Natural Selection and Economics

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Since Alchian’s famous article of 1950, natural selection has often been invoked to justify, on different grounds, the conclusions of neo-classical economics. Since not all selection is of a “Darwinian” type, however, it is important clearly to distinguish between arguments invoking natural selection strictly speaking from arguments – like those of Alchian and Friedman – which are more closely related, in some ways, to a Lamarckian approach. While this latter approach is compatible with traditional microeconomics, a line of argument based solely on natural selection is not, which means that economists wishing to account for an economic equilibrium must choose between an explanation supposedly based on natural selection and one that is based on some form of rationality.

Since Alchian’s 1950 famous paper [Alchian, 1950, see also Enke 1951], many economists tend to consider that they benefit from a powerful line of defense against the objections periodically raised against the traditional neoclassical theory of the firm. Profit maximizing behavior remains the preferred hypothesis for most economists, but if anyone denies that it is realistic to assume that entrepreneurs behave in such a rational fashion, it is always possible to answer that however they behave, the surviving entrepreneurs will actually be quasi maximizers since those who had taken decisions too far removed from those who had generated a sufficient level of profit would have gone bankrupt. Thus those firms actually observed on a market tend willy nilly to behave as described by neoclassical theory. Various objections have been raised against this type of argument [see especially Penrose, 1953 and Winter, 1964], but here, I would like to restrict my discussion to the question of the specificity of this so-called “survival”, “natural selection” or “Darwinian” approach and to the question of compatibility between the traditional profit maximizing argument and an argument really based on natural selection.

For most of those who refer to this survival argument, it seems self-evident that they do not have to choose between it and the traditional one. This is so much so that, in his seminal paper of 1953, Friedman, while maintaining that the realism of assumptions do not really matter if these assumptions are helpful in producing testable predictions, refers directly to Alchian’s argument to suggest that any attack against profit maximizing assumptions would not cause serious damage to economic theory, since a “survival” type of analysis looks superior (because more general) even to a traditional maximizing one [Friedman, 1953, p. 19-20]. Thus — at least, this is what this way of arguing suggests — two protections are better than one: if any objection is raised against the realism of profit maximizing assumptions, an economist can invoke the survival argument. Then, if this is not enough, he or she might argue that insofar as valid predictions can be derived from assumptions, the realistic or unrealistic character of these assumptions do not really matter.

But let us push aside this Friedmanian instrumentalist defense to concentrate on the one that is based on the “survival” argument. How could we compare an explanation based on “natural selection” with the traditional explanation, associated with profit maximizing, which is based on “intentionality” and “rationality”? To give an appropriate answer to this question, let us consider first which phenomenon is explained in both cases and to characterize this phenomenon, let us admit that, to avoid bankruptcy, entrepreneurs must choose among a very large number of possible sequences of successive decisions about investing or disinvesting, increasing or reducing the level of production, hiring and firing, setting prices, buying raw materials, etc. Like players in a game with a lot of moves, they have to manage to make the better
move each round. Clearly, if all the decisions were to be taken at random, the prospect of bankruptcy would be very high in such a game. But suppose that it is clear for everybody that most entrepreneurs actually manage to get a much better record than what would be expected to result from purely random decisions. Then, one has to explain this fact which, by hypothesis, is highly improbable if all decisions were randomly taken.

Thus, the phenomenon to be explained by the neoclassical theory of the firm is the fact that, even though sequences of decisions that would quickly place their businesses in trouble seem statistically much more probable than sequences of decisions which tend to reach economically meaningful results, most entrepreneurs in an actual market seem to produce in a relatively efficient fashion. If one prefers, the phenomenon to be explained is the fact that free economies seem to be much more efficient than chaotic.

An intentional explanation of this phenomenon would say that entrepreneurs, far from taking their decisions at random, desire to reach the most satisfactory economic position and use their knowledge and their natural skill to choose one of the sequences of decisions that can bring them close to the desired position (note that this may involve no more than practical knowledge and not necessarily a knowledge of economic theory). However, since the economic game is competitive, it follows that this course of action does not imply any guarantee of success for all of them. In this sense, such an economic game would result in the “selection” of some entrepreneurs since others will go bankrupt. Thus a typical intentional explanation leaves room for a kind of selection which is indissociably linked with the very idea of competition. But the point is that this selection has very little to do with natural selection. Rather, it is just a part of the mechanism through which unintended consequences play a determinant role in intentional explanations provided by traditional economics.

