



Limits to the Economy of Knowledge and Knowledge of the Economy

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Because different people can develop different skills, a knowledge rich society must be an ecology of specialists; knowledge is distributed within each human brain, within each organisation and within the economic and social system; and being distributed it can grow, provided that it is sufficiently coordinated to support increasing interdependencies (Loasby 1999, p. 130).

We can save men from hunger or misery or injustice, we can rescue men from slavery or imprisonment and do good...but any study of society shows that every solution creates a new situation which breeds its own new needs and problems (Berlin, 1991, p. 14).

We are active, we are constantly testing things out, constantly working with the method of trial and error (Popper, 1987, p. 53).

1. Introduction

It is commonplace in modern times to claim not only that we live in a knowledge economy but also that knowledge is the font of human prosperity and its many corollaries. Yet every economy, always and everywhere is a knowledge economy, for social systems, and economies are social systems, could not be arranged otherwise. What meaning can we assign to this current fashion for the knowledgeable economy? Is this a matter of new kinds of knowledge or of new ways of creating knowledge? Is it instead a misnomer arising from the confusion between information and knowledge? Could it be that the tenor of modern times has been to transform the manner in which information is generated, and stored? Yet again, is the question to be answered in terms of new methods for communication and thus the patterns of interaction between knowledgeable individuals? If all economies are necessarily knowledge economies, what is it about the modern economy that makes it distinctive in this regard? Even the most 'primitive' societies, if they are to survive, must depend on a systematic and sophisticated understanding of their material environment, an understanding that is reproduced without significant variation from generation to generation.

In this essay, we explore some of these issues with a particular emphasis on the evolutionary adaptive systems perspective. The three quotations at the head of this essay encapsulate its major themes. They draw attention to the division of knowing in a knowledge economy, to the restless nature of knowledge and to the principle of variation and selection that makes the growth of knowledge an evolutionary process. However, the issues run much deeper into the history of economic thought. No less an authority than Adam Smith laid the foundations for

our discussion when he suggested that the most fundamental aspect of the division of labour is the division of knowledge, and the consequential existence of roundabout and combinatorial ways of producing knowledge. The notion of roundaboutness also connects our discussion with the writings of the Austrian school of economists, which we discuss further below. Indeed, it is the Austrian school that has come closest to understanding the open-ended and evolutionary nature of knowledge based economic activity. Whether this discussion justifies the view that the growth of knowledge is a complex process is addressed in the final section.

2. On the Nature of Knowledge and Understanding

In this section, we explore the problem of knowledge and understanding as a basis for comprehending how different patterns of knowledge accumulation are reflected in different institutional structures. Since few scholars would deny that economic and social change is contingent on the continued growth of knowledge this is not a trivial issue. But precisely who is said to know more when we link the growth of knowledge to the growth of the economy?

The view we take here is known as foundationalism. Only individuals can know and what they know depends on perceptions, introspection, memory and inference, in short, experience allied with reason (Audi, 1998). Individual knowledge is thus shaped, refined and continually moulded by the activities that individuals engage in during their lifetime and by the contexts that frame these activities. In this sense, individual knowledge is relative and as the Austrian economists are wont to put it, 'subjective'. What we know arises and develops partly in the context of our innate curiosity as human beings and partly via the stimuli provided by everyday experience of interaction with others. All these forms of knowledge are held in the subconscious recesses of our mind, they are essentially a matter of electro-chemical responses in the human brain with the consequence that mind is a store of latent potentialities. Indeed we are conscious of knowing only when we are confronted by a problem or discontinuity in our sense of the outside world. Personal knowledge is from this viewpoint a conversation with oneself perhaps substantially unconscious. What we hold in our conscious mind at any point in time is knowledge of organising principles and reference points from which to interrogate the subconscious when confronted by questions that capture attention. It is our private way of making sense of the world, of distinguishing facts, of

grouping related phenomena, of finding connections and of establishing cause and effect. Private knowledge is thus our ever-changing frame of reference for interaction with the wider world. As such, it is always incomplete and it is only because of this that learning and creative thought become possible. We can of course only conjecture a difference in knowledge against some existing frame of reference.

Quite crucially for the following argument, these private states of mind are not accessible by any other individual and this carries with it an implication of great importance. Namely, that those processes, by which we come to know as individuals, are augmented greatly by social processes that permit exchanges of information, representations of knowledge communicated between individuals such that they can lay claim to common understanding. Through sense experiences of the knowledge of others, our individual states of knowledge become interdependent. In this way, private knowledge is connected with but not identical with the private knowledge of others. An immediate implication of this distinction is that knowledge is always tacit, it is only information, the more or less imperfect representation of knowledge, that can be codified in symbolic form.

This extended reliance upon the testimony of others is one of the key factors in comprehending understanding as a complex system predicated on the knowledge of individuals and indeed in comprehending the nature of capitalism as a knowledge-based system. For it leads us directly to one of the most powerful of the ideas derived from Adam Smith, namely the division of labour in the production as well as in the use of knowledge. Every economist is familiar with the Wealth of Nations and the story of the pin factory and the detailed specialisation within that work process. Yet within a few pages of this famous example, Smith turns to a far more powerful case, the case that underpins modern economies and indeed forms the test for a modern economy. For Smith applies the division of labour to the growth of knowledge, pointing to the role of those specialised philosophers and men of speculation, “whose trade is not to do any thing, but to observe everything; and who, upon that account, are often capable of combining together the powers of the most distant and dissimilar objects” (Cannan edition, p. 11). Moreover, because the division of labour also applies to the philosophers, “Each individual becomes more expert in his own peculiar branch, more work is done upon the whole, and the quantity of science is considerably increased by it” (ibid, p. 11). In this way Smith reaches the core of the matter, identifying capitalism as a self-exciting system that has evolved and continues to evolve new methods of

inventing. It is this, which makes possible modernity as a persistent feature of capitalism, that make it a system in which fundamental changes are always in train, changes that arise from within the system, that mean in a fundamental sense the new economy is ever present. What Smith does not develop is how this growth of knowledge is to be co-ordinated, how individual knowledge is to be shared in the wider social context for this will determine how individual knowledge will grow. What is the instituted process that achieves for knowledge activities what markets achieve for conventional productive activities?

