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Keywords

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Keywords

Neoclassical economics, business innovation, purely deductive economic models, invisible hand doctrine, evolutionary economics

JEL CLASSIFICATION

A2, B41, B310

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1. Introduction

One of the striking characteristics of the modern economy is the rapid creation adoption, and diffusion of innovation. Not surprisingly, the economics of innovation has grown immensely. What is surprising, however, is that business innovation is everywhere, except in current textbooks of undergraduate economics. There are at least two major reasons for this bizarre situation. First, neoclassical economics was the predominant style of doing economics in the 20th century, and second, the neoclassical approach confined attention to efficiency but left the most important part of economic evolution, namely innovation, unexplained. Nelson (2002).

Schumpeter (1947) threw a wrench into theoretical economics by pointing out that, if you take your model seriously, innovation cannot be easily ruled out. Consider the world of reality (say, an economy or a sector of an economy) operating with an ‘existing practice’ and given data (for example, the state of technology, tastes, governmental and institutional framework, etc.). The real world can be thought of as a system with interconnected parts. Generally speaking, if one or more data change, the system will react. Schumpeter (1947) made the following simple, yet fundamental point: in general, the response of the system to the change in data can be analytically bifurcated into a response *within* the existing practice (*adaptive response*) and a response *outside* the range of the existing practice (*creative response*).

The preceding insight gives rise to what may be called the *Schumpeter’s critique* of economics: economic theorists tend to concentrate their intellectual effort on the adaptive response and assume away the creative response.ⁱ Antonelli (2011) has argued that the standard answers to the Schumpeter’s critique leave a lot to be desired, and proposed a framework –in which complexity enters the picture in a fundamental way– to capture the creative response. As will become apparent in the present paper, the Schumpeter’s critique finds an important application in the neoclassical interpretation of Adam Smith.

Progress in economics is cumulative and based on the great economic thinkers of past times, as well as the lesser scholars and practitioners. Previous economic knowledge accumulates and feeds into the generation of modified and new conceptual frameworks. Sometimes knowledge is made obsolete by the emergence of newer, superior frameworks of analysis. At other times paradoxical arguments are clarified to reconcile seemingly contradictory facts or to make counterintuitive propositions understandable. Examples of economic paradoxes abound: the paradox of value (e.g. diamonds and water), the Giffen paradox in demand theory, the Leontieff paradox in international trade, the paradox of thrift, and the paradox of voting are a few.

The first systematic attempt to found an economic science was made in France around the middle of the 18th century by the Physiocrats. Adam Smith (1723-1790) resided several years in France and interacted with the Physiocrats. (Marshall 1966, 626). In that epoch, new technologies were being created and applied to the manufacture of products such as cotton, wool and iron, in what came to be called the First Industrial Revolution. Adam Smith was

keenly interested in technological innovation because he wanted to understand the sources of the wealth of nations.

However, Smith undertook the colossal task of founding the economic science by focusing on existing products, and thereby, left the issue of introducing new products into the market untouched. Quite obviously, the fact that business innovation was left out of the picture does not imply that technological innovation was irrelevant to him. It was left to Schumpeter's acute powers of observation and abstraction to go inside the black box of technological creativity and pull out business innovation as the most important factor underlying economic change. Economic growth cannot be understood solely in terms of the accumulation of capital and the expansion of the labour force.

Adam Smith will be "the most famous of all economists" forever and his insights will always be recognized as enduring stepping stones for scientific progress. Overall, Smith's theoretical conceptions focus on the free-market economy and the forces determining economic growth. His belief that a free-market economy is of absolutely fundamental importance for attaining economic prosperity was not primarily based on its allocative efficiency but on its growth inducing effects. (Landreth and Colander 2002, 104).

Beyond any doubt the Smithian vision of the market mechanism has had a profound impact on the economic science in particular, and posterity in general. Some of his influential ideas have been used as teaching and learning tools ever since the publication of the *Wealth of Nations* in 1776. Smith's immortal metaphor to describe the power of the free-market mechanism as a guiding 'invisible hand' conducive to economic prosperity can be found in nearly all the contemporary introductory economics textbooks. For example, the Invisible Hand is a recurrent topic in the sixteenth edition of Samuelson's *Economics* –the textbook first published in 1948 that established a new pattern for all the late 20th textbooks.

It is generally agreed that Adam Smith invoked the Invisible Hand –an expression that occurs only once in the *Wealth of Nations*– to send the message to posterity that a free-market economy is the best form of economic organization. Smith did not formally prove anything in relation to the Invisible Hand of the free-market mechanism. Strictly speaking, the Invisible Hand of Adam Smith is a *conjecture* about the virtues of a free-market economy.

Smith also used the phrase 'invisible hand' only once in his *Theory of Moral Sentiments* in a somewhat different context (Smith 1981, 264) and only once in his *History of Astronomy* as the 'invisible hand of Jupiter,' where Jupiter represents the ignorant savage's view of the divine order. (Smith 1980, 49).

