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HOW ENTREPRENEURS LEARN: A POPPERIAN APPROACH AND ITS LIMITATIONS

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NOTE: These lecture notes represent a summary of earlier work. For a much fuller, and more technical exposition, I refer the reader to works cited in the bibliography, especially Harper (1994, 1996).

HOW ENTREPRENEURS LEARN:

A POPPERIAN APPROACH AND ITS LIMITATIONS

1 INTRODUCTION

The purpose of this paper is to provide an overview of recent work applying Popper's theory of the growth of knowledge to entrepreneurship and market processes. This perspective takes as its starting point the fact that profit opportunities do not leap out of the business environment and tell entrepreneurs how to conceive them. Rather, these opportunities are personally created mental constructs. When the market changes or evidence is generated about the effects of past decisions, any learning that happens is not automatic or exogenously determined. It is instead a consequence of entrepreneurs choosing to test particular hypotheses in the market and to interpret the results according to the rules of their own learning methodologies. The Popperian approach sees entrepreneurship as a kind of scientific process of discovery and learning in which entrepreneurs form conjectures, select which ones to test and make judgments about revising them in the light of evidence from testing their plans in the market (Harper and Earl 1996: 306--7).

The development of a Popperian approach is warranted because there has not been sufficient constructive debate aimed at providing an alternative to Kirzner's theory of entrepreneurship -- though there have been plenty of critiques. Kirzner's is the most significant recent contribution to the theory of entrepreneurship. It represents an important advance upon mainstream neoclassical theory because it enhances our understanding of market processes rather than equilibrium states.

However, from the point of view of theories of the growth of knowledge, Kirzner's theory does not provide a complete account of the market process. First, there is a distinct lack of symmetry in Kirzner's treatment of entrepreneurship: only ex post successful entrepreneurship is considered and explained. His entrepreneurs do not face structural uncertainty, they do not make mistakes, they do not make losses, their business do not fail, they do not disrupt plans and their actions are rarely, if ever, disequilibrating.

Second, and following on from the first, Kirzner's conception of entrepreneurial knowledge is not truly dynamic. Once accepted as a basis for action, entrepreneurial conjectures are never refuted during the execution of

the entrepreneur's plan. An entrepreneur's knowledge of market data does not change as decisions are made in the course of exploiting a particular profit opportunity.

Third, Kirzner presumes that there is some intuitive and psychological learning process by which entrepreneurs can acquire true knowledge of market conditions. Alert entrepreneurs discover opportunities by simply "opening their eyes" and noticing facts ("\$20 bills lying on the ground") that had previously been overlooked by all other market participants. I consider this to be an inadequate explanation of how entrepreneurs acquire knowledge in a disequilibrium setting.

For these reasons, I think Popperian insights are important to injecting a more sophisticated approach to knowledge and learning in the theory of entrepreneurship. The Popperian approach is concerned with the rules that economic agents adopt in order to obtain knowledge required for decision-making. In contrast to Kirzner, it relaxes the assumption that entrepreneurs do not make mistakes and that they tend to be successful by definition. Indeed, it examines the nature, causes and effects of entrepreneurial error. Furthermore, it does not assume that there is a strict tendency towards coordination of economic activities in markets. It considers both disequilibrating and equilibrating changes that occur as a result of entrepreneurial activity.

1.1 Organisation of the paper

In the first section of this paper, I explain the distinguishing characteristics of the Popperian approach. I describe the overall goals of the project, the characteristics of a more sophisticated economic theory of entrepreneurial learning, and how Popper's theory of the growth of knowledge can help build an economic theory with these characteristics. I also indicate the range of applications of the new approach that have already been undertaken so far.

In the second section, I specify in some detail the hard-core assumptions and rules of the Popperian program. I am also explicit about the motivational and rationality assumptions that I make about entrepreneurs.

In Section 3, I analyse how entrepreneurs learn from their market experiences in real time. I want to unpack what exactly is involved in testing plans in the market. In particular, I investigate what happens when the real

world disappoints entrepreneurs by not conforming to their expectations, and the type of learning and plan revision that may follow from it. I examine the difficulties that entrepreneurs have in interpreting the results of testing their plans in the market and I look at the range of strategies that entrepreneurs can use for dealing with such situations. I then draw out the implications of this approach for the endogeneity of entrepreneurial learning processes.

In the final section I discuss the potential criticisms of applying Popper's conception of rationality to entrepreneurship and possible responses to such a critique.