To have a better view of the different types of selection involved in different types of explanation, let us first consider the following situation. Suppose that a group of candidates interested in a few job openings at a prestigious university are submitted to a very sophisticated test by the Hiring Board of this university. Let us also assume that most of them turn out to get a very high score in this test, but that only the very few with the best results are chosen. Suppose that an external observer arrives at this stage in the process and observes that the very few elected by the University Hiring Board performs intellectually in a fashion that is far superior to what could be expected from an average person. It would be rather odd if, in seeking to explain this remarkable situation, the observer were to conclude that this explanation is based on “natural selection” merely from the fact that the proper explanation refers to some kind of selection. It would be odd, indeed, to claim that a genius similar to Darwin’s was required to explain this “remarkable situation”. In such a case, the explanation that has to be offered to our external observer is rather a straightforward intentional explanation, and this at a double level, at a global and at an individual level. At the global level, there was indeed selection, but this selection, far from being a “natural” one, was clearly an intentional one: the Hiring Board had intentionally chosen those who ranked the best and eliminated those whose score was less remarkable. And at the individual level, it was no surprise that the candidates constituted a pool of high scorers among which the Hiring Board could choose. Indeed, each of them wanted the job, and therefore each wanted a high score; with the help of knowledge resulting from proper intellectual preparation, each managed as far as possible to choose the proper answer for each question on the test. While this explanation implies a kind of selection at some point, it is very far from being based on a “natural selection” type of argument. If one finds it useful to connect this argument with one of those which have been used to explain the biological evolution of species, the most appropriate candidate would be a creationist argument. For only in this type of explanation is the selection intentionally carried out at the global level, in this case by God who chooses among all the possible species those that are the most fit to survive.

But let us come back now to our neoclassical economic explanation of the relative efficiency of a free economy. The crucial difference with the Hiring Board case or with the creationist explanation is that, in the case of the economic explanation, the selection involved by the competition is not done at a global level by the intentional decision of any Board or of any God. However, at an individual level, intentional decisions continue to play an essential role. An entrepreneur decides to increase his acreage of wheat because he feels that more profit could result from such a decision than from the decision to invest otherwise or to refrain from investing. But this entrepreneur is just a player among many others in a competitive game and this fact implies that success is not warranted for anyone. Since Adam Smith, economists managed to explain,
in a more and more sophisticated way, the fact that the multiple decisions of all entrepreneurs, limited in scope as they are, produced a result permitting the whole society to work and to progress just as if an “Invisible Hand” were operating at the global level. I am not at present interested in the content of this classical argument but in its form. The essential character of an “invisible hand explanation” is that intentional behaviors are interconnected in such a way that an unintended global result is obtained, but it is obtained insofar as intentional goal-oriented actions are carried on at the individual level. The standard example of such an “invisible hand explanation” of economic phenomena is nothing but the traditional “profit maximizing” type of explanation referred to above. Entrepreneurs desire to reach the most satisfactory economic position and use their minds to choose a sequence of decisions intended to bring them close to the desired position: but, since the game is competitive, the result is not precisely the one they expect. Rather, after some of them go bankrupt, a situation pertains in which those who survive face relatively fixed prices that maintain profit at a relatively moderate but acceptable level. Neoclassical theory even radicalizes this state of things: at the individual level, entrepreneurs take decisions in order to maximize profit, but, at the global level, all those who survive operate theoretically at a zero profit level. In such an “invisible hand” type of explanation, there is no intentionality at the global level but, at the individual level, everything is explained through intentionality. This is so because competition plays an important role and implies that some kind of selection is going on, but this selection has very little to do with natural selection understood in a Darwinian sense.