Two important points about the *History of Astronomy* are worth noting. First, Smith (1980) surmised that the scientific activity consists of formulating 'connecting principles' (somewhat roughly, creating analytical categories and establishing links between them), as Loasby (2002) explains with care, insight, and lucidity. Second, Smith wrote the *History of Astronomy* before 1758. Unfortunately, we do not know how long before 1758 the *History of Astronomy* was written. What matters, however, is that with all probability the *History of Astronomy* shaped the writing of the *Wealth of Nations*.

The formidable task of formalizing the meaning of the Invisible Hand conjecture was undertaken by Kenneth Arrow, Gerard Debreu and many other economic theorists who interpreted the Invisible Hand conjecture as signalling economic efficiency. Specifically, Arrow and Debreu (1954) proved mathematically that under certain (idealized) conditions a free-market economy is efficient. That is, the allocation of products achieved at the equilibrium prices originated by the free market is efficient.

To write a paper on Adam Smith's Invisible Hand more than two hundred years after the publication of the *Wealth of Nations* is intellectually risky. For example, some readers might ask: Why do we need to revisit the interpretation of the Invisible Hand after the publication of Hahn's (1982) paper "Reflections on the Invisible Hand" or Persky's (1989) paper "Adam Smith's Invisible Hands"?

There are three claims in this paper concerning the interpretation of the Invisible Hand conjecture. First, the neoclassical interpretation engenders a conceptual confusion –identified here as the 'double paradox' of the Invisible Hand. Second, the interpretation of Adam Smith's conjecture on the beneficial effects of the free-market economy cannot –and should not– be confined to the production and consumption of existing products. While the paradoxes are resolved taking the notion of a free-market economy out of the straight-jacket imposed by the general equilibrium model, the content of the second claim lies in the separation between the Invisible Hand Theorem from the Invisible Hand Doctrine. Failure to distinguish between these two quite distinct interpretations of the Invisible Hand metaphor distorts thinking about Adam Smith's message, creating the misconception that the Invisible Hand passage excludes business innovation. Third, the central message conveyed by Invisible Hand is to be read in the context of modern evolutionary economics. To defend this claim, we take advantage of evolutionary economics synthesis articulated by Loasby (2002).

In order to develop the argument of this paper we have had recourse to several quotations from the original texts, preferring that the authors we discuss should speak in their own words rather than running the risk of misrepresenting them by paraphrase. The next section succinctly summarizes the neoclassical interpretation of the Invisible Hand conjecture and introduces the notion of a purely deductive economic model. Section 3 brings into sharp focus the two paradoxes emerging from the neoclassical interpretation. Section 4 resolves the double paradox. Section 5 outlines the Invisible Hand Doctrine and makes contact with evolutionary economics. In the (concluding) Section 6 we summarize the thread of the argument articulated in this paper to attain an acceptable interpretation of the Invisible Hand conjecture.

2. Neoclassical Interpretation

Few economists would disagree with the following interpretation of the Invisible Hand conjecture:

Two centuries ago, Adam Smith proclaimed that, through the workings of the invisible hand, those who pursue their own self-interest in a competitive economy would most effectively

promote the public interest. This concept –that the rough-and-tumble of market competition– is a potent force for raising output and living standards– is one of the most profound and powerful ideas in history.

(Samuelson and Nordhaus 1998, 265)

Clearly, the way Samuelson and Nordhaus paraphrase Smith can accommodate the two basic functions of markets: allocative and creative.

2.1. The invisible hand theorem

The formal interpretation of the Invisible Hand conjecture is based on the general equilibrium model. Strictly speaking, as Debreu says, the general equilibrium model is “logically entirely disconnected from its interpretation.” (Debreu, 1959, p. x). The neoclassical interpretation of the Invisible Hand was labelled the “invisible hand theorem” by Paul A. Samuelson.ⁱⁱ In essence, the theorem states that a free-market economy implies economic efficiency.

The intuition behind the axiomatic proof this theorem is that the free interaction of utility-maximizing buyers and profit-maximizing sellers ends up producing efficiency. In particular, this happens because the price mechanism induces private firms to allocate the ‘right’ amount of resources in each activity, and that allocation will be an efficient allocation of resources. The prices and profits of the existing products are signals that determine where the resources will flow. Earnings (positive profits) emerging from a particular sector attract resources into that sector, and losses (negative profits) induce resources to move elsewhere. Furthermore, the realization of normal profits (that is, the minimum remuneration for the firm to remain in the market) is the criterion according to which successful firms are selected.

In the neoclassical interpretation of the Invisible Hand conjecture, the meaning of both ‘free-market economy’ and ‘efficiency’ is precise. A free-market economy is a perfectly competitive economy with no government intervention. An economy satisfying this definition does not and cannot exist and presumably never existed. This definition – which constitutes the traditional textbook concept of a free-market economy – will be referred to as the *strong* definition of a free-market economy because of the stringent conditions involved in its formulation.

As it is well-known, the defining characteristics of perfect competition consist of four conditions: (1) both firms and consumers are numerous (strictly speaking, there exists an infinite number of economic agents); (2) firms produce homogeneous products (the product of a firm is indistinguishable from the products of others) and consumers are identical from the seller’s viewpoint; (3) there is perfect information on both sides of the market; and (4) entry into and exit from the market is free for firms and consumers. In particular, resources always move into sectors from which they derive the greatest advantage.