To answer this question it is necessary to develop the distinction between personal knowledge and shared, interactive understanding in more detail. What Smith drew attention to is the individually idiosyncratic, specialised nature of personal knowledge, the corollary to this is that not only the use of knowledge but the growth of knowledge is embedded in a social process that is co-ordinated through appropriate patterns of social interaction. The problem here is clear, if knowledge remains private it can inform private action but not social action. For social action to be possible, for actions to be mutually supporting and collaborative it is necessary that private knowledge becomes public understanding to the requisite degree. The transmission of private knowledge into shared understanding is a socially distributed process and this process must depend on institutions for the sharing and common interpretation of flows of information. We can never say two individuals have the same knowledge, nor devise a way of establishing what they know. We can say instead that as individuals they have the same understanding in so far as they provide indistinguishable, or at least closely correlated answers to the same question or if they respond in indistinguishable ways to the same instructions.

If information flow is to convey personal knowledge with sufficient accuracy to achieve commonality of understanding, then there must be common standards of communication, language or other forms of symbolic representation, and agreed standards for the justification of that which can be said to be known. Moreover there must also be shared interpretive frames, theoretical schema to judge the content of information otherwise private knowledge cannot develop into collective understanding. As Nelson puts it, there must be 'social technologies' to make testimony possible (Nelson, 1999). In this regard, institutions matter in two fundamental ways in relation to the connection between knowledge and understanding. First, they constitute the means to store and communicate information in general and the means to support particular patterns of interaction, "who talks to whom with what frequency

and with what authority”, in a society. This is the question of language, commensuration and symbolic representation in general. Different patterns of interconnection imply different distributed patterns of understanding and thus different paths for the growth of knowledge. Secondly, institutions embody the rules, the standards of socially agreed belief, that are the means to accumulate justifiably true knowledge in relation to science, technology, as well as organisation and social discourse. It is the institution of understanding in common that makes economic and social life possible while simultaneously constituting a powerful engine for the differential growth of personal knowledge. North (1990) is correct in arguing that institutional rules constrain behaviour by facilitating the growth of common understanding. However, these same rules are to a degree enabling and facilitating in that the spread of understanding opens up opportunities for the further growth of private knowledge.

To summarise the argument thus far, human interaction generates directly and indirectly a flow of information between individuals who, at best, treat that information as a representation of the knowledge of others, and interpret it through the confrontation with their own sense of knowing. In the process, the disjunctures which arise are a powerful stimulus to new thoughts. Information flow may change the knowledge states of the recipients but there can be no expectation that the change of knowledge will be complete, that it will be identical for all recipients, or that it will be accepted. Indeed, it is the fact that information is not interpreted in uniform fashion that is essential to the continued growth of knowledge and thus understanding. A world in which all private knowledge was identical would be a world in which the problem of knowledge had ceased to exist.

To speak of knowledge in general is to speak of the union of everything that is known privately, while to speak of understanding is to speak of that which is shared, that which is held to a degree in common. As is individual knowledge, understanding is an open system, it is emergent, it can grow combinatorially fast, at least in local domains, and it has no rest points or stable, invariant attractors. It can undergo subtle changes as information percolates across networks of relationships or it can undergo more radical sweeping changes in a relatively short period of time that take understanding into entirely new dimensions. To this degree understanding is unstable. Yet the kinds of understanding we develop and share are not unconstrained. The path of understanding is we suggest chreodic, it is channelled primarily by the particular nature of the social and institutional context. The conventions as to what information is made public and who could communicate with whom about what are

deeply important for the growth of knowledge. Institutions, conventions, social standards can suppress the generation of understanding just as they can enable it. We can find here the unpredictability of knowledge accumulation, the uneven nature of knowledge accumulation, and the corollary, the unpredictability of the surface forms of capitalism in terms of what is produced and consumed.

From this viewpoint it is natural to emphasise the role of personal creativity in the growth of understanding. Inventive genius associated with individuals or teams is crucial to the progress of knowledge in all its forms. However, creativity alone is not sufficient. What is personal at source must be capable of being placed in and spread within the public domain and here the development of information and communication technologies has been of paramount importance in permitting the creation, storage and transmission of symbolic records. Yet this technological view leaves the account incomplete. Equally crucial has been the invention and adoption of standards or norms to distinguish reliable from less reliable knowledge. The process of establishing error, of identifying mistakes, is absolutely essential to the growth of understanding. Criteria for falsification and rejection have provided the critical edge that combats the problem of superfecundity, the problem of being unable to distinguish which of the too numerous rival courses of action to follow. In regard to science, we enquire of the truth of the relation between conjecture and natural fact. In regard to technology, we enquire whether the device works in the environment in which it is intended such as to achieve the desired effect. In regard to business, we ask does the plan achieve the profitability required to justify its continuation. Without these instituted and thus shared winnowing processes it is not at all clear how knowledge and understanding can grow. Thus all knowledge and all understanding reflect multiple processes of trial and error of variation and selection. In this regard we would agree with Campbell (1960) when he argues that all growth of knowledge is predicated upon a process of blind variation and subsequent selection. It should be noted that blind does not mean random rather it means that the validity of new knowledge can never be known in advance since those tests of validity always lie in the future.