Indeed, should we wish to connect this argument with one of those which have been used to explain the biological evolution of species, we must again turn to a different theory. In this case, the most appropriate candidate is the Lamarckian argument. The logic of Lamarck’s explanation of the evolution of species implies that, at the global level, the selection (based on environmental changes) that is going on among all possible species (whose individuals are actively involved in improving their adaptation to their environment) is in no way an intentional process, as in a creationist approach, but is rather a totally unintended one, as in Darwin’s approach. At the individual level, however, there is no mechanism to explain why individuals become more adapted, except their goal-oriented attempts to improve their chances of surviving. It is true that Lamarck’s biological theory does not refer to intentionality as such, but intentionality could just as well be invoked to explain those individual attempts without contradicting the Lamarckian mechanism of adaptation as it strictly contradicts Darwinian natural selection. The giraffe instinctively makes an attempt to fulfill the goal of elongating its neck because some changes in the environment forces it to satisfy its vital needs by reaching fruits located in higher branches. The interesting point, for the present comparison between economics and biology, is not whether animal behavior is based on intention or on instinct, but the fact that a remarkable result, the adaptation of species, is supposed to be obtained through goal oriented activities of individuals. According to Lamarck, giraffes instinctively tend to elongate their necks and, since Lamarck (wrongly) admits that acquired characters can be transmitted from generation to generation, the result is that of today’s giraffes have very long necks indeed. Now, it was surely self-evident for Lamarck that, through the centuries and millennia, individual giraffes have been more or less brought to actually use their neck and more or less successful in elongating it and that, since only a small fraction of the potential descendents of earlier giraffes are living today, the giraffes of today, that have a long neck and are consequently adapted to their environment, are only those that have been lucky enough to have inherited the result of a long chain of successful attempts at neck elongation. This is self-evident since it is successes and not failures in such attempts that have contributed to explain what is to be explained by Lamarck, i.e. the remarkable adaptation of contemporary giraffes and species in general.

Similarly, according to economic theory, entrepreneurs, to satisfy their need for profit, make sequential attempts to be correctly adapted to their environment — whether this adaptation is intentional rather than instinctive is not the point here — and, since they do not all succeed equally well in this respect, those who actually survive in a market are better adapted to earn profits than those who, for any reason, did not succeed to adapt and who, consequently, are no longer in the game. The present allusion to “those who actually survive” hardly adds anything substantial to the traditional neoclassical theory: since this theory is a theory about a competitive market, it implies that success in attempts to comply with its requirements is a condition for survival. But this whole story is much more consonant with a Lamarckian than with a Darwinian story even if it concerns survivors only.

But what would be a Darwinian or a “natural
selection” story? The key element is that it would provide an explanation which would eliminate the need for goal-oriented behavior at both the global and the individual levels. For Darwin, evolution has nothing to do with giraffes’ attempts to elongate their necks. If some earlier giraffe, once and a while, showed some evolution-making difference with other member of its species, it was due, for Darwin, to a pure genetic accident and it is because this accidental characteristic turned out to be advantageous for survival, and consequently for procreation, that it was transmitted to a larger population of offspring. It is usually admitted that the Darwinian story is more satisfactory than the Lamarckian one, because it is based only on the transmission of genetic (by contrast with acquired) characteristics. The crucial problem with such genetic characteristics, however, is that it would be absolutely impossible to explain their mutation by any goal-oriented process, whether instinctive or intentional. Thus, the remarkable point about Darwinian theory is that it can provide a consistent explanation of evolution involving only the transmission of randomly produced genetic changes, and not of goal-oriented (whether instinctive or intentional) processes. Naturally, a Darwinian explanation does not deny that individual behavior can be goal-oriented. Darwinian giraffes tend to reach for high branches with the same eagerness as Lamarckian ones — but it excludes the possibility that these goal-oriented activities might play a role in the explanation of the phenomenon to be explained, which is the adaptation of actual species.

In economics, goal-oriented behavior at the individual level, and even genuinely intentional behavior, are hardly as problematic as they are in biology. Consequently, it is not surprising if, with a single exception, there have been no serious attempts, at least in the influential literature, to build economic models totally free of intentional (or rational) behavior. Alchian’s paper, even when it is mistakenly presented as an application to economics of Darwin’s idea, does not suggest that we eliminate explanations based on goal-oriented behavior, as its author emphasized in his answer [Alchian, 1953, p. 602] to Penrose’s objections. This can hardly be surprising since, as we have just seen, its argument is more consonant with a Lamarckian than with a Darwinian context. The single attempt to go so far, to which I have just referred, is Gary Becker’s argument about irrationality [Becker, 1962]. Becker indeed introduced a type of behavior which he defined as irrational since it could in no way be characterized as goal-oriented, as adaptive, or as responsive to environment changes. Beckerian irrational behavior was either purely random or purely repetitive. The challenge for Becker was to prove that the working of a market — the main phenomenon that the traditional theory is supposed to explain — could be explained as well without invoking any rational or (intentional) goal-oriented behavior. Most commentators have concluded that Becker has not satisfactorily met this challenge, but this is a separate question which I have had occasion to discuss in another paper [Lagueux, 1993a]. For the time being, I would like to emphasize the fact that Becker’s way of discussing the question illustrates very well what could have been, if his attempt had been successfully developed, a genuinely Darwinian or “natural selection” approach to economics. Such an approach is characterized by the explanation of a remarkable phenomenon (a market that works in a relatively efficient manner or a species that looks remarkably adapted to its environment) without resorting to goal-oriented activities either at the global level or even at the individual level. Since it would explain everything to be explained without resorting to intentionality (or rationality), such an argument, by contrast with the more “Lamarckian” type of explanation proposed by Alchian, would leave no room for an intentional (or rational) explanation such as the one provided by traditional microeconomics. My point is that such an argument is even incompatible with an intentional explanation in the sense that one has to choose between them when explaining a phenomenon. Either the explanation is based on the fact that economic agents have goals and take actions to fulfill them in such a way that it is possible to predict what should result from those actions that really count because they are those taken by the winners (i.e. those who turned out to be relatively successful in reaching these goals or, if one prefers, the survivors) in competitive games like markets. Or the very idea of reaching a goal is considered as meaningless and the explanation has to be based on a mechanism introducing some order in random moves by selecting from among players those whose moves display specific characteristics responsible for the result to be explained.