As to ‘efficiency,’ the Invisible Hand Theorem refers to ‘Pareto optima.’ Specifically, the theorem states that a free-market economy is Pareto efficient. In turn, a Pareto-efficient allocation of resources is a situation in which no feasible reallocation of resources in the

economy could increase the level of utility of one or more buyers without lowering the level of utility of any other buyer.

2.2. Purely deductive economic models

To bring into sharp focus the bizarre consequences of the neoclassical conception of the Invisible Hand conjecture, we pause for a moment to introduce a dichotomy of economic models. Economic models are necessary. They are merely simplified frameworks, and there is no inherent reason why they must be mathematical. Formal logic and mathematical consistency come into their own in checking the consistency and completeness of the models and exploring their implications. We will find it useful to distinguish ‘scientific’ economic models from ‘purely deductive’ economic models.

The essential distinguishing features of *scientific* economic models are two: first, the propositions are logically consistent with each other, and second, there must be at least one statement derived from the assumptions which could conceivably be refuted by the empirical evidence. In brief, a scientific economic model is one capable of producing empirically falsifiable statements.

In contrast, a *purely deductive* economic model is a consistent mathematical model – originally suggested by an economic problem – which cannot be refuted by empirical data. What kind of evidence could contradict this model? No hypothetically conceivable experiment could ever controvert a purely deductive model. These models do not have empirical content. Note that this characterization remains silent about the realism of the assumptions. The assumptions or axioms of a purely deductive economic model can be factually true or factually false. For this kind of economic models what matters is logical completeness and consistency, not the realism of the assumptions.

Purely deductive economic models are not new. More than sixty years ago Paul A. Samuelson identified the conceptual framework of welfare economics as an empirically empty construct:

(...) It is only fair to point out, however, that the theorems enunciated under the heading of welfare economics are not meaningful propositions or hypotheses in the technical sense. For they represent the deductive implications of assumptions which are not themselves meaningful refutable hypotheses about reality.
(Samuelson 1965, 221)

2.3. A Supreme and Extreme Example

Existence of equilibrium entails the logical possibility of pre-reconcilable choices. (Weintraub 1979, 29). The proof of the existence of general equilibrium in the fifties was considered a major intellectual achievement. It was shown not only that a perfectly competitive equilibrium exists but also that every free-market equilibrium is Pareto-efficient

and that Pareto-efficient allocations can be realized by a price system such that the allocation is also a free-market equilibrium. (Weintraub 1983, 28).

However, the general equilibrium model is a *supreme* example of a purely deductive economic model. In fact, Kirman (1989) has shown that this model is empirically empty in that it is unable to produce empirically falsifiable propositions. But there is a further serious difficulty. The general equilibrium model is also an *extreme* example because the necessary assumptions for the existence of equilibrium are patently false (that is, directly contrary to the real economic world, not just ‘abstract’). For example, the assumption of perfect competition is directly contradicted by observation. Kaldor (1972).

Purely deductive economic models tend to display mathematical beauty. For example, the proof of existence of general equilibrium is obtained using the elegant machinery of topology with particular regard to fixed point theorems. “One must be far gone in philistine turpitude not to appreciate the quite surprising nature of this result [existence of general equilibrium], or to be unmoved by the elegant means by which it is proved.” (Hahn 1982, 4).

To be sure, purely deductive economic models are of value to organize thinking about real world issues. A case in point is the conventional notion of ‘market failure.’ This concept is inextricably linked to the lack of economic efficiency. *Market failure* refers to breaches of the multitude of conditions necessary to squeeze efficiency out of the free-market economy. Generally speaking, externalities, market power, and imperfect information are efficiency-destroying factors. For example, for a free-market economy to be efficient there must be no technological externalities. ⁱⁱⁱ

3. The Double Paradox

Adam Smith’s simile comparing the workings of a free-market economy to an Invisible Hand continues to convey a profound message. However, the identification of the Invisible Hand conjecture with Pareto efficiency is not free of difficulties. As will become apparent the Invisible Hand Theorem engenders a double paradox.

3.1. *First paradox: losing the Smithian vision*

It is pertinent to reiterate that the conditions necessary to squeeze efficiency out of general equilibrium are factually false. The Samuelson-Nordhaus evaluation of the practical use of this Invisible Hand Theorem is devastatingly unambiguous:

But the invisible-hand result [Invisible Hand Theorem] holds only under very limited conditions. All goods must be produced efficiently by perfectly competitive firms. All goods must be private goods like loaves of bread, the total of which can be cut up into separate slices of consumption for different individuals, so that the more I consume out of the total, the less you consume. There can be no externalities like air pollution. Consumers and firms must be fully informed about

the prices and characteristics of the goods they buy and sell. If all these idealized conditions were met, the invisible hand could provide perfectly efficient production and distribution of national output, and there would be no need for government intervention to promote efficiency.

(...) In reality, each and every one of the idealized conditions enumerated above is violated to some extent in all human societies. (...)

(Samuelson and Nordhaus 1998, 285)

This evaluation is bewildering because it suggests that the notion of a free-market economy is a kind of fantasy whose key elements contradict reality. Is the Invisible Hand conjecture a deep insight or a curiosum?