These considerations tell us a great deal about the unique properties of capitalism as a knowledge-based system. It is a system for generating business experiments based on the accumulation of scientific, technical, organisational and market knowledge. Business conjectures create sequences of new problems to be solved, give meaning to

entrepreneurship, and give to the firm as organisation the unique role of combining the multiple knowledge elements that are needed to innovate successfully. In being a problem solving system, any organisation such as a firm is necessarily a problem generating system. Hence the restless nature of firms and whole economies: capitalism can never be at rest because understanding and knowledge are never at rest and never can be given the rules of the game. An 'equilibrium of knowledge' is an oxymoron. By this notion of restlessness, we intend to convey two separate meanings: first that economic actors are to a degree ill at ease, they can never be sure that their position will not be challenged; and second, that they are always searching for new situations and the route to these is the growth of knowledge. Of course, it is important to emphasise that the growth of understanding cannot be random without further processes to focus that randomness to good effect. Unaided, random systems do not evolve they drift. We make rapid economic progress precisely because the underlying processes of variation are guided, because they explore only limited regions of the space of possibilities. Nor can the growth of understanding be entirely deterministic for it involves choice, judgement, and creativity in the sense of the expansion of thought and action into new dimensions and spaces. For this reason alone uncertainty is an unavoidable element in the picture for only when the space of possibilities is closed can probability judgement and its formal calculus be entertained (Shackle, 1958). Not only are the winnowing processes referred to above crucial but the possibility of the recombination of ideas and concepts is essential to the cumulative growth of personal knowledge and shared understanding, for what is important about combinatorial processes is that they build on memory and thus upon experience. Only then is it possible to entertain the idea of cumulative learning and cultural transmission. What seems to be unique about capitalism as a knowledge-based system is that it has evolved a system of knowing and understanding that is in reality a system for standing on the shoulders of giants.

3. Economic Growth and the New Economy

These ideas have some important implications for the economic approach to knowledge and information. If knowledge is of necessity a private attribute of individuals then it is not obvious that it is a 'good' in the public domain. This is the 'ether problem' that knowledge is simply in the air and can be 'inhaled at will'. At its source is confusion between information and knowledge. Because knowledge is necessarily private, idiosyncratic, individual, what we should say is that only its representations, symbolic or otherwise, can be in the public

domain. However, if we say more accurately that information is in the public domain this does not imply that it is uniformly accessible, available to all without effort or cost. To turn information into knowledge requires prior knowledge (and beliefs), including the social knowledge of who to ask, where to look, and the investments of time and effort to acquire that knowledge. This is a necessary consequence of the specialisation of knowledge. Expertise in some domains is a trained aptitude for ignorance in other domains and this is why testimony is dependent on trust and the underpinning instituted structures that foster communication. Indeed if knowledge were ‘in the ether’, if there were a universal public library of the answers to all questions it is difficult to understand how any economy could be underdeveloped, difficult to understand why one should, for example, think of technology transfer as a problem. There is perhaps no more compelling testimony to the non-public nature of knowledge and to the difference between knowledge and information than the varied experiences of developing economies (Easterly, 2001).

Obviously, knowledge and information obey the principle of non-rivalry in use. While this has been emphasised in the recent economics of growth (and indeed in Arrow’s statement of the economics of information, Arrow, 1962) an important part of the knowledge dynamic is missed namely non-rivalry in the use of knowledge to produce knowledge. The production of knowledge is autocatalytic and this is why social testimony plays such an important role in shaping the growth of private knowledge. As scholars from Marshall (1898) to Kuznets (1971, 1977) have recognised, economic activity changes knowledge directly and indirectly and every change in knowledge opens up the conditions for changes in activity and thus further changes in knowledge, ad infinitum, and in quite unpredictable ways. Popper (1985) is of help here, not least because of the clarity with which he argues that the accumulation of knowledge is an unfolding process in which the realisation of possibilities makes possible the specification of new possibilities. Since all knowledge is provisional we adhere to what we know is workable until something demonstrably better comes along, and this is as true of business conjectures as it is of conjectures about the social, natural and man-made worlds. It is the fact that knowledge generates knowledge that also links together selection and development so as to mark economic evolution as an inherently unpredictable positive feedback process. Complex, adaptive, evolutionary processes may provide the most promising way to capture this dynamic as we explore below.

In assessing the institutional framework for generating knowledge and shared understanding in an economy, emphasis is rightly given to formal processes of education and research. The development of these processes as investment activities is surely one of the principal factors in the cumulative growth of knowledge and understanding, particularly in respect of science and technology. But the accumulation of knowledge in capitalism is subtler than this; the engine of capitalism is greatly enhanced by but not simply dependent on having discovered and instituted formal processes for education and research. There is a danger in overemphasising the idea of a distinct 'knowledge sector'. The point is that knowledge does not accumulate out of context or of the passage of time. Much economic knowledge therefore results from the conduct of the market process as suppliers and customers interact and learn what to produce and from whom to buy. To this extent, economically valuable knowledge is a product of market co-ordination and can be expected to accumulate differently in different co-ordination systems: a centrally planned system must be expected to generate quite different patterns of knowledge to those arising in a decentralised market economy. It is this fact, which links evolutionary explanation with some Austrian approaches depicting economic evolution as a socially mediated discovery process (Rizzo, 1994; Cowan, 1994).