1.2 Overall goal of the project

As already mentioned, the overall goal of this project is to provide a more sophisticated theory of how entrepreneurs learn. I consider that such a theory is important because it is:

- a prerequisite to any explanation of sequential entrepreneurial decision-making
- and thus a prerequisite to any theory of the endogenous dynamics of the market process.

I propose that a more sophisticated theory of entrepreneurial learning is likely to have several characteristics:

(a) it will emphasise that entrepreneurs' knowledge is always conjectural and tentative. Entrepreneurs can only ever have theories of what consumer preferences are, together with conjectures about what new uses for an input are possible and what new technologies might achieve.

(b) it will take full account of entrepreneurial errors, losses and failure, and not just treat them as a residual. This is especially important given empirical studies have suggested that most new innovative ideas do actually turn out to be mistakes. It is necessary to emphasise genuine uncertainty, the unpredictability of the future growth of knowledge, and the potential for discontinuity. It will also acknowledge the possibility that entrepreneurs can disrupt plans and be a disequilibrating force.

(c) it will depict individuals' knowledge as a dynamic and evolving system rather than a static or stationary structure. The theory should allow

knowledge to change as decisions are made in the course of exploiting profit opportunities. It should not conflate initial plans with the execution of plans.

(d) it will not just emphasise the imaginative and intuitive components of learning and entrepreneurship, but it will also stress the rational and critical aspects of enterprising activity. I am interested in how the entrepreneur must apply critical methods of error elimination in attempting to solve market problems at a profit.

(e) it should provide a broad conception of the scope of market processes and other learning processes. It should allow more than one type of economic change, not just equilibration in response to exogenous disturbances. Thus, it must seek to explain and hence endogenise disequilibrating economic changes - including changes in technology, resources and tastes. It should not treat forces that create disequilibrium as necessarily exogenous to the market system and, therefore, as by definition outside the scope of economic analysis.

(f) it should make novel predictions about entrepreneurship and market processes which are capable of being tested empirically.

1.3 Why Popper's theory of the growth of knowledge?

Brian Loasby, Peter Earl, James Wible and Lawrence Boland have argued for some time that philosophical theories of the growth of knowledge can provide significant insights into how markets operate and how people learn from their experiences within the market. It is suggested that by extending the scope of these theories, science can be taken as a generalised model of sophisticated decision-making in structurally uncertain and complex problem situations.

My approach therefore draws upon the abundant literature in the philosophy of science - in particular, Popper's, and to a lesser extent Lakatos's, theories of the growth of knowledge.

Popper's theory is an appropriate starting point since it exhibits many of the desirable characteristics of a theory of learning described earlier. It is the first non-justificationist philosophy in the history of the philosophy of science. It is non-justificationist in that it divorces knowledge from certainty, proof, and hard facts. According to Popper, all knowledge is tentative and conjectural.

These conjectures can never be positively justified or proven true. Theories are simply genuine conjectures - highly informative guesses about the world. Popper elaborates a fallibilistic theory of knowledge - according to which all learning is depicted as a process of trial and error.

Finally, Popper vindicates problems of the growth of knowledge. He employs a dynamic evolutionary conception of knowledge rather than a structural concept. Problems connected with the growth of knowledge are the most central problems of his epistemology. Popper sees all learning as a sequence of continuous conjecture and refutation.

My approach involves the direct application of Popper's theory. It does not simply rely upon a metaphor. The relationship between scientific and market processes is not just that of analogy because the growth of knowledge is the subject of both.

1.4 Range of applications of the Popperian approach

The overall project investigates entrepreneurship and market processes within a Popperian framework. To date, there have been four main applications of Popperian insights:

(a) a theory of entrepreneurial learning -- how entrepreneurs improve their knowledge in a disequilibrium setting. This theory examines the nature, causes and effects of entrepreneurial errors.

(b) a model of venture capitalist decision-making -- the screening of entrepreneurial ideas by venture capitalists and other transactors in the market process. Indeed, the process of interpersonal criticism within the external venture capital market may be the paragon of critical rationalism in the context of the growth of market knowledge.

(c) a theory of entrepreneurial firms. Such an approach introduces a theory of learning into the theory of the firm. It provides an explanation of the growth of firms and the long-run evolution of business strategy and structure.

(d) a preliminary framework for analysing market processes. The Popperian approach has implications for: how the market process operates, how it is organised, the criteria by which it screens new ideas, the origins and

continuity of this process, and its comparative performance in generating and testing new entrepreneurial conjectures.

