research and the normative implications of such research in the absence of a clear and unambiguous reference to the theoretical foundation of the research tend to result in a confusion of theoretical language. When it comes to interpreting the world, evidence is meaningless without the theoretical lens and it is the clear specification of the theoretical lens which often determines which empirical observations count as evidence and which are trivial 'noise'. In the case of innovation in general, and the system of innovation in particular, the adoption of appreciative theory has in many cases allowed a persistent contradiction with the retaining of the critique of neoclassical economics alongside the implicit acceptance of neoliberal economics, with the latter negating the former. In this slippage in the identification of its counter-discourse, the system of innovation approach has as yet failed to develop a coherent discursive formation which can challenge the mainstream account of the economy.[17] In light of this, it is difficult to contest the assessment of Fine and Rustomjee (1996: 244) when they propose that the '(NSI) framework is unduly descriptive in content, merely pointing to the various institutional components driving technical change, albeit breaking with received notions in orthodox economics'. The result of this is that the system of innovation approach has yet to develop a comprehensive alternative general theory of the economy and is at best seen as a, often a case study based, contribution to a sub-sector of an economy implicitly formed by the language of neoliberal economics.

The resumption of the critique found in Coricelli and Dosi (1988) and of the search for an alternative general theory of the economy could be built on three closely inter-linked pillars. The first is a revisiting of the theory of value, essentially re-articulating the labour theory of value as an innovation theory of value. A broad enough interpretation of

[16] 'Common sense is constructed out of long standing practices of cultural socialisation…(It) can, therefore, be profoundly misleading, obfuscating or disguising real problems under cultural prejudice' (David Harvey, 2005: 39, citing Gramsci).

[17] Variava (1989: 50) succinctly summarises Foucault's guidelines for the recognition of discursive formations: "a discursive formation is identifiable if the statements in it refer to the same object; a discursive formation has a regular 'style', a common way in which statements are made; a discursive formation is identifiable if the concepts in the statements have a constancy; a discursive formation exists if all the statements support a common theme, or what Foucault calls in his later books a 'strategy', a common institutional or political pattern".

innovation would interpret all human economic activity, manifest in goods, services and experience, as current innovation or as the embodiment of historical streams of innovation. This re-visiting of value would also help to revitalise the challenge to an exchange theory of value which implicitly runs through the mainstream discourse, even when exceptions are permitted as 'market failure' and 'externalities'. The second foundation for an emerging discourse would be to anchor systems of innovation in specific accumulation regimes. Boyer (1988) provided an enticing prospect of the theoretical possibilities of this pursuit, more fundamental than the complementing of the study of the national system of innovation by the specification of a particular type of capital accumulation, as proposed by Fine and Rustomjee (1996). The third pillar would be the conceptual extension of the informal institutional and tacit knowledge base to permeate and ultimately define systems of innovation. This would entail the drawing in of traditional sociology and modern anthropology, and interpretative historical reading within a political economy theoretical framework of evolutionary economics. The consideration of power should form an essential element of this expanded approach and in this area the work of Mushtaq Khan (Khan, 2000 and 2013) provides a promising conceptual framework.

References

Becker, Gary S. (1962) 'Investment in Human Capital: A Theoretical Analysis', *Journal of Political Economy*, 70 (5): 9-49.

Becker, Gary S. (1993) 'Nobel Lecture: The Economic Way of Looking at Behaviour', *Journal of Political Economy*, 101 (3): 385-409.

Bowles, Samuel and Herbert Gintis (1975) 'The Problem with Human Capital Theory – A Marxian Critique', *The American Economic Review*, 65 (2): 74-82.

Boyer, Richard (1988) 'Technical Change and the Theory of Régulation', in Giovanni Dosi, Chris Freeman, Richard Nelson, Gerald Silverberg, and Luc Soete (eds.) *Technological Change and Economic Theory*. London: Pinter, pp. 67-94.

Chang, Ha-Joon (2001) Breaking the Mould: An Institutionalist Political Economy Alternative to the Neoliberal Theory of the Market and the State. *Social Policy and Development Programme Paper Number 6*, United Nations Research Institute for Social Development.

Coricelli, Fabrizio and Giovanni Dosi (1988) 'Combination and Order in Economic Change and the Interpretative Power of Economic Theory', in Giovanni Dosi et al, op cit.

Cyert, Richard M. and James G. March (1963) *A Behavioural Theory of the Firm*, Englewood Cliffs, N. J.: Prentice-Hall.

Dosi, Giovanni, Chris Freeman, Richard Nelson, Gerald Silverberg, and Luc Soete (eds.) *Technological Change and Economic Theory*. London: Pinter

Edquist, Charles (ed.) (1997) *Systems of Innovation: Technologies, Institutions and Organizations*, reprinted 2005, London: Routledge.