Our perspective on the differences between knowledge and information and knowledge and understanding has important implications for the connection between the growth of knowledge and the growth of the economy. Modern treatments of economic growth are macro economic in scope and use as the central organising device the idea of a uniform rate of expansion of all activities. For this to be possible it is clear that what is required is that knowledge and understanding in the aggregate should grow at a steady rate either in terms of ideas or in terms of their practical applicability. That knowledge feeds on knowledge through the intermediary of understanding is a perfectly sensible idea but that it does so at a uniform geometric rate seems particularly hard to swallow. That research effort may grow in aggregate at such a rate does not entail the steady growth of the output of that enquiry, an observation that is surely consistent with the uneven growth of science and technology over time let alone its uneven rate of application. That innovation scholars have found it useful to distinguish radical innovations from incremental innovations, or macro innovations from micro innovations reflects this obvious fact (Freeman and Soete, 1997; Mokyr, 1990).

Part of the problem here is in conceiving of an aggregate stock of ideas. Are ideas to be added, multiplied together, or aggregated in combinatorial fashion, in which case the stock grows faster than exponentially? Whatever the process of aggregation we still need the weights (prices) with which an idea in carbon chemistry, say, is to be combined with an idea in the production of insurance services. It is not obvious what these weights are, and they certainly are not to be found in market prices. There is unfortunately no metric through which knowledge can be reduced to a scalar quantity. Part of the problem lies in separating what is known from who is said to know and thus from what is understood. The notion of ‘disembodied’ knowledge, is surely one of the strangest ideas to grace modern economics. It hides the fact that knowledge is necessarily distributed and that economic activity depends on shared understanding not shared knowledge. Thus, different institutional arrangements for communicating information may mean that levels of understanding do not map easily onto what is known within a given population (Potts, 2001). What one cannot expect from such processes is that knowledge and understanding expand uniformly across time and place. To the extent that economic growth depends on the growth of knowledge and understanding it is necessarily uneven and unpredictable in its distribution and cannot be otherwise. There is a further implication that needs far more development than we can afford here. It is that new knowledge is a joint product with the proper outputs of the economic activities that individuals engage in, perhaps the most powerful case of joint production in the economic sphere.

One consequence of this argument is that knowledge-based systems cannot be in equilibrium for, in equilibrium time passes but nothing happens, cause and effect evaporate. For the point about equilibrium is that there is no escape from it without the introduction of some external disturbing perturbation not explained within the model. To capture the evolutionary nature of capitalism we need a concept of open-ended development, of development from within the system that does not necessarily have an attracting set of limiting states. How else can we capture the historical record, the incessant emergence of qualitative and quantitative change, the utterly unpredictable long-term development of the modern economy.

This perspective is reinforced when we recognise that all economic processes take place in real time, subjective time, and that the mere passage of time means experiencing events and thus gaining new information and new thoughts (Loasby, 2001a). On both these counts it is particularly problematic if we try to posit some equilibrium state that is invariant to the

motion towards it, for this is tantamount to holding knowledge (and the real time of human experience) constant while we get to equilibrium. This makes no sense other than as a formal way to avoid the problem. In short, if economic and social systems are out of equilibrium they stay out of equilibrium and their behaviour is irreversible. But they always exhibit order and that order reflects, and might be measured in terms of processes of interaction and the patterns of co-ordination that ensue. This is precisely why markets are so important, they establish order and in so doing deeply shape the conditions for the generation of understanding and the growth of knowledge. In that order is self organising it is different from organisation, the purposeful construction of structures. Capitalism is from this view the self-ordering of organisation and thus the self-ordering of understanding.

What then of the new economy? It will be clear, we hope, from the above that not much credence is to be given to this concept. The surface form of capitalism is always evolving and it is not at all obvious that the biotechnology revolution for example means anything more in its economic fundamentals than the railway revolution or the electricity revolution. Yet there is a deeper sense in which a fundamental shift is occurring in the generative processes connecting the growth of knowledge with the diffusion of understanding. The technologies of storing and communicating information are bound to influence the indirect connectivity of individual minds, to influence the development and diffusion of understanding and thus the processes of personal knowledge accumulation. It is by changing the technology of invention in its broadest sense that new arrangements for business experimentation are perhaps being created. Thus the micro heterogeneity of individual knowledge may become even more important for the evolution of understanding.

In summary, the fundamental point about knowledge- based systems is that they are creative systems and creative systems are to be understood in terms of evolution not of equilibrium. They are to be understood in terms of the idea of changing patterns in the co-ordination of actions. It is this view of the world that fits more naturally with Austrian perspectives on the economy than with any other major school of economic thought.

4. On the Economics of Knowledge and Understanding: A brief overview of the Austrian Interpretation

There is a sense in which any commentary on the economics of knowledge without recourse to the Austrian school of economic thought is akin to discussing the theory of relativity without acknowledging the remarkable insights of Einstein. Hayek (1937, 1945) above all Austrians, challenged the peculiar notion of economic equilibrium, the role of knowledge in understanding the market process and the particular economic problem facing societies arising from the way in which knowledge is dispersed and localised. Indeed it is because individuals are globally ignorant but locally wise that the economic problem arises at all. But this connects of course with Adam Smith because one of the deeper consequences of the division of labour is the division of knowledge. If we think of expertise as the capacity for localised learning then it is simultaneously a barrier to learning more generally.

To understand the relevance and importance of knowledge in Austrian economics, one must first come to an appreciation of subjectivism and the role that it plays in the development of this body of thought. Subjectivist economics is concerned with the connectivity between individual choice and the purposefulness of human action. At the most fundamental level, subjectivism refers to the presupposition that the contents of the human mind and hence individual decision-making are not determined solely by external events nor can it be reduced in mechanical fashion to constrained optimisation (O'Driscoll and Rizzio, 1985, p. 1). Social science explanations, it is argued, must start with the subjective mental states of the actors being studied (Horwitz, 1994, p. 17), that is to say, their private knowledge. This admits scope for creativity and autonomy of human conjecture and choice and thus the continued growth of knowledge. Making sense of human action therefore is impossible if the diversity of human perceptions and plans is disregarded in any explanations of reality.