Table 1: Range of applications of the Popperian approach

Application	Source
Theory of entrepreneurial learning	Choi (1993), Harper (1994, 1996); Loasby (1986)
Theory of entrepreneurial firms	Earl (1984: Ch.5; 1992); Harper (1996); Harper and Earl (1996); Loasby (1971, 1976, 1983)
A model of venture capitalist decision-making	Harper (1992: Chs 10 and 11)
Theory of the market process	Harper (1996: Ch.9)

As yet, there are no applications of the Popperian approach to public policy issues related to entrepreneurship and market processes.

The scope of this paper is limited to considering the first of these applications: the question of how entrepreneurs learn.

2 THE SPECIFICATION OF THE POPPERIAN APPROACH

Before considering the subject of entrepreneurial learning, I need to explain in more detail what the Popperian approach involves.

In this section, I specify what I call the “growth of knowledge (GK)” research program. We can also refer to it as the non-justificationist program or the Popperian approach, and I will use these terms interchangeably. This program can be regarded as a set of assumptions and rules that we are going to use for thinking about entrepreneurship and market processes. Following Lakatos, these descriptive assumptions and normative rules are called hard-core propositions and positive heuristics, respectively.

2.1 The hard core of the Popperian program

The hard core describes the most basic assumptions upon which the new approach is built. The key hard-core assumption states that learning is a logical process rather than an internal psychological or sociopsychological process (**H6**). In so far as they embody rational decision-making, entrepreneurs reason correctly when reaching conclusions by connected thought. Learning from market experiences, and especially the experience of error, involves deductive reasoning. In testing plans in the market, economic agents need logical rules for rationally rejecting the particular conjectures and assumptions on which their disappointed plans were based. The approach thus assumes that there is no difference of kind between the methods of science and the methods of hypothesis-selection in everyday life.

2.2 The positive heuristic

As well as the descriptive hard core, the Popperian program has a normative set of rules for doing economics. The program attempts to pursue the principles of methodological individualism more aggressively by prescribing a more detailed and individualistic treatment of economic agents' knowledge and learning. It seeks to build methodology into the content of theories of economic processes in order to explain how economic agents acquire the knowledge required to make decisions. The most important heuristic recommends explicitly ascribing Popperian theories of learning to the economic agents in economic theories (**PH1**).

Table 2: The hard core of the Popperian program

Hard-core assumption	Description
HC1	Only individual economic agents have aims, conjectures and preferences, and only individuals can make decisions.
HC2	Economic agents face objective problem situations, and an objective reality exists which is independent of their conjectures and preferences.
HC3	There is no infallible method by which economic agents can acquire true knowledge. The knowledge of economic agents is essentially theoretical and conjectural, and their knowledge of the objective situation is very often false. Consequently, all economic agents are fallible (i.e. prone to error).
HC4	Economic agents form their tentative solutions (i.e. conjectures) to problems in a world of structural uncertainty, complexity, and real time.
HC5	The conjectures of economic agents are potentially objective (i.e. they can become conscious and can be articulated), and they can potentially be exposed to interpersonal criticism.
HC6	Learning is a <i>logical and scientific process</i> rather than an internal psychological or socio-psychological process. There is no fundamental difference of kind between the methods of science and the methods of hypothesis selection in everyday life. Like scientists, economic agents use deductive logic in the evaluation of their hypotheses.
HC7	Although economic agents do not possess proven true knowledge, they can still make rational decisions. Rational decision-making involves evaluating rival schemes of action in the light of logic <i>and</i> experience.
HC8	Entrepreneurship is characterised by "multiple-exit" problem situations.

Table 3: The positive heuristic of the Popperian program

Positive heuristic	Description
PH1	Explicitly ascribe Popperian theories of learning to the economic agents in economic theories.
PH2	In any explanation of economic phenomena (especially dynamic economic processes), progressively upgrade those aspects which pertain to the growth of knowledge and the theories of learning with which economic agents approach their problem situations. In particular, try to reduce as much as possible the inductivist and justificationist elements in agents' learning methodologies and theories of knowledge.
PH3	Only construct theories and models which are consistent with the principles of methodological individualism.
PH4	Construct models in which only rational decision-making plays a part in the explanation.
PH5	Construct dynamic models which explicitly recognise the relationship between real time and knowledge. That is, construct models employing a dynamic conception of economic agents' knowledge, according to which the acquisition of knowledge (i.e. learning) is a real-time and irreversible process. Develop models which treat economic agents' knowledge and learning processes as endogenous rather than as exogenously fixed or exogenously variable.
PH6	Construct multiple-exit decision models.

2.3 The aim structure of entrepreneurs, and the theories they hold

The Popperian theory assumes that entrepreneurs aim to predict, to explain and to control economic and market events in the pursuit of economic gain.