To help to understand these distinctions, let us consider two of the famous examples proposed by Friedman in his 1953 paper to illustrate his thesis about the realism of assumptions. One concerns “the density of leaves around a tree” and is explicitly related to Alchian’s survival argument. The second, which does not seem so clearly related to such an argument, concerns “expert billiard players”. Let us consider this last example first.
Let us suppose with Friedman that there is some highly complicated formula — let us say trigonometric formula — that permits us to determine the trajectory of a ball that must knock a few other balls in an optimal way and let us suppose that the expert billiard players are totally unaware that such a formula exists. However, the expert billiard players are very far from knocking the balls at random. Just like entrepreneurs, they do the best they can, given their knowledge, to reach their goal. Naturally, some players succeed better than others, but only those who “in some way or other” are “capable of reaching essentially the same result” as the one corresponding to the mathematical formula are “expert billiard players”. I have shown in another paper [Lagueux, 1993b] that Friedman was wrong to claim that this example suggests that the realism of assumptions do not matter, but I think that he was perfectly right to claim that this example illustrates fairly well how traditional economic theory explains the working of a market economy. Just like the mathematical theory of billiard playing, economic theory analyses what is going on behind the actions of an agent who acts intentionally to reach a goal in a competitive game. This agent’s success is not warranted, but the argument suggests that, “in some way or other”, the successful agents have made some moves whose underlying logic is more or less precisely analyzed by the theory. Indeed, such an argument implies that, in both situations, those who do not comply with the requirements of the theory will be pushed out of the game. When an economist says that an entrepreneur will not sell at such and such a price because he or she will lose money at that price, the economist means that continuing to sell at this price for a long time is surely possible, but not without probable bankruptcy for the entrepreneur. In competitive games, like the economy or billiards, there are winners and losers or, if one prefers, there is selection. But when this selection results merely from the fact that the players are intentionally fighting to survive — like the expert billiard players in a tournament or the entrepreneurs in a competitive economy — it will not make sense to characterize it as Darwinian “natural” selection.

To illustrate what could be a process more akin to natural selection, the standard billiard game would have to be replaced by what I would call a Labyrinthine Billiard game. In this crazy game, the billiard table would be designed in such a way that, the ball being conducted in highly complex labyrinthine channels, even the expert billiard players would be totally unable to reach their target otherwise than by pure chance and they would be totally indifferent between knocking the ball in one direction or in another one. If we suppose that players are eliminated from this game after too many unsuccessful attempts and that they tend to stick to their random choices — choices that will be modified only by accidental and exceptional circumstances (in such a way that their behavior is normally “transmitted” from game to game) — then some kind of natural selection could possibly explain the fact that, after some time, the survivors in such a game turned out to knock the ball very efficiently (and in relative conformity with the mathematical law established by the theoretician of the game).