Elliot, John T. (1980) 'Marx and Schumpeter on Capitalism's Creative Destruction: A Comparative Restatement', *The Quarterly Journal of Economics*, 95 (1): 45-68.

Fine, Ben and Zavareh Rustomjee (1996) *The Political Economy of South Africa: From Mineral-Energy Complex to Industrialisation*, Johannesburg: University of the Witwatersrand Press.

Foucault, Michel (1970) 'The Order of Discourse' (Inaugural Lecture at the Collège de France), in Robert Young (ed.) (1981) *Unifying the Text: A Post-Structuralist Reader*, London: Routledge and Kegan Paul.

Foucault, Michel (2004) *The Birth of Biopolitics: Lectures at the Collége de France 1978-1979*, Hampshire: Palgrave Macmillan.

Freeman, Christopher, and Carlota Perez (1988) 'Structural Crises of Adjustment: Business Cycles and Investment Behaviour', in Dosi et al (eds.), op cit.

Friedman, Milton (1953) 'The Methodology of Positive Economics', in Milton Friedman, *Essays in Positive Economics*, Chicago: University of Chicago Press.

Harvey, David (2005) *A Brief History of Neoliberalism*, New York: Oxford University Press.

Hayek, Friedrich A. (1942) 'Scientism and the Study of Society, Part I', *Economica*, 9 (35): 267-291.

Hayek, Friedrich A. (1943) 'Scientism and the Study of Society, Part II', *Economica*, 10 (37): 34-63.

Hayek, Friedrich A. (1944) 'Scientism and the Study of Society, Part III', *Economica*, 11 (41): 27-39.

Hayek, Friedrich A. (1945) 'The Use of Knowledge in Society', *The American Economic Review*, 35 (4): 519-530.

Hayek, Friedrich A. (1948) *Individualism and Economic Order*, Chicago: The University of Chicago Press.

Hodgson, Geoffrey M. (1998) 'On the Evolution of Thorstein Veblen's Evolutionary Economics', *Cambridge Journal of Economics*, 22: 415-4.

Hodgson, Geoffrey M. (2002) 'Varieties of Capitalism and Varieties of Economic Theory', Geoffrey Hodgson (ed.) *A Modern Reader in Institutional and Evolutionary Economics*, Cheltenham: Edward Elgar.

Jessop, Bob (2002) *The Future of the Capitalist State*, Cambridge: Polity Press.

Jun, Bogang, Gerybadze, Alexander and Kim, Tai-Yoo (2016) 'The Legacy of Friedrich List: The Expansive Reproduction System and the Korean History of Industrialization', *Hohenheim Discussion Papers in Business, Economics and Social Sciences, No. 02-2016*, Universität Hohenheim, Fakultät Wirtschafts- und Sozialwissenschaften, Stuttgart, http://nbn-resolving.de/urn:nbn:de:bsz:100-opus-11894

Khan, Mushtaq and Kwame Sundaram Jomo (eds.) (2000) *Rents, Rent-Seeking and Economic Development: Theory and Evidence in Asia*, Cambridge: Cambridge University Press.

Khan, Mushtaq (2013) 'Political Settlements and the Design of Technology Policy', Joseph E. Stiglitz, Justin Lin Yifu, and Ebrahim Patel (eds.) *The Industrial Policy Revolution II: Africa in the 21st Century*, London: Palgrave Macmillan, pp. 243-280.

Levi-Faur, David (1997) 'Economic Nationalism: from Friedrich List to Robert Reich', *Review of International Studies*, 23: 359–370.

List, Friedrich (1841) *National System of Political Economy Vol. I-III*, USA: Cosimo, 2005.

Lundvall, Bengt-Åke (ed.) (1992) *National Innovation Systems: Towards a Theory of Innovation and Interactive Learning*, London: Pinter; 2nd edition (2010), London: Anthem Press.

Machlup, Fritz (1967) 'Theories of the Firm: Marginalist, Behavioural, Managerial', *American Economic Review*, 57 (1): 1-33.

March, James and Herbert Simon (1993) *Organizations*, UK: Blackwell Publishers.

Marshall, Alfred (1890) *Principles of Economics (8th edition)*, London: Macmillan.

Marx, Karl (1857-1861) *Grundrisse*, translated by Martin Nicolaus (1993), London: Penguin Books.

Marx, Karl and Frederick Engels (1848) *Manifesto of the Communist Party*, (2015) Millennium Publications.

McNulty, Paul J. (1968) 'Economic Theory and the Meaning of Competition', *The Quarterly Journal of Economics*, 82 (4): 639-656.

Mincer, Jacob (1958) 'Investment in Human Capital and Personal Income Distribution', *Journal of Political Economy*, 66 (4): 281–302.