Needless to say, we encounter an awkward situation. If we identify the Invisible Hand of the marketplace with unseen forces operating in a free-market economy and recognize the pervasiveness of market failure, it follows at once that the free-market mechanism is incapable of attaining efficiency. Or, to put it differently, the Invisible Hand cannot work its magic in the real world. The Invisible Hand Theorem makes the Invisible Hand conjecture a curiosum.

Typically, an economist would immediately assert: to show that the free-market economy is subject to market failure is not the same as showing that government intervention will do better than actual free markets (which is correct). But this is not the point. The issue is that we praise the Smithian vision because it works exceedingly well in the real world, but the formalization of the insight leaves us naked in a cold winter. When we look at the real economy through the lens of the general equilibrium model, the Smithian vision of the Invisible Hand is *lost*. (Hahn 1982, 6).

To put it bluntly, it is impossible for a free-market economy to attain efficiency because the conditions imposed by the strong definition of the free-market economy are not satisfied by any real economy. If we accept that the pursuit of the impossible is irrational, trying to organize an economy according to the tenets of a free-market economy is irrational. What would Adam Smith's reaction be to this implication? Smith would have recoiled in horror from such conclusion.

No one would object that knowing the Invisible Hand Theorem is important. What is objectionable is the use of the theorem to interpret the message conveyed by the Invisible Hand conjecture. The claim that the Invisible Hand Theorem *is* the interpretation of the conjecture is unreasonable because it engenders a double paradox.

The first paradox of the Invisible Hand is fairly obvious: the free-market mechanism is of absolutely fundamental importance for the organization of the economy but when we translate the insight into the language of general equilibrium we find that no real economy satisfies the necessary conditions to squeeze efficiency out of the free-market economy.

This paradox has a perplexing impact on economics students. We teach our students that the Invisible Hand Theorem is comparable to the Newtonian law of gravity, but then, we immediately comment that there is no real economy that satisfies the idealized conditions necessary for the Invisible Hand to work its magic. It is like designing a pollution-free power plant and proving that the facility can only function with minerals that do not exist on this planet.

3.2. Recovering the vision: the Samuelson-Nordhaus advice

Attempts to recover the theoretical relevance Invisible Hand started in the mid-fifties. Unfortunately, the theory of second best showed that attempts to solve the paradox (that is, the first best optimum conditions simply cannot be satisfied in the real world) are in the nature of taking a shortcut through quicksand. The typical result is a formidably complex collection of decision rules in place of the simple “price = marginal cost” conditions customary in the first best problems. The main result reached by Lipsey and Lancaster (1956) is that when the first best conditions cannot be attained, it is no longer desirable to fulfil the other first best conditions.

Faced with this disconcerting fact, we can resort to the Samuelson-Nordhaus’s analogy of the frictionless vacuum of the physicist and believe that the distortions of the real world will disappear in the long-run:

The perfectly competitive world of the economist is like the frictionless vacuum of the physicist. Even though engineers know that they can never create a perfect vacuum, they still find the analysis of behaviour in a vacuum extremely valuable for illuminating many complex problems. So it is with our competitive model. In the long run, many imperfections turn out transient as monopolies are eroded by competing technologies. While oversimplified, the [perfectly] competitive model points to many important hypotheses about economic behaviour, and these hypotheses appear especially valid *in the long run*.

(Samuelson and Nordhaus 1998, 275, *italics added*)

In essence, the Samuelson-Nordhaus advice consists of following Joan Robinson’s dictum that one must be patient and optimistic with simplifications. In the long-run, the economy will converge to the perfectly competitive model.

3.3. Second paradox: suppressing business innovation

Practical people, including most economists, understand that the Samuelson-Nordhaus’s optimism about the long run may not be warranted. But even if we accept that the Invisible Hand Theorem can be used to gain an understanding of the beneficial effects of the free-market mechanism in the long run, we encounter a daunting obstacle: the neoclassical interpretation of the conjecture *suppresses* the creative function of the free-market.

The line of argument that gives rise to the second paradox is direct. The perfectly competitive model refers to *existing* products in a fundamental way. The requirement of a constant set of products and processes of production (or production functions) is inextricably linked to the notion of perfect competition. Furthermore, the first two defining characteristics of a perfectly competitive economy –conditions (1) and (2)– ensure that no economic agent has market power. It follows at once that business innovation is logically impossible under perfect competition because innovation always entails market power.^{iv}

Business innovation is an economic activity. Prospective profits and the pursuit of market power are powerful forces conducive to the creation of new products or processes or new forms of organization. It should be clear that the study of innovation as an economic activity requires both the abandonment of perfect competition and the acceptance that the existence of technological externalities is the rule rather than the exception. It should also be clear that the purely deductive model employed to formalize the Invisible Hand conjecture leads to a counterintuitive conclusion: innovation provokes market failure.

In a nutshell, the second paradox of the Invisible Hand emerging from the general equilibrium treatment of the conjecture can be formulated as follows: innovation is an economic activity of absolutely fundamental importance in the modern economy, but this economic activity is not open to the influence of the Invisible Hand.