But what if some wise and skillful players find some tricks to beat the odds and to win in such a crazy game, by playing in a definite way instead of playing randomly? In such a case, the problem is totally modified. In the first case (the random case), natural selection could explain that some efficiency is generated even when players do nothing to produce it. In the second case (the case of the tricky players), some efficiency — which is by hypothesis superior to that obtained by random, otherwise there would be no point in speaking of “tricks to beat the odds” — is explained precisely by the fact that players intently do something to produce it. Thus, in this second case, the result based on randomness is overshadowed by the result based on intentionality and it is precisely for this reason that I maintain that these explanations are, in some sense, incompatible. One has to choose between explaining a purely mechanical result or explaining something that is precisely characterized as more (in term of efficiency) than can be expected from a simple mechanism. If the results obtained by the wise fellows who “beat the odds” were not better (at least as far as the time required to reach efficiency is concerned) than those obtained by others playing at random, it would make no sense to suppose that they had found any trick at all. Thus, in my crazy billiard game, either I use a selection mechanism to explain the fact that non-intentional moves produce some efficiency, or I talk about wise intentional actions that produce a still more remarkable efficiency. I cannot, however, mix these two explanations, since each is intended to explain a different phenomenon. Similarly, in economics, either I explain, through a “natural selection” mechanism, that irrational moves by entrepreneurs produce a situation astonishingly close to profit-maximizing or I explain that rational decisions by entrepreneurs produce a much better result in terms of profit-maximizing, but mixing the two explanations would be meaningless. More precisely,
if mixed in such a way, one of the explanations would have to be subordinated to the other one and, by being mixed with a dominant one, the subordinated explanation would be reinterpreted in the terms of the first.

In brief, if entrepreneurs cannot do better than random moves would do, there would be nothing to explain by anything other than a "natural selection" mechanism, whereas if they do better, there is no point in explaining their result by a "natural selection" mechanism that, by hypothesis, is unable to explain it. Naturally, in this last case, an intentional explanation based on rational behavior would have to be completed by a process of selection, but, as we have seen, this type of selection would in no way be "Darwinian". To illustrate what I mean by the meaningless character of such a mix of explanations, let us consider the following example. If a group of archers is remarkably successful in reaching a difficult target, I must explain their success by invoking their skill, the rationality of their purposeful moves, and so on. On the other hand, if I discover that a powerful magnet is hidden behind the middle of the target and that it attracts all the arrows flying in the area, then there is nothing left to be explained by rationality and skill. Resorting to an explanation based on intentionality will be meaningful only if there is something to be explained (like the success of skillful archers) which, in normal circumstances, cannot be explained by the presence of a magnet.

To clarify a little more the consequences of this point for economics, let us consider, in conclusion, Friedman's leaves example that, by contrast with his billiard game example was explicitly related to natural selection. In this example, the (hypothetical) fact that "leaves are positioned as if each leaf deliberately sought to maximize the amount of sunlight it receives" (Friedman, 1953, p. 19) is explained in a way which is free from any reference to intentional maximization. Let us quote Friedman himself: "We are inclined to "explain" its validity on the ground that sunlight contributes to the growth of leaves and that hence leaves will grow denser or more putative leaves survive where there is more sun, so the result achieved by purely passive adaptation to external circumstances is the same as the result that would be achieved by deliberate accommodation to them." [Friedman, 1953, p. 20]

In this passage, it is not clear whether the argument is of a Larmarkian or a Darwinian type. An "adaptation to external circumstances" is more consonant with Larmarkianism, but for Larmark, such an adaptation is not "purely passive". For Darwin, however, pure passivity will not produce adaptation without the working of a quite different mechanism. A genuine natural selection argument would explain, for example, the presence of a large population of a tree variety with leaves optimally arranged to capture a maximum quantity of sunshine. But to explain such a phenomenon, not only passivity but random mutations embedded in genes transmitted with rigid fidelity (inertness) through many generations will be required. Such an explanation would be more akin to the one (involving inertness with occasional random modifications) that I have suggested in my reinterpretation of Becker's irrationality model or in my crazy labyrinthine billiard game.

In a properly Darwinian explanation, the idea is not just that the density of passive leaves tends to be greater on the sunny side than on the shady one. What a wonder to observe that there is more grass in rich soil than in rocky and dry soil and to explain (non-teleologically) such a remarkable case of "adaptation" by underscoring that grass was prevented from growing by a lack of grass-growing elements in the second type of soil! This type of explanation, which is implicit in one parable of the Gospel, is surely not typically Darwinian. Similarly, sun-loving leaves are indeed more abundant where sun is present than where sun is absent! It is true that grass and leaves grow in these fine places just as if they knew what the biologist knows about what is good for them. Similarly, cannon balls follow their path just as if they knew Newton's law about the movement of projectiles, but this has nothing to do with a Darwinian explanation.