In order to fulfil their basic aims of explaining the world in which they operate and of effecting changes within it, entrepreneurs need to construct theories. It is suggested that in developing entrepreneurial ideas for new business ventures, entrepreneurs put together three main types of empirical theories:

- theories of latent demand: this involves conjectures about the most urgent of the as yet unsolved problems of consumers and conjectures about the new bundles of product characteristics that will satisfy these latent demands. It also includes conjectures about the price-quantity-quality configurations by which target consumers will be willing to buy the entrepreneur's new product over a period of time.
- theories of production: it contains conjectures about the technological possibilities of combining given inputs into novel products or of obtaining given product concepts from novel combinations of inputs.
- theories of governance: this involves conjectures about the critical dimensions with respect to which economic transactions differ and hypotheses about the most efficient and flexible ways of organising certain types of transactions.

3 APPLICATION: HOW ENTREPRENEURS CHANGE THEIR KNOWLEDGE AND PLANS

This section is concerned with explaining how individuals -- especially entrepreneurs -- learn from their experiences within the market. To explain how entrepreneurs learn, I highlight the role of an entrepreneur's learning methodology as a device for handling and responding to change. The entrepreneur's methodology determines how fast he or she identifies significant errors, responds to them and learns from them over time. In short, an entrepreneur's methodology is the "technology" by which counterexamples to his or her ideas are processed into changes in the entrepreneur's conjectures and plans.

I focus upon entrepreneurs who learn from their mistakes and the refutation of their ideas. These "Popperian" entrepreneurs, as I call them, artificially make the growth of their knowledge more intensive by consciously adopting

an overtly critical and systematic approach to problem-solving. Like scientists, these entrepreneurs carry out piecemeal experiments as a way of acquiring knowledge by comparing the results observed with the results expected.

They acknowledge the tentative and conjectural nature of all knowledge, including their own, and recognise that many entrepreneurial forays into the unknown turn out to be mistakes in their original form. They emphasise that since they can learn from their mistakes, it is desirable to discover their mistakes as fast as possible (e.g. because new product development costs rise exponentially). Consequently, they conduct severe tests in order to expose their conjectures to refutation.

More technically, we can say that to assist their own learning, Popperian entrepreneurs adopt:

- the falsifiability principle, which offers broad policy direction for the selection of ideas
- and a set of methodological rules which they use in testing those ideas.

3.1 The falsifiability principle

An entrepreneur's theory is falsifiable in principle if there exists some imaginable market event, or set of events, which is inconsistent with the theory, that is, which if it were in fact to occur, would falsify the conjecture.

For example, consider the following hypothesis:

T_1 : all male consumers will respond favourably (in terms of attention, interest, and arousal) to the advertising copy for our innovative health insurance package;

T_1 is falsifiable. A priori, there are opportunities for T_1 to clash with conceivable market events. There are conceivable market events which could contradict T_1 : e.g. some male consumers do not respond favourably to the advertising copy. There is a chance for T_1 to be refuted by experience. It can be subjected to severe testing.

The basic thrust behind the falsifiability principle is that entrepreneurs must attempt to specify in advance under what conditions they will regard their

theories as refuted. The entrepreneur should specify those falsifying conditions as exactly as possible in order to avoid ad hoc post-experimental adjustments (something like this is evident in techniques of market segmentation and market targeting).

The falsifiability principle is simply a way of enhancing the quality of negative feedback from testing plans. It increases the speed of learning from experience. Entrepreneurs prefer those ideas which have a higher degree of falsifiability because they convey more empirical information. The more falsifiable a theory is, the more it asserts about the market because it rules out more market events that could conceivably happen.

3.2 Methodological rules

Popperian entrepreneurs adopt methodological rules which ensure the falsifiability of their ideas. They make the decision to adopt these rules in order to promote the growth of their knowledge. The basic tenet of these rules is that entrepreneurs should not systematically evade refutation by continually reformulating either their ideas or the evidence in order to avoid a conflict between them.

Thus, Popperian entrepreneurs avoid dogmatic strategies for immunising their own ideas against refutation. In particular, they avoid:

- introducing ad hoc solutions or hypotheses (e.g. substantial decline in market growth dismissed as normal seasonal fluctuation)
- always adopting a sceptical attitude to the reliability of the experiment or experimenter (e.g. market research firm).

These dogmatic tactics must be avoided because they serve to reduce the informative content of the entrepreneurs' ideas and so diminish the scope of what the entrepreneur can say about the world.

3.3 Difficulties in interpreting the results of testing plans in the market

In no way is it assumed that the testing of plans is a simple or mechanical affair. Indeed, I investigate the difficulties which economic agents encounter in interpreting market evidence, in pinpointing the source or cause of specific

plan failure, in deciding whether their plans have been effectively refuted and in determining whether to abandon a particular course of action.