4. Resolving the Double Paradox

Where does this leave us with respect to the role of the Invisible Hand? In a somewhat muddled state, but being muddled is not unusual for economics. At this point, it seems reasonable to read again Adam Smith's justly famous paragraph:

Every individual necessarily labours to render the annual revenue of the society as great as he can. He generally, indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security; and by directing the industry in such a manner as its produce may be of the greatest value; he intends only his own gain, and he is in this, *as in many other cases*, led by an invisible hand to promote an end which was no part of it. Nor is it always the worse for the society that it was not part of it. By pursuing his own interest he frequently promotes that of the society more effectively than when he really intends to promote it.

(Smith 1776, 423, *italics added*)

Smith proffered that the free-market mechanism acted like a guiding Invisible Hand. It is clear that prices and profits are the unseen forces guiding economic behaviour. People act economically when an opportunity for gain is presented to them and they take it. Or, to put it differently, economic agents are motivated by self-interest and the Invisible Hand of the

marketplace guides these profit-seeking creatures into promoting economic prosperity. It should also be clear that the ‘individual’ involved is not necessarily a producer. The Invisible Hand paragraph does *not* preclude profit-seeking innovators in any imaginable way.

4.1. Abandonment of the neoclassical approach

The double paradox of the Invisible Hand can be resolved in two steps: first, showing that the existing neoclassical interpretation of the conjecture must be rejected on both methodological and conceptual grounds, and second, taking the notion of free-market economy out of the straight-jacket imposed by the general equilibrium model.

The compelling methodological tenet –obvious, but often forgotten– is that a purely deductive economic model whose necessary assumptions are incompatible (in a fundamental way) with any actually existing economy cannot decide the empirical relevance of an economic insight that refers to the real economy. The formal proofs of the existence and efficiency of general equilibrium do not prove or disprove the Invisible Hand conjecture.

Having seen that the use of purely deductive economic models lacks rigorous defence to validate economic insights, it is important to note that the problematic factor in the interpretation of the conjecture is not the mathematics involved in the proof of the proposition ‘free-market economy implies efficiency.’ The strong definition of a free-market economy is responsible for the paradoxes because a free-market economy is a perfect-market economy. In particular, the defining characteristics of this ideal type of economy (no time, no strategic behaviour, no patents, no trademarks, etc.) automatically imply an economy where no innovative activity can take place. Consequently, a free-market economy is a stick-in-the mud economy, one populated by economic agents lacking initiative, opposed to new ideas, progress, and novelty.

One inevitable conclusion follows. If we do not want to ‘lose’ the powerful message of the Invisible Hand, we have to relax the notion of a free-market economy. The general equilibrium notion of ‘free-market economy’ has to be abandoned in order to capture a salient feature of most modern economies, namely incessant business innovation.

4.2. Weak definition of a free-market economy

An economy is a collection of interrelated economic activities revolving around the allocation of resources to producing both existing products and new products emerging from business innovation. The consumption of the economy is regarded as the end of economic activity. This is the loosest possible description of the notion of an economy.

Generally speaking, a real economy displays two additional characteristics. The economy (a) operates in the context of a legal system which includes well-defined property rights and constraints on what products economic agents are entitled to produce and sell; and (b) allows cooperation between the private sector and the government.

Preferring to err on the side of defining the free-market economy too broadly, we adopt the following *weak* definition: a free-market economy is one based on two structural pillars,

private property of capital and what Marshall (1966) called the System of Economic Freedom.^v In practice, economic freedom has to reach a balance between strong economic competition and government interference with the economy. For example, patent and copyright laws imply government interference because they temporarily reduce economic competition based on price.

The weak definition is consistent with the Smithian vision of a free-market economy. Lord Lionel Robbins documented effectively Smith's externality argument for government intervention (Robbins 1978, 31) as well as the extensive role that Smith assigned to the state in the economy (Robbins 1978, 37).

In a free-market economy the signals guiding resource allocation are the prices of existing products and the prospective profits associated with new ideas with economic value. Any organization systematically unable to make normal profits (be it a profit-seeking company, a cooperative, a social enterprise, etc.) either leaves the market or has to be financially supported by other participants in the economy (for example, by the government).

5. Invisible Hand Doctrine and Evolutionary Economics

It sometimes seems that general equilibrium theorists invoked the name of Adam Smith in order to endow their models with an impressive intellectual origin. Many economists know in their hearts that the connection of general equilibrium with the spirit and even the letter of Adam Smith is distant.

An obvious question immediately suggests itself. What is the framework in which the Invisible Hand conjecture makes sense? As will become apparent, the 'weak' definition of a free-market economy allows the separation between the Invisible Hand Theorem from the Invisible Hand *Doctrine*, and leads naturally to the evolutionary economics framework.