Clearly this contrasts sharply with how agent/individual behaviour is modelled in mainstream economics. Rather than attempt a difficult explanation of how knowledge and information considerations relate to and impact upon models of resource allocation, mainstream economic theory assumes away the problem by imbuing agents with full 'neo-classical rationality' premised upon full information. For the latter to be possible there cannot be uncertainty, only risk, never conjecture, only calculation. This allows 'agents' to have knowledge of all the variables pertinent to the decision making process, along with the probabilities, and

instantaneous and costless access to information. The implications of this are considerable and not better expressed than in the words of Hoppe:

'Imagine a world characterised by complete certainty. All future events and changes would be known in advance and could be predicted precisely. There would be no errors and no surprise. We would know all of our future actions and their exact outcomes. In such a world nothing could be learned and accordingly nothing would be worth knowing' (Hoppe, 1997).

Implicitly the neoclassical framework enables individual agents, subject to the usual constraints, to attain their plans. To put it bluntly, individuals always get what they plan to get when markets do their proper job. Individuals know their objectives, and they are intimately aware of the means for achieving them, in this sense of relating known means to known ends they are completely rational. Moreover, in forming their expectations of future economic variables they have a full economic knowledge of the process they are trying to forecast; the same full knowledge as any other actor. To the extent that they make errors, the errors are expected errors and therefore do not entail any adjustment to the rational plan. Apart from being questionable on epistemological grounds (Boland, 1979), this particular way of framing the economic agent implies that the individual decision maker's knowledge is always correct and this makes for only a very static concept of knowledge – one which is timeless and poses the conundrum of why there should ever be the need to learn. Indeed, the very notion of competitive behaviour and innovation from a process perspective implies that agents form plans that are not anticipated by other agents. The consequence of divergent plans is that they lead to systematic errors, which can only be responded to by a change in plan or more fundamentally by a change in belief. Moreover, it is precisely the ability to formulate and implement better plans than one's rivals that is the source of profit in the economy. One makes money and generates economic growth from the diversity of knowledge and beliefs not their uniformity.

Fortunately, the real world is far from perfect. It is not made up of Olympian, maximising, information rich, uniform agents. Instead, it is characterised and inhabited by heterogeneous, creative, error making individuals who operate without the luxury of a perfect model of the world and their ignorance is manifested in their daily activities and in their choices and their actions.

A subjectivist viewpoint proves to be a novel and illuminating way to capture the importance and relevance of knowledge or its converse, ignorance in the market context. It was Hayek who emphasised that it was not so much the actual products themselves (steel and wool in his example) that enter into economic explanations but rather, the knowledge and beliefs that individuals hold about them. Analogously one may be tempted to infer a quite similar interpretation in the context of knowledge is equally valid, that it is not knowledge itself but what people share in terms of their mutual understanding of phenomena that makes a market economy viable. This is the point that we have emphasised above. Knowledge is private but understanding is social. But then as Kirzner (1976b) advances, a subjective approach yields a further insight, ‘it leads to recognition of precisely that kind of knowledge *of which men know nothing at all*’ (p. 138, italics as in original). Such a perception openly admits individual ignorance but it also allows for the existence of opportunities for the acquisition of knowledge about which no one is aware. This is quite similar to what Kirzner (1976a) refers to as the Shackle-Boulding knowledge paradox: ‘that we have to know what we want to know before we start looking for it’. It is, in the ‘Austrian’ world, the market process that performs this crucial function in discovering economic knowledge that no one knew exists.

In its approach to mapping an understanding of the market as a process rather than a state of affairs, the Austrian theory of knowledge presents the market as a solution to the two fundamental sources of ignorance. The first of these, attributed to Hayek (1945), relates to the division of knowledge in society, while the second employs the subtle but powerful subjectivist methodological argument that even though the act of decision-making implies an expectation or vision of the future, at the very moment the individual makes a decision, the future is indeterminate (Shackle, 1958). Indeed, if the future were known, there would be no reason to make a decision (O’Neill, 2000). But the future cannot be known and in opening the door to creativity this simultaneously opens up the possibility of interpreting the economy as a complex evolutionary adaptive system. Elsewhere we have referred to this as the problem of restless capitalism, and as we pointed out above the economic system is restless because knowledge and understanding are restless.

In the case of the division of knowledge, Hayek identifies clearly the ‘distributedness’ of knowledge that is characteristic of the complex order of modern society. Knowledge can reside only with individuals and consequently it is distributed across society. It exists only in:

‘dispersed bits of incomplete and frequently contradictory knowledge which all separate individuals possess (Hayek, 1945, p. 77).

The problem that this gives rise to and the context in which Hayek focused his discussion was on the nature and character of the economic system that would best facilitate societal/economic progress. The central concern he perceived was not so much the means-ends allocation/optimisation problem focused on by mainstream economics, as the use of knowledge in society – the way knowledge is acquired and transmitted through social interaction. Viewed through this lens, the question that the society must resolve and the economist explain becomes how to utilise private knowledge to explain the order that is observed in the ensemble of relations that defines an economy. The answer to this is to be found, as explained above, in the generation of social understanding. The issue is one that extends beyond the notion that knowledge is fragmented and distributed to an understanding that the kinds of knowledge agents require to plan and engage in economic activity are, in addition to connecting principles, the knowledge of the particular circumstances of ‘time and place’. This is a knowledge that is specific and local, both in a geographic and subjective sense, and it is a knowledge characterised by an element of tacitness, which makes it difficult to communicate and sometimes uneconomic to quantify or codify.