The Duhem-Quine irrefutability thesis emerges as the most important and comprehensive problem in this regard. The thesis argues that a single hypothesis can never be falsified conclusively because it is necessary to test the hypothesis in combination with additional premises.

Expressed symbolically, an entrepreneur faces the following situation whenever his or her plans cannot be carried out in the market without disappointment:

$$[(T \bullet A \textcircled{R} P) \bullet (\sim P)] \textcircled{R} \sim(T \bullet A)$$

where T is the specific idea which the entrepreneur is testing, A is the entrepreneur's set of background assumptions and $T \bullet A$ is their conjunction, P is the entrepreneur's prediction (e.g. about the existence of a profit opportunity), and the symbols \textcircled{R} , \bullet and \sim mean "imply", "conjoined with" and "not", respectively.

For example, suppose that an entrepreneur wishes to test a hunch (T) about the market:

T There is a LATENT DEMAND for at least 1000 units per week of a new PC business simulation game (Profitania) at a unit price of \$ 45.00 within Northeastern USA during the summer months of 1999.

In order to undertake a market test of this idea, the entrepreneur must specify an elaborate "experimental hook up" which consists of a hierarchy of auxiliary assumptions ($A_1 \dots A_m$; $C_1 \dots C_n$), which include such things as:

- A_1 Linking to a Virtual Pet Cemetery Website is an effective promotional and distributional channel for this market experiment
- A_2 The particular advertising copy on the Website is appropriate (in terms of visual appearance, accessibility and readability) for the successful test marketing of this new business simulation game

- A_3 LavaMind's online Website store which accepts major credit cards is an effective method for enabling consumers to place their orders.
- A_4 Timing: A test market conducted during the first week of July is a representative test.

From the target hypothesis T and these and other auxiliary assumptions ($A_1, \dots, A_m, C_1, \dots, C_n$), the entrepreneur derives the testable prediction, P , that she can sell over 1000 items of the new product at a price of \$ 45 during the first week of July in Northeastern USA during 1999:

Major premise: If T (and $A_1, \dots, A_m, C_1, \dots, C_n$) are true, then P is true;

Minor premise: T (and $A_1, \dots, A_m, C_1, \dots, C_n$) are true;

Conclusion: therefore P is true.

Should the entrepreneur's cluster of hypotheses be refuted by testing in the market, the question arises as to what exactly is deemed to be refuted by that particular market test: the entrepreneur's target conjecture and/or one or more of the auxiliary conditions?

There is nothing to prevent the entrepreneur from sticking to her target hypothesis (T) and arguing that the latent demand for the new product does indeed exist but that poor sales resulted because one of the cooperating assumptions was false: namely, the distribution channel used was inappropriate, or the advertising copy was inappropriate, or the information system was not working as expected. (The entrepreneur could also invoke a number of other immunising stratagems.) Furthermore, the disappointing test results may be due to any conjunction of these factors.

3.4 Possible strategies entrepreneurs can use to respond to apparent refutations and the Duhem-Quine problem

People cope in different ways with the apparent failure of their plans and the DQ problem. Possible strategies entrepreneurs can adopt range from minor tinkering of their theories to devising altogether new sets of conjectures which replace their original assumptions and ideas:

(i) challenge the original derivation of his or her prediction (e.g. P: "There is a profit opportunity in the space-time region k") by showing that P does not in fact follow logically from the conjunction of his or her target hypothesis (T) and the auxiliary assumptions (A);

(ii) only modify his or her theory (T) by minor changes;

(iii) reject T (i.e. dramatically revise his or her basic theory) and keep the set of supplementary hypotheses (A);

(iv) stick to the theory (T) and reject one or more of the cooperating hypotheses (A);

(v) reject his or her entire set of conjectures (i.e. both the specific theory T and the supplementary hypotheses A) and devise an altogether new set (T'•A');

(vi) try to identify any parts of his or her set of conjectures which are independent of the failed plan (and hence which are not involved in the refutation of that plan by market testing), thereby reducing the scope of the DQ problem.

It is argued that the scope and order of responses that people are willing to try will depend upon their particular methodology.

Entrepreneurs who subscribe to conventionalist methodology prefer uncritical, conservative responses to apparent refutations and the DQ problem. They will only try the least drastic, ad hoc solutions and will never consider more extensive alterations to their plans even after earlier revisions have failed. Consequently, conventionalist entrepreneurs make minor ad hoc adjustments to their sets of conjectures, for example, by attributing the responsibility for their failed plans to one or more of the supplementary hypotheses that they made in order to test those very plans in the market (strategy iv above).