5.1. The Invisible Hand Doctrine

Loosely speaking, we can characterize an *economic doctrine* as a consensus of rational opinions on economic matters that float in the scientific mind. The opinions are defended using induction (facts), deduction (logic) and abduction (a mix of the inductive and deductive approaches). Metaphors and stories are necessary components of an economic doctrine. Metaphors in economics serve as instruments of thought and as devices for communicating meaning.^{vi}

The merits of a particular economic doctrine rest less on its theoretical foundations than on its advantages over the actual performance of rival doctrines. Furthermore, the relative importance of competing economic doctrines is historically tested in the sense that history decides which doctrine will prevail. Time provides the ultimate test to accept or reject an economic doctrine.

The Invisible Hand Doctrine proclaims that a free-market economy in the sense just defined is the best available form of economic organization. There can be little doubt that this

doctrine is a truly remarkable insight. It is the dominant view in which today's economists think and communicate.

Quite obviously, the stunning success of the Invisible Hand Doctrine is based on historical evidence, not on the Invisible Hand Theorem. For example, when Nikita Khrushchev visited the United States in 1959 and promised that the Soviet Union would soon bury the United States –by outproducing it– the Russian leader was (subliminally) predicting that the Communist Doctrine would historically prevail over the Invisible Hand Doctrine. History has shown that societies which rely on the Invisible Hand Doctrine achieved their economic aims more successful than others. Economies cannot, so far as we know, be planned by a 'central intelligence.'

It would hardly be necessary to stress that the appropriate interpretation of the Invisible Hand paragraph is inextricably linked to the Invisible Hand Doctrine. Failure to separate the Invisible Hand Doctrine from the Invisible Hand Theorem distorts thinking about the Invisible Hand conjecture, creating the misconception that business innovation is overlooked by the Invisible Hand passage.

The Invisible Hand Doctrine is the most famous guideline in all of economics: the road to economic prosperity starts with a free-market economy. An economy revolving around economic freedom and private ownership of resources typically displays three attributes. First, free-markets generate prices able to coordinate the millions of firms and consumers that make up the economy. Second, free-markets engender a continuous flow of innovations that add to economic prosperity. And finally, this sort of economy tends to produce satisfactory social outcomes. It is no exaggeration to say that the doctrine survives only because there is nothing better we know about.

5.2.Evolutionary Economics

It should be clear that the Invisible Hand conjecture is an insight that supports a doctrine. But we still need a satisfying conceptual structure in which the conjecture can be embedded in a meaningful way. We believe that an appropriate interpretative framework for the Invisible Hand conjecture can be found in the evolutionary approach. To be more precise, the Invisible Hand fits nicely with the convergence of scholarly strands associated with Joseph Alois Schumpeter, Friedrich August von Hayek, Israel M. Kirzner, Frank H. Knight, George L. S. Shackle, and Brian J. Loasby, to name some of the most prominent contributors.

It is impossible to summarize in a few paragraphs the enduring contributions of these prolific authors. But it is true, also, that all scholars of innovation are familiar with their work. We feel that the following succinct outline –admittedly incomplete– is an acceptable background vision for interpreting the central message conveyed by the Invisible Hand.

We start the outline with a summary formulation of the 'connecting principles.' The line of reasoning Schumpeter (1934)-Hayek (1978)-Kirzner (1973) can be thought of as a conceptualization of a *creative economy*, that is, an economy in which the increase in the standard of living of its residents is primarily based on the production of profitable new ideas.

The incessant search for novelty is the manifestation of a creative economy at work. This leads us to Knight (1921) and Shackle (1972): uncertainty is the precondition for imagination, and imagination is the source of creativity. Loasby (2002) articulates what may be called *evolutionary economics synthesis*. This synthesis presupposes a creative economy and is the natural environment in which the Invisible Hand works its magic.

To bring out clearly the progression of thought through time, a very brief review of the individual contributions is in order.

(1) Schumpeter

Schumpeter (1934) was the first economist to maintain that it is impossible to understand the economy without a thorough understanding of business innovation and to emphasize the crucial role of growth-inducing profit-seeking innovators. Schumpeter (1954, p. 182) was also the first economist to surmise that the original contribution of Adam Smith is to be found in the set of *Essays on Philosophical Subjects*, and especially his *History of Astronomy* –not in the *Wealth of Nations*.^{vii}

(2) Hayek

In a conference delivered to a meeting of the Philadelphia Society at Chicago in 1968, Friedrich Hayek considered an economy in which competition is a discovery process. The economic agents in this economy are constantly striving to expand their knowledge into some area where knowledge is scarce or non-existent in order to find out whether they might develop new products or processes or new forms of organization. In the view of Hayek (1978), innovations are launched first, the benefits and costs are discovered afterward.

(3) Kirzner

Kirzner's (1973) entrepreneurs are alert economic agents seeking unexploited opportunities. Kirzner's fundamental proposition is that the greater the range of unexploited opportunities, the greater the chance that someone will discover them, and the greater the incentive to search for new ideas with economic value.

(4) Knight

Innovativeness raises uncertainties and ambiguities. It was Frank Knight (1921) who first stressed the importance of separating risk (or calculable uncertainty) from uncertainty in the strict sense (or Knightian uncertainty). Risk poses no threat to perfect competition but the homogeneity of perfect competition cannot be preserved under Knightian uncertainty. Economic success is in part a reflection of entrepreneurial capabilities. Knight did not believe that economic success was purely a matter of chance. Innovativeness poses ambiguity and the law of 'unanticipated consequences' applies. Merton (1936).