To summarize, the role of intentionality (or of goal-orientation) in these different types of explanation can be described as in the following table:

<table>
<thead>
<tr>
<th>Economic theory</th>
<th>Illustrative examples</th>
<th>Biological evolution</th>
<th>Intentional (or goal-oriented) behavior as an individual at a global level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hiring Board</td>
<td>Creationism</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Neo-classical theory of the firm in a competitive market</td>
<td>Friedman's Billiard players</td>
<td>Lamarckianism</td>
<td>yes</td>
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<tr>
<td>Invisible Hand explanation</td>
<td>Friedman's sun-loving leaves</td>
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<tr>
<td>Becker's irrationality model</td>
<td>&quot;labyrinthine&quot; billiards</td>
<td>Darwinian</td>
<td>no</td>
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<tr>
<td>Friedman's optimally sun-catching types of trees</td>
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If one wants to use the example of leaves being in an optimal sun-catching position to illustrate what is going on in economics, one has to choose between invoking a Lamarckian type of active adaptation — which does not necessarily, however, imply any knowledge of a law, such a question being a quite different one which confuses the main issue — or invoking a Darwinian natural selection mechanism involving random mutations transmitted through a long chain of individuals (or, at least, of attempts). In the first case, one acknowledges that entrepreneurs are actively looking for the best way to adapt themselves to a competitive environment, in such a fashion that those who are the winners in this game tend to be, as suggested by neoclassical theory, in a relatively optimal position. In the second case, one admits that entrepreneurs cannot do anything at all to improve their position but, thanks to an argument similar to Becker's, maintains that randomness and inertness should not do too much damage to a global result that will be produced anyway through natural selection. In this last case, nothing will be left to be explained by intentionality and rationality. And, in the first case, nothing will be left to be explained by natural selection, since the neo-classical argument based on rationality will be legitimate precisely because the economic order to be explained would be considered irreducible to natural selection.

At this point, one can restate Alchian's argument and say that, thanks to selection, the survivors, as a matter of fact, will behave in a way more or less correctly described by economic theory, but the question is to know how this selection operates. Admittedly, "Natural selection" through bankruptcies would be a very long process. If this process is accelerated by the fact that entrepreneurs learn by experience and correct their decisions to avoid grim situations, the selection producing the result to be explained is no longer Darwinian natural selection. It is true that one can also argue that an economic society is complex and made up of some entrepreneurs who are eager to make profits and some who pursue quite different goals. Then, why not allow for complementary types of selection? But the point is that both types of entrepreneurs are competitors in the same competition. On the one hand, if it turns out that the eager ones tend to be the winners and to eliminate those who are too relaxed, then the selection going on has little to do with a Darwinian process and the economic explanation provided is much closer to a Smithian "invisible hand" one. On the other hand, if this eagerness really does not matter because random moves result in a situation just as efficient as the one expected from eagerness to make profits, then this astonishing phenomenon has to be established and explained on its own grounds, possibly by a "natural selection" type of argument. The appropriateness of such an explanation cannot be postulated on the ground that economic competition will finally crown some winners because this reference to an intentional and "rational" contest among entrepreneurs is precisely what a "natural selection" type of argument was supposed to dispense of. Certainly, economists can appreciate the attractiveness of both types of argument, but they could hardly add them together and consider the second one as a second line of defense to protect their theory. Either they would invoke a selection that is nothing but simple economic competition and then there would be no second line of defense, or they would refer to a (highly hypothetical) natural selection process explaining mechanically the emergence of a race of entrepreneurs simply incapable of acting in an inefficient way in which case there would be no place for any economic theory at all.

Notes
1. This paper was presented at the joint AEA-INEM session of the A.E.A. meetings held in Anaheim, January 1993. The author would like to thank SSHRCC (Ottawa) and FCAR (Québec) for financial assistance. He is also grateful to D. Hammond, P. Mirowski, R. Nadeau, B. Toombs. Naturally, none of them are responsible for any of the final version’s shortcomings.
2. For a comprehensive discussion of the relationship between economics and theories of biological evolution, one should consult Hodgson (1993).
3. For a discussion of Friedman’s theses on this point, see Lagieux (1993b).
4. For the classical discussion of the relation between “invisible hand” and “natural selection” types of arguments, see Ullmann-Margalit (1978).
5. It is well known that natural selection does not necessarily produce perfectly adapted species, but allowing for such considerations would not change the central question. Whatever the result of a hypothetical natural selection process, the question remains: is something to be explained over and above what is supposed to be explained by natural selection? A specifically economic question arises when one answers "yes" to this question. It is not meaningful to say, otherwise than in a tautological way, that ants equalize their marginal cost and their marginal revenue!
References