Knowledge of ‘time and place’ suggests that the resolution of the problem posed by the division of knowledge exceeds the capacity of any one individual or group to resolve. Instead, such problems are best solved through spontaneously evolved institutions such as the market, precisely because they allow for the ***combination and utilisation*** of diverse and fragmented knowledge embedded in the minds of individuals. Thus understanding is instituted by the market process and the way in which it is instituted will undoubtedly influence the way that private knowledge develops. The market solution consequently yields a socially beneficial result that exploits every relevant bit of knowledge without in any sense concentrating that knowledge in a single mind (Kirzner, 1992, p. 167). By analysing the market process in this manner, Kirzner is led to elaborating and extending Hayekian insights

by proposing that the market also facilitates the discovery of knowledge. The issue for Kirzner (1992, p. 52) is that not only is it likely that individuals who possess information are ignorant of where complementary information resides, but they are likely to be ignorant that they are ignorant. This unknown ignorance expresses itself and is resolved in the market in terms of incentives (profit opportunities), that attract the alertness of entrepreneurs. Thus during the market process, new economic facts are discovered by those alert to opportunity. This notion of entrepreneurial discovery that Kirzner postulates relates quite closely to Hayek's understanding of the competitive process as a discovery procedure (Hayek, 1978). This discovery process is quite distinct from the rational maximisation problem precisely because 'the potential discoverer is perceived not to have any specific search objective or search procedure in mind and is (therefore) not seen as weighing the likely benefits of a successful find against the cost of necessary search' (Kirzner, 1994, p. 103). Moreover discovery in this context is not perceived as an act of learning but lies 'midway between that of the deliberately produced information in standard search theory and that of sheer windfall gain generated by pure chance' (Kirzner, 1997, p. 72).

Turn now to the second source of ignorance. For the Austrians, this lies in the impossibility of knowledge about the future. This is the theme that Kirzner (1976a) regards as the second basic tenet of Austrian methodology: that there is an inherent unpredictability and indeterminacy with regard to human preferences, expectations and knowledge. In the Austrian argument, the very idea of autonomy of individual choice negates the extent to which the future consequences of the choices of all individuals can be accurately predicted.

There are major two lines of thought that influence this argument. The first, a derivative of the Hayekian tradition, is couched in terms of the complexity of social phenomenon (Hayek, 1967). The main idea that Hayek develops is that unlike the case of the natural sciences, when the objects of enquiry are complex systems in such areas as economics there are obvious limits to theorising and prediction. To quote:

One of the chief results achieved so far by theoretical works in (this) field seems to me to be the demonstration that here individual events regularly depend on so many concrete circumstances that we shall never in fact be in a position to ascertain them all; and that in consequence not only the ideal of prediction and control must largely remain beyond our reach, but also the hope remain illusory that we can discover by observation regular connection between the individual events (p. 34).

O'Driscoll and Rizzo (1985, p. 24) elaborate on this theme in a slightly different but equally pertinent way. The fact that the economy is an open system means that the conditions at the boundary of analysis are always in a state of flux and this frustrates the best efforts at prediction. System closure in this context requires a model of an order of complexity that far exceeds the capabilities of the human mind for all interactions would have to be accounted for in a precise way. Since such a model cannot be constructed, explanations of complex phenomena can only be limited to explanations of general principle.

The second strand of thinking, developed in the more modern tradition of subjectivism, explores the insight that in a world of human interaction the full consequences of one's actions will partly depend on the decisions and courses of action that others are intending to or are pursuing. This leads to the crucial proposition that where:

'there is autonomous or creative decision-making ... the future is not merely unknown, but unknowable' (O'Driscoll and Rizzo, 1985, p. 2).

This particular discourse on the 'unknowability' of the future has been developed both within and outwith the tradition and the weighting that is given to it varies from author to author. The one striking feature that is common to the various strands however is the recognition of the crucial importance of incorporating the passage of time into the market process analysis. Decision-making occurs in real time; moreover, any actions undertaken are never made with complete knowledge of all facts nor of the consequences. The essence of this is revealed in the unfolding market process by focusing on the expectations of market participants; expectations affect the process and are affected by it. They are, in this sense, neither truly endogenous nor exogenous. Thus it is only by invoking the *ceteris paribus* assumption and consequently impounding the state of expectations it becomes possible to hypothetically deduce price and quantity changes that result from changes in market conditions (Garrison, 1986). To the Austrians, the neoclassical treatment of the present/future distinction follows a very different and untenable trajectory. Uncertainty is characterised as an objective probability distribution defined over an exhaustive set of events, a closed list of possibilities. This is tantamount to saying that the future exists independently of the autonomous choices of individuals. In effect by claiming that the expectations of market participants are 'rational', the future is collapsed into the present (Garrison, 1986). The reality is that market participants engage in decision-making without recourse to either the relevant true

probabilities or the full range of possible outcomes. Even if it were at all possible to have such knowledge, the world would be one in which there is neither room for surprise nor for error. Such would not be a world of genuine uncertainty and as Horwitz (2000) suggests ‘where there is neither surprise nor error there cannot be either discovery or learning’. It is only when there are facts of which individuals are unaware of at the moment of decision can there be room for learning or discovery.

The problems that this interpretation gives rise to is that taken to the extreme the subjectivist interpretation denies the regularities that make economic knowledge and action possible (Kirzner, 1976a, 1997). This paradox is often referred to as Lachmannian nihilism. Rather than conceive of the economy and the market as equilibrium constructs, engendered by the actions of discovering (and arbitraging) entrepreneurs, as in the Kirznerian framework, Lachmann and Shackle compare the working of the market economy to a kaleidic society ‘interspersing its moments or intervals of order, assurance and beauty with sudden disintegration and a cascade into a new pattern’ (Shackle, 1972, cited in Lachmann, 1976). This is a model of economic restlessness where the discovery of new facts, new knowledge arising from market interaction impinge upon human choice and decision-making. With the passing of time the expectations of some actors come to be realised while those of others get frustrated consequently the order and patterns characterising market activities continually give way to new order and new patterns (of prices and activities) that could not have been predicted.