(5) Shackle

This is not the occasion for an evaluation of the George Shackle's (1972) contributions to economics; but it is relevant to note that he considered with care and lucidity two important

insights for evolutionary economics. First, prices have an allocative role and a practical role as conventions which simplify decisions (Shackle 1972, 227-228). Second, uncertainty can be exploited and endured, and above all, uncertainty is the mother of imagination (Shackle 1972, 444).

(6) Loasby

The *evolutionary economics synthesis* is due to Loasby (2002). His synthesis presupposes a creative economy in a fundamental way. The economy is populated by indefatigable seekers of novelty who are elements in a vast and complex system plagued by uncertainty. The perpetual search for successful innovations incites the growth of knowledge.

More specifically, Loasby's (2002) paper is a tour de force involving three stages. The first stage consists of the formulation of a broad definition of the term evolution: "evolution is broadly defined as a process, or cluster of processes, which combines the generation of novelty and the selective retention of some of the novelties generated." (Loasby 2002, 1227). This definition suffices to attain two objectives: first, drawing the line between evolutionary and non-evolutionary economics, and second, establishing the differences between evolutionary economics and the biological model.

Then, Loasby convincingly argues that Adam Smith's economics provides a better basis for evolutionary economics than biological models, and identifies seven elements in Smith's psychological theory: innovation (new ideas); complex motivation; link between emotion and aesthetic; diffusion of connecting principles; renewed search for connecting principles; the evolution of the evolutionary process itself; and division of labour (the prime connecting principle).^{viii}

In the final stage, Loasby invokes the unifying principle of evolutionary economics, namely: the behaviour of any system depends on both the elements of which it is composed and the pattern of interactions between them, and remind us that understanding business innovation requires understanding of human knowledge. The construction of knowledge consists of creating categories and establishing links between them, that is, "human intelligence relies on connecting principles." (Loasby 2002, 1235).

5.3. The Ultimate Message

Reverting to the purpose of our paper –reconciling the Invisible Hand and innovation– we proffer that the ultimate message of Adam Smith's immortal metaphor has to be read within the evolutionary economics synthesis. Smith proclaimed that the economic process works exceedingly well in the context of free-markets and well-defined property rights. The free-markets envisaged by Adam Smith are populated by self-interested profit-seeking individuals and involve both an allocative function and a process of discovery. These individuals decipher the signals sent by either the prices of existing products or the potential profits associated with products not yet introduced in the market. There are purposeful interactions and unintended consequences resulting from these interactions. The signals are the unseen

forces (or Invisible Hand) that govern the evolution of a creative economy and stimulate the growth of knowledge.

Homo economicus is not the only economic agent alluded in the Invisible Hand paragraph. *Homo creativus* –defined as someone who is ingenious in introducing novelty that adds to his own wealth, prestige, and power– is also touched by the unseen forces of the free-market. He is a decision maker unable to optimize because uncertainty pervades the innovation process. His job is to create new ideas and to put them into effect.

6. Summary

Returning to the opening paragraph of this paper, it should be emphasized that no complete understanding of the economy is possible without a thorough grounding in the world of business innovation. As a result, the neoclassical orthodoxy deeply rooted in the teaching of economics should be complemented with an integration of innovation in elementary economic education.^{ix} Fortunately, this integration fits nicely with the Invisible Hand conjecture.

Adam Smith proposed that the free-market mechanism acted like a guiding Invisible Hand. The felicitous metaphor he chose was exactly apposite to describe the impersonal workings of that human institution, the free-market economy. Free markets typically work well to expand income and wealth as well as economic opportunities.

The idea that perfect competition achieves both Pareto efficiency and some form of welfare maximization –often captured by the expression Invisible Hand Theorem– pervades much of the history of economic thought. This theorem exhibits two severe limitations: first, the theorem refers to a non-existent economy, and second, innovation is assumed away. Certainly, Adam Smith did not suggest as much with the assertion that in pursuing her own gain, the individual is led by an Invisible Hand to promote an end that she does not intend and is frequently in the interest of society.

However, confusion still prevails. For example, Landreth and Colander assert that Arrow and Debreu *proved* the Invisible Hand conjecture:

General equilibrium theorists have found the answer to the question “Does the invisible hand work?” to be yes, as long as certain conditions hold true. Their *proof*, for which Arrow and Debreu received Nobel prizes, was a milestone in economics because it *answered* the conjecture Adam Smith has made to begin the classical tradition in economics. Much subsequent work has been done in general equilibrium theory to articulate the invisible-hand theorem more elegantly and to modify its assumptions, but by first proving it, Arrow and Debreu earned a place in the history of economic thought. (Landreth and Colander 2002, 393, *italics added*)

Undoubtedly, the proof of existence of general equilibrium constitutes a major achievement for the formalist revolution in microeconomics that started in the late 1930s. It is true that the

Arrow-Debreu proof of the existence and optimality of general equilibrium is mathematically impeccable but it is true, also, that the Arrow-Debreu model does not prove or disprove the Invisible Hand conjecture. The Arrow-Debreu model is both a supreme and extreme example of a purely deductive model.