Mittermaier, Karl (1986) *The Hand behind the Invisible Hand: Dogmatic and Pragmatic Views on Free Markets and the State of Economic Theory*, unpublished PhD thesis, University of the Witwatersrand, South Africa.

Nelson, Richard R. (1990) 'Capitalism as an Engine of Progress', *Research Policy*, 19: 193-214.

Nelson, Richard R. (1991) 'Why Do Firms Differ, and How Does it Matter?', *Strategic Management Journal*, 12 (Special Issue: Fundamental Research Issues in Strategy and Economics): 61-74.

Nelson, Richard R. (1998) 'The Agenda for Growth Theory: a Different Point of View', *Cambridge Journal of Economics*, 22: 497-520.

Nelson, Richard R. (2007) 'Economic Development from the Perspective of Evolutionary Economic Theory', *GLOBSELICS Working Paper Series*, No. 2007-02, at http://www.globelics.org/wp-content/uploads/2016/05/GWP2007-02.pdf

Nelson, Richard R. and Winter, Sidney G. (1982) *An Evolutionary Theory of Economic Change*, (USA: Harvard University Press).

Pareto, Vilfredo (1897) 'The New Theories of Economics', *Journal of Political Economy*, 5 (4): 485-502.

Prebisch, Raul (1950) 'The Economic Development of Latin America and Its Principal Problems', *Economic Bulletin for Latin America*, 7: 1-12.

Ricardo, David (1817) *On the Principles of Political Economy and Taxation*, London: John Murray (1821), at http://www.econlib.org/library/Ricardo/ricP.html

Scerri, Mario (2008) 'Neoclassical Theory and the Teaching of Undergraduate Microeconomics', *South African Journal of Economics*, 76 (4): 749-764.

Schultz, Theodore W. (1961) 'Investment in Human Capital', *The American Economic Review*, 51 (1): 1-17.

Schumpeter, Joseph Alois (1934) *The Theory of Economic Development*, (2008) New Brunswick: Transaction Publishers.

Schumpeter, Joseph Alois (1943) *Capitalism, Socialism and Democracy*, (2010) Oxford: Routledge.

Sen, Amartya (1999) *Development as Freedom*, USA: Anchor Books.

Shafaeddin, Mehdi (2000) 'What did Frederick List actually say? Some Clarifications on the Infant Industry Argument', *UNCTAD Discussion Paper 149* (UNCTAD/OSG/DP/149), at http://unctad.org/en/docs/dp_149.en.pdf.

Simon, Herbert (1959) 'Theories of Decision-Making in Economics and Behavioural Science', American Economic Review, 49: 253-283.

Singer, Hans (1950) 'The Distribution of Gains between Investing and Borrowing Countries', *American Economic Review, Papers and Proceedings*, 40: 473-485.

Smith, Adam (1776) *The Wealth of Nations*, (2003) New York: Bantam Dell.

Soete, Luc, Bart Verspagen and Bas ter Weel (2010) 'Systems of Innovation', *CPB Discussion Paper 138, CPB Netherlands Bureau for Economic Policy Analysis*, at https://www.cpb.nl/sites/default/files/publicaties/download/systems-innovation.pdf

Solow, Robert (1956) 'A Contribution to the Theory of Economic Growth', *Quarterly Journal of Economics*, 70: 65–94.

Solow, Robert (1957) 'Technical Progress and the Aggregate Production Function', *The Review of Economics and Statistics*, 39 (3): 312-320.

Stigler, George J. (1957) 'Perfect Competition, Historically Contemplated', *Journal of Political Economy*, 65(1): 1-17.

Stigler, George J. (1984) 'Economics -The Imperial Science?', *Scandinavian Journal of Economics*, 86 (3): 301-313.

Stigler, George J. and Gary S. Becker (1977) 'De Gustibus non est Disputandum', *The American Economic Review*, 67 (2): 76-90.

Streeck, Wolfgang and Kozo Yamamura (2001) *The Origins of Non-Liberal Capitalism: Germany and Japan in Comparison*, New York: Cornell University Press.

Sweezy, Paul M. (1943) 'Professor Schumpeter's Theory of Innovation', *The Review of Economics and Statistics*, 25 (1): 93-96.

Variava, Rooha (1989) The Deployment of Racism in South Africa, Ph.D. dissertation, Cambridge University, UK, at http://v1.sahistory.org.za/pages/library-resources/thesis/deployment-racism/

Veblen, Thorstein (1898) 'Why is Economics not an Evolutionary Science?', *Quarterly Journal of Economics*, 12: 373-397.

Von Mises, Ludwig (1949) *Human Action: A Treatise on Economics*, (1998) Auburn, Alabama: The Ludwig von Mises Institute.

Walras, Léon (1899) *Elements of Pure Economics* (English translation, 1954), London and New York: Routledge.

Williamson, Oliver (1985) *The Economic Institutions of Capitalism*, USA: The Free Press.