However, the nihilistic position contains an obvious flaw. Knowledge and understanding presuppose regularity and order, if there are no fixed points there is no basis for establishing a different view of the world. Learning is only possible within frameworks of ideas that are substantially stable (Loasby, 1999). Hence, we are forced to the middle ground; there is no historic, fatalistic inevitability about economic life, nor is the world random. Rather, the creativity, which continually redefines patterns of economic activity, cannot be so great as to destroy the patterns on which that creativity is presupposed. Explaining the process through which human decisions lead to unintended consequences relies upon the empirical proposition that individuals learn from market experiences. By rejecting the hypothesis that the market process is equilibrating one can only assert that market interactions generate new private knowledge and new understanding but not in what direction. An explanation of the consequences of human action – that there is a tendency for entrepreneurial profits to be

eliminated or for prices to move in one direction or another, requires an explanation about the manner in which human knowledge and human expectations become modified. This brings us full circle to our main theme, the relation between knowledge and understanding.

5. Adaptive Systems and Understanding

In this section, we bring together the Austrian and epistemic arguments within a framework of adaptive system dynamics to elaborate the argument that there is a co-evolution of private knowledge and public understandings and that the growth of understanding is itself systemic; it depends on which individuals communicate on what topics, directly and indirectly. Thus, the relation between knowledge and understanding is symbiotic, dynamic, and unpredictable; it involves introspection allied with experience including experience of the knowledge of others as we pointed out above.

First, we need to make clear what we mean by a complex, adaptive system. A view that resonates closely with our thinking perceives them as systems that are capable of more than one response to any particular stimulus, whether arising from within or without the system (Allen, 2001). They are capable of creative responses, and these responses, in Austrian fashion, are inherently uncertain. They imply the exercise of imagination, the emergence of innovative solutions somewhere within that system. This definition seems to capture the dynamic connectivity between private knowledge and shared understanding in a productive fashion for it emphasises the importance of personal idiosyncrasy and the significance of non-average behaviours for the evolution of understanding and knowledge.

New knowledge can only be generated within individual minds by cognitive, mental processes. For knowledge to have a wider impact, it must be encoded, transmitted as information to others and they must be capable of decoding this information flow and interweaving it with their own knowledge (Loasby, 2000). Understanding grows through widening processes, selection processes that involve social as well as physical technologies, and it is reflected in the increase in the number of individuals capable of giving highly correlated answers to the same questions or instructions. In the process, the knowledge of the individuals concerned is augmented and the stimuli are created for the further growth of private knowledge. Distributed personal knowledge and socially contingent understandings feed off one another to generate a system dynamic for their mutual development. Thus, the

growth of knowledge always exhibits immense micro diversity, whilst the growth of understanding is a process of eliminating diversity. Moreover the evolution of knowledge, whether theoretical or practical, is purposive and often an emotional rather than a rational force (Loasby, 2001b).

It is inevitable that the theory of complex adaptive systems, when applied to the economic and social domain, confronts the distinction between private knowledge and the institution of social understanding. For we have suggested that, while knowledge is a characteristic of individuals, understanding becomes an emergent phenomenon arising from the interaction between individuals in specific contexts. Understanding has boundaries it has components that possess great heterogeneity and it is sustained by the connections of information flow. The growth of understanding therefore is dependent on a systemic context, on the way a given set of individuals interact to share information and thus to further develop their idiosyncratic knowledge. It is highly improbable that isolated individuals would develop knowledge in closely correlated patterns. It is social interaction and the associated flow of information that generates the requisite degree of co-ordination for understanding to occur. However, since social connections are always limited and 'local' it follows that the spread of understanding is never complete and will vary widely across different epistemic realms. Any one individual is normally a party to many different communities of understanding and systems of understanding are instituted in many different ways. Since understanding involves interaction between different minds it creates the scope for dispute and the contesting of ideas. The institution of understanding create multiple orders yet opens up the opportunity for those orders to be developed, in short, what we can understand is limited, what we understand can never be entirely at rest. This is the Faustian bargain that defines capitalist knowledge based societies, they are ordered but those orders are generated at the price of impermanence, they are never stationary and cannot be stationary because the institution of understanding of itself creates the most powerful of engines of change, the continued growth of personal knowledge and beliefs about economic action.

Consider the following examples of adaptive systems of understanding. The institutions of science and engineering provide one model of a knowledge system. Scientists and technologists share highly specialised understandings of particular phenomena and create these understandings by sharing information according to well-defined rules and dissemination practices, within the community of practitioners. Yet the continued growth of

knowledge can only depend on the motivation and thought processes of the individual scientists and technologists, and understanding provides the constraints and opportunities for the development of these private thought processes. This is why science and technology can grow as rapidly as they do, the relation between multiple sources of knowledge and the community sense of understanding is autocatalytic, knowledge feeds on knowledge in an irreversible way (Foster, 1993). What is private is made public with the further consequences for the development of that which is private; the generation of understanding coordinates and extends the division of knowledge labour to incredibly productive effect. The capitalist firm provides another model of a knowledge/understanding system that is unique in the way that it combines together quite different kinds of knowledge to practical effect; knowledge of science and technology, of the organisation of production, and of the nature of the market. Notice however that this is very different from claiming that a firm knows anything. Only the members of the firm can be said to know, while the firm can only act to the degree that its members can be said to possess a degree of highly correlated understanding. This is entirely in the spirit of Nelson and Winter's argument (1984) that the firm, like any organisation, is defined by a bundle of routines, which jointly embody and develop its understanding of purpose and practice. What the firm understands clearly depends on the way the members of that firm are organised but also on the internal efforts made by the firm to generate appropriate understandings. Finally, ideologies, as shared beliefs, are bodies of understandings in our sense and they are central to the operation of societies, providing senses of identity, social cohesion and social co-ordination.