In contrast, Popperian entrepreneurs consider that strategy iv must not be pursued each time that a plan fails a market test. They will tend to revise their basic theories or will try to devise entirely new conjectural frameworks when they experience repeated disappointment in the market (strategies iii and v, respectively). However, these entrepreneurs are most unlikely to develop a completely new set of first principles every time their plans are

frustrated, because if they were to do so, they would never be able to see a venture through to completion and would be forever returning to the drawing board. Thus, falsificationist entrepreneurs generally aim to scrutinise and to retest their stocks of background knowledge in a more or less piecemeal fashion.

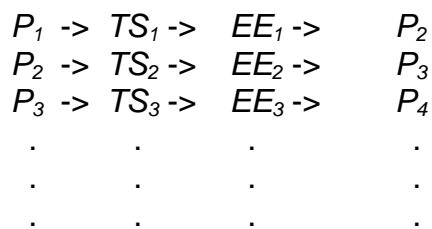
3.5 The endogeneity of entrepreneurs' learning processes

The Popperian approach results in an evolutionary conception of the entrepreneur's learning process, which emphasises its endogenous nature. According to this model, the entrepreneur's learning process consists in going from problems to deeper problems and subproblems. Entrepreneurial activity begins and ends with problems. Because the entrepreneur's problems are ill-structured, the entrepreneur's task does not begin with the attempt to solve a problem, but rather the attempt to define the problem and to account for why it is a problem. As in scientific discovery, the generation of new hypotheses is "problemistic": the entrepreneur has a particular problem to solve and that problem galvanises the entrepreneur into creating potential solutions.

A falsification of an idea implies that the entrepreneur should develop a better trial solution because his or her conjecture or plan in its present form cannot solve all its problems: "For to regard a theory [say, TS_i] as falsified is to be aware of a problem [P_{i+1}] whose solution will require some sort of theoretical innovation [TS_{i+1}]" (Musgrave 1971: 33; parentheses added).

And even when succeeding in solving any particular market problem, the entrepreneur discovers new problems so that his or her learning process is conceivably without end.

Diagram 1
The endogenous process of learning



$$P_n \rightarrow TS_n \rightarrow EE_n \rightarrow P_{n+1}$$

A simple reconstruction of a real-world example may help illustrate the point:

P_1 : to obtain resources to produce a new magazine

TS_1 : business plan: budget for the purchase of a large piece of capital equipment

EE_1 : refuted by testing in the capital market because of unacceptable financial structure

P_2 : to devise a plan with an acceptable financial structure so as to obtain finance from a bank

TS_2 : revised plan: budget for the lease of the equipment at conventional rates.

The diagram provides some insights into the continuity of the market process. It shows that an entrepreneur's learning process is both ongoing and non-determinate and that it is pervaded by endogenous changes. Given that the market process is generated by the interaction in the market of individual decision-makers as they learn from their new experiences and revise their plans, it follows that the market process too is made up of a series of endogenous changes taking place over time.

We can generalise this evolutionary model of learning to explain how the market process can be perpetuated by purely endogenous forces. Unexpected new problems and opportunities may emerge as the often unintended byproducts of entrepreneurial solutions to previous market problems. Thus, disequilibrium is something endogenous to the operation of the market process itself; it is endogenously-created change.

The Popperian model does not treat changes in tastes, technology and resources as necessarily exogenous to the market system. For example, in trying to formulate profitable solutions to perceived market problems, entrepreneurs may develop new technologies and discover new uses for inputs.

4 LIMITATIONS OF THE POPPERIAN APPROACH

As mentioned earlier, a key hard-core assumption of the Popperian program is that there is no difference of kind between the methods of science and those of practical decision-making in everyday life. Science is merely a highly sophisticated case of human problem-solving activity. The Popperian program assumes that the method of trial and error-elimination (i.e. the method of conjecture and refutation) is fundamentally the method both of science and of decision-making in other fields of human activity, including entrepreneurship.

This is not an uncontroversial assumption. Several authors (e.g. Salanti 1987) make a deep and sharp separation between scientific and practical rationality, and they criticise proposals to portray economic agents as Popperian decision-makers.

In the following discussion, I summarise their philosophical and empirical criticisms. I also provide a Popperian defence of the application of Popper's conception of rationality to entrepreneurship. I argue that many of the criticisms spring either from:

- a false conception of the goals of economic agents
- a false, justificationist conception of science
- a misunderstanding of the experimental methods in the natural sciences (especially physics).