The Arrow-Debreu proposition that “a free-market economy throws up efficiency” engenders two paradoxes. First, no real economy satisfies the necessary conditions for the Invisible Hand Theorem and it is impossible to empirically refute the Invisible Hand Theorem. Second, the Invisible Hand of the free-market economy cannot perform any task in relation to business innovation. This is nonsense as descriptive economics.

The famous Invisible Hand paragraph in the *Wealth of Nations* is silent on the question of efficient allocation of resources and Smith had little to say on the subject anywhere else in the *Wealth of Nations*. In this paper we have disentangled what we believe is the appropriate interpretation of the Invisible Hand conjecture from what we believe is the distorted view emerging from the Invisible Hand Theorem.

The reconciliation of the Invisible hand and innovation has been accomplished in two steps. First, we have shown that the conjecture supports the Invisible Hand Doctrine. Somewhat loosely, this doctrine asserts that the road to economic prosperity starts with the organization of the economy along the lines of the weak definition of a free-market economy (a far cry from perfect competition). Second, we make contact with evolutionary economics to find an approach able to accommodate the Invisible Hand Doctrine.

Loasby (2002) has argued convincingly that Adam Smith provides a foundational model of the growth of knowledge as an evolutionary process and has articulated an evolutionary economics synthesis by connecting the lines of argument associated with Schumpeter, Hayek, Kirzner, Knight, and Shackle. If we want to do economics in the spirit of these outstanding pioneers, we must switch from close to open systems, and from logical inference to reliable inference.

The evolutionary synthesis is the appropriate framework for the comprehension of the fundamental message of the Invisible Hand paragraph. A creative economy lies at the heart of this synthesis. Smith is saying that the participants in a free-market economy are profit-seeking creatures motivated by self-interest and that the Invisible Hand of the free-markets guides this self-interest into promoting general economic well-being. Both *homo economicus* and *homo creativus* are tacitly contemplated in the paragraph in question. Both of them are profit-oriented individuals. However, *homo economicus* does not innovate and never will. *Homo creativus* is the key agent behind the growth of knowledge.

Economists know well that to interpret the great economic thinkers of past times is not an easy task. However, the succeeding generations of economists –Nobel Prize winners included– who are ‘standing on the shoulders of the giants,’ should make sure that their interpretations of the outstanding pioneers do not constitute an historical travesty.

References

- Antonelli, Cristiano. 2011. "The Economic Complexity of Technical Change: Knowledge Interaction and Path Dependence." In *Handbook on the Economic Complexity of Technical Change*, edited by Cristiano Antonelli, 3-51. Massachusetts: Edward Elgard.
- Arrow, Keneth, and Gerard Debreu. 1954. "Existence of Equilibrium for a Competitive Economy." *Econometrica* 22 (3): 265-290.
- Debreu, Gerard. 1959. *The Theory of Value: An Axiomatic Analysis of Economic*. New Haven Conn.: Yale University Press.
- Hahn, Frank. 1982. "Reflections on the Invisible Hand." *Lloyds Bank Review* 144 (1): 1-21.
- Hayek, Friedrich. 1978. "Competition as a Discovery Procedure." Reprinted in Friedrich Hayek, *New Studies in Philosophy, Economics and the History of Ideas*. Chicago: University of Chicago Press. Lecture originally delivered in 1968.
- Kaldor, Nicholas. 1972. "The Irrelevance of Equilibrium Economics." *Economic Journal* 82 (328): 1237-1255.
- Kirman, Alan. 1989. "The Intrinsic Limits of Modern Economic Theory: The Emperor has no Clothes." *Economic Journal* 99 (395): 126-139.
- Kirzner, Israel. 1973. *Competition and Entrepreneurship*. Chicago: University of Chicago Press.
- Knight, Frank. 1921. *Risk, Uncertainty and Profit*. Boston: Houghton Mifflin.
- Landreth, Harry, and David Colander. 2002. *History of Economic Thought*. Boston: Houghton Miffling.
- Lipsey, Richard, and Kelvin Lancaster. 1956. "The General Theory of Second Best." *Review of Economic Studies* 24 (1): 11-32.
- Loasby, Brian. 2002. "The Evolution of Knowledge: Beyond the Biological Model." *Research Policy* 31 (2): 1227-1239.
- Marshall, Alfred. 1966. *Principles of Economics*. London: Macmillan. First published in 1890.

- McCloskey, Donald. 1983. "The Rhetoric of Economics." *Journal of Economic Literature* 21 (1): 481-517.
- Merton, Robert. 1936. "The Unanticipated Consequences of Purposive Social Action," *American Sociological Review* 1 (2): 894-904.
- Nelson, Richard, and Sidney Winter. 2002. "Evolutionary Theorizing in Economics." *Journal of Economic Perspectives* 16 (2): 23-46.
- Persky, Joseph. 1989. "Adam Smith's Invisible Hands." *Journal of Economic Perspectives* 3 (4): 195-201.
- Pol, Eduardo. 2013. "Innovation and Economic Education: An Integration." *Journal of Economics and Economic Education Research* (forthcoming).
- Robbins, Lionel. 1