A deep consequence of the adaptive system perspective on knowledge is the emphasis on the micro heterogeneity of what is known and the impossibility of any individual knowing all that is known. Specialised knowledge and its corollary more general private ignorance is built into the division of labour and to pretend otherwise is, as Hayek (1978) pointed out, to fall victim to the fatal conceit. Thus, the normal state of economic and social affairs is an outcome of our individually limited knowledge and collectively limited understanding, a reflection of our private and social struggle with ignorance. This is why the development of screening and winnowing arrangements to validate and make use of the knowledge of others is so important. Without these devices, we would not be able to generate understanding.

Systems characterised by micro heterogeneity are also systems that evolve through variation and selection, and they evolve in unpredictable ways under the influence of non-average behaviours. This is true of understandings in general and economic understandings in particular, and one reason for this is the experimental nature of the market process and the pervasive role of entrepreneurship. Capitalism is highly ordered in the way that market processes co-ordinate the relation between resources and needs but this surface sense of order and pattern conceals the turmoil and uncoordinated nature of the process of idiosyncratic knowledge creation and application. Markets provide the stable frameworks of reference within which innovations and new theories of business can be conjectured, tried and tested. Without this systemic order, the role of the entrepreneur would be severely curtailed. Moreover, entrepreneurs are agents of change they cannot exist in equilibrium, the rewards they earn depend on the economy being far from equilibrium, and the very notion of enterprise is tied to the introduction of novel behaviours. In the presence of the entrepreneur, prices can never be equilibrium prices for the entrepreneur is formulating plans from within the system to change those prices and to redistribute the relation between needs and resources. Prices are connected to order but order is not equilibrium. Clearly, any evolutionary, adaptive account of the knowledge economy must give the entrepreneur and enterprise a special place in its analysis. Indeed the notion of entrepreneurial behaviour is we believe an unavoidable component of any complexity-based adaptive approach to the economy.

We have suggested above that spread of understanding depends essentially on social processes, on their instituted form, and on the technology of communicating information. When patterns of interaction or the technologies of interaction change, so the processes for the generation of understanding also change. It further follows that understanding decays and may be lost if interaction is diminished, practice in social contexts is crucial to the replication and survival of understanding. Where this raises particular difficulties is in the maintenance of understanding across generations, Included in the notion of understanding we need to include the sharing of information what scholars have called cultural transmission. Here the development of physical technologies to complement social technologies has been of paramount importance, for one of the most important sequences of inventions ever has been that associated with the storage of information independent from the minds of individuals. The vast range of technologies following on from the printing press has been essential to the

cumulative development of understanding, as is made clear by the growth of scientific understanding.

Summary and Conclusions

In this short essay, the application of a complex adaptive framework to the economic and social domain has enabled us to confront the themes of private knowledge and the institution of social understanding. The approach that we have taken resonates in many areas with the Austrian views on the central importance of knowledge in market economies. These views, informed by a subjectivist perspective have characterised the emergence of Austrian scholarship on knowledge and ignorance, imagination and discovery. This we have argued needs to be augmented by the study of how social understanding emerges from private knowledge.

In quite similar manner to the Austrian we have taken as a starting point, the view that knowledge is idiosyncratic, that it is individual, that what we as individuals know depend on individual experiences that these are augmented by social processes that enable information exchanges. Understanding, the social shared reflection of knowledge, we have suggested evolves as a socially distributed process and its growth depends on institutions for sharing and common understanding. These are the institutions that make economic and social life possible; they facilitate the storage and communication of information, guide and reinforce patterns of interaction and embody the rules and standards of socially agreed belief.

Recognising that understanding is necessarily distributed leads to the insight that economic activity, which is necessarily social, depends not on shared knowledge but rather on shared understandings. This provides a clue as to the unpredictability and unevenness of knowledge accumulation, and of course the unpredictability of the capitalism as a knowledge driven system. In very much the same way that understanding is an open restless system, so too is capitalism – it is a dynamic, open-ended environment for generation and testing of business experiments. It is, in the perception of the market as an unfolding dynamic process that the Austrian literature has reflected principally on limited individual knowledge and to a lesser extent, on the collective limited understanding that reflects our struggles with ignorance. The institution of the market helps us to overcome this ignorance about economic possibilities. It allows for the combination and utilisation of diverse and fragmented knowledge embedded in

the minds of individuals, and it facilitates the discovery of knowledge as, during the market process, new facts are discovered by those alert to opportunity. Economic systems are necessarily restless, the clock can never be turned back (Foster, 1993) and these are features uniquely associated with the capitalist system of organisation. For capitalism is at its core a system for the decentralised generation of new knowledge and the co-ordination of the consequences of that knowledge in ordered patterns of understanding. What makes it so distinctive is the way that it has instituted the dynamic interplay of knowledge and understanding through a combination of physical and social technologies. The immense micro heterogeneity of the processes by which individual knowledge is generated are turned to social effect through the institution of understanding. At the heart of these processes are the evolutionary principles of variation and selection. Thus may it not be that in the final analysis the case for capitalism may rest upon its adaptive intellectual capabilities rather than any notion of its efficiency.

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