(a) The epistemic aims and methods of science differ from those of individual economic agents

According to this argument, entrepreneurs aim for predictive success and success in their practical actions. They pursue profit. Unlike scientists, entrepreneurs are not at all concerned with the pursuit of truth because successful action does not require true knowledge. In the short-run, an entrepreneur's theories do not need to be true to be profitable. The pursuit of truth and the pursuit of profit may even conflict. Thus, because the practical aims of entrepreneurs differ from the theoretical aims of science, their corresponding methods must differ.

A response to this argument is that it is incorrect to propose that innovative entrepreneurs are only concerned with short-run predictive success. Entrepreneurs are hard-nosed realists who aim to make sense of the world. If entrepreneurs aim to create a new market for a new product, they may expect to be able to achieve their goal more effectively, the better they understand market needs, the nature of existing obstacles to trade, and the operation and relations between existing markets (though success is never assured and can be achieved in other ways).

Indeed, entrepreneurs undertake specific actions with the express aim of augmenting their knowledge of markets and technologies. Entrepreneurs frequently test the plausibility of their market assumptions by obtaining in-depth customer reaction during the new product development process. Venture capitalists also examine the realism of the entrepreneur's assumptions in the business plan.

(b) Scientific knowledge is different in kind from the practical knowledge of economic agents

This demarcation is most prominent in the work of Hayek and to a lesser extent in that of Lachmann and of O'Driscoll and Rizzo.

The Hayek-Lachmann demarcation between scientific and practical knowledge can be summarised as follows. Scientific knowledge is proven true, inherently static and objective. It is theoretical and comprises only general rules (i.e. universal laws and hypotheses). It relates to the typical and permanent features of the world. In contrast, practical knowledge is potentially false and may quickly become out of date. As well as being tacit, it is also nontheoretical (comprising as it does information about particular facts). And it pertains only to specific transient and local conditions (i.e. it comprises empirical knowledge of the particular circumstances of time and place).

A major problem with the Hayek-Lachmann distinction is that it is based upon a false, justificationist theory of knowledge which equates scientific knowledge with proven truth. Scientific theories cannot be distinguished as different in kind from practical knowledge because they are provable. Knowledge - whether practical or scientific - cannot be proven true, even if it is true. Like practical knowledge, scientific knowledge can also be false. Far from being static, established scientific knowledge can be overthrown and replaced by better scientific theories. There is competition between scientific theories just as there is

competition between dispersed bits of market knowledge; the Darwinian struggle for survival is common to both domains.

In addition, all practical knowledge (including empirical knowledge of profit opportunities) is essentially theoretical and hence conjectural. Entrepreneurs have to select which "bits of information" are relevant to the discovery of profit opportunities. The selection of these "facts" implies a point of view on the part of the entrepreneur, and that point of view is itself a theory.

Furthermore, scientific knowledge is not restricted to universal laws as construed by Hayek. Popper explicitly denies that only universal statements of laws belong to science. Indeed, given his criterion of testability for demarcating science, he acknowledges that singular statements can belong to science, provided they are testable, and all singular test statements do (Popper 1974: 988).

(c) The variability of economic conditions precludes experimentation under precisely controlled laboratory conditions as in science

Related to the Hayek-Lachmann distinction is the variability argument. The argument is that the variability of economic conditions makes it impossible for economic agents to apply the experimental method in a useful way. Experimentation "only applies... to systems which are stable, repeatable, and divisible, such as chemical systems...We cannot do experiments on unique events, and we cannot experiment on the past" (Boulding 1981:10). The one-way traffic of human history does not allow us to repeat market experiments under precisely controlled conditions. Hence, entrepreneurs are seldom (if ever) able to test their hypotheses by carrying out experiments.

Popper (1960: 86, Section 25) considers that the variability argument is invalid. It is based upon a mistaken view of the experimental methods of the physical sciences. Two physical experiments, which first appear to be conducted under precisely similar conditions, may give rise to very different results (e.g. as is the case with the production of high-temperature superconductors, and the boiling of water at different altitudes).

Like economic agents, physicists are also sometimes very limited in their ability to vary at will experimental conditions, especially if these require different gravitational fields or extreme temperatures (Popper 1960: 97). In many cases in experimental physics, it is very difficult to identify the factors

specific to each experiment which lead to differing results. The method of piecemeal experimentation must be applied to determine the kind and degree of similarity between conditions which are required for experimental reproducibility (Popper 1960: 94).

Thus, according to Popper, there is no fundamental difference between the pre-scientific experiments of economic agents and the experimental approaches of scientists because piecemeal experiments are fundamental to both approaches. Differences in experimental conditions are differences of degree rather than of kind (cf. Popper 1960: 85-87, 97).

(d) The Popperian conception of rationality contradicts the best-corroborated theories in empirical psychology

Studies in cognitive psychology suggest that much of the time people do not reason in accordance with the rules of logic (e.g. Anderson 1980; Johnson-Laird 1983, 1993). Empirical studies have found that many scientific researchers do not even employ falsificationist strategies for a variety of inference tasks (e.g. Mulkey and Gilbert 1981; Kern, Mirels and Hinshaw 1983). Thus, if scientists do not have the wits to apply falsificationist strategies, how can economic agents be expected to?

Several lines of argument could be advanced in response to this empirical attack. First, a Popperian approach to entrepreneurship requires only that a small minority of economic transactors be as sophisticated and open-minded in their decision-making as Popperian-like scientists. In particular, entrepreneurs may experience fewer cognitive boundaries for a specific complex problem than other market participants.

Second, the Popperian approach focuses upon rational economic decision-making and not on rational economic decision-makers (cf. Boland 1982, p.177). The Popperian approach seeks only to provide a purely logical skeleton of how entrepreneurs learn, not a description of the thought processes by which flesh-and-blood entrepreneurs actually acquire knowledge. It is a psychologistic error to propose that the rules of logic characterise actual cognitive processes. Interpreted in this manner, economic decision-makers may in general only approach the Popperian ideal of rational action. An ideal of rational action influences entrepreneurial behaviour without rendering those entrepreneurs who subscribe to it ideal.

Third, doubt is expressed regarding the appeal to empirical psychology as the metacriterion by which to judge competing theories of how entrepreneurs learn. Popper's principle of transference claims that logical matters may be shifted to psychological concerns but not vice versa. Boland applies this principle to develop a case against a psychologistic view of rationality: "Psychologistic rationality cannot be more than what is provided by logical arguments. Thus, any discussion of rational decision-making need not involve psychology" (Boland 1982: 38-39). Furthermore, cognitive psychology is not as yet "explanatorily adequate" to serve as a metacriterion for evaluating theories of learning (Weimer 1974).

(e) The Popperian approach neglects important extralogical forces (especially culture) which affect market processes

According to this argument, the acquisition of knowledge in an interpersonal setting is a discursive process, proceeding by reorganisations, ruptures and mutations in a disjointed manner. All learning is inseparable from its cultural frame. The ideological values of people and the language through which these values pass permeate people's consciousness, affecting their perceptions and learning activity. The Popperian approach fails to explain how entrepreneurs' learning is affected by culture, ideology and language.

In my view, it is indeed true that the Popperian approach does not encompass sociological, cultural-anthropological or political aspects of entrepreneurship. The Popperian approach develops a largely logical perspective on entrepreneurial learning. It focuses upon the logical, methodological and epistemological aspects of entrepreneurial activity. It does not profess to provide an interdisciplinary account of entrepreneurship and the market process. It investigates the latent structure of rationality behind entrepreneurs' problem-solving efforts in markets.

(f) The Popperian theory of entrepreneurship is not empirically testable or falsifiable and hence it is not even scientific in a Popperian sense

The potential criticism is that the Popperian theory of entrepreneurship is not scientific because it is not operationalised in a sufficiently falsifiable way, because it cannot be applied in practical analyses of observed economic behaviour, and/or because it is concerned with entrepreneurs' learning methodologies which are themselves not observable.

I believe that the Popperian theory of entrepreneurship is indeed testable (in any case, more so that at least two of its rivals -- the theories of Kirzner and Casson). Harper (1996: Ch.10) describes a particular empirical test of this theory. In particular, I specify a possible test of the prediction that Popperian entrepreneurs perform significantly better than entrepreneurs who adhere to other learning methodologies. As part of this empirical test, I propose a new technique for determining the learning methodologies of individual entrepreneurs which at the same time reduces the need for economic researchers to make external rationalisations of observed entrepreneurial behaviour. Once the learning methodologies of a sample of entrepreneurs have been identified, it would be possible to conduct statistical tests of the theory's predictions which posit a relationship between entrepreneurial performance and entrepreneurial learning methodologies.

5 CONCLUSION

This paper has sought to present the outlines of a new Popperian approach to entrepreneurship. By formally building in explicit conjectures about entrepreneurs' learning methodologies and knowledge, the new approach can lay the groundwork for explaining endogenous learning and the endogenous dynamics of the market process. It can provide a way of explaining the changes over time in economic agents' knowledge, expectations and plans which form the basis of the competitive market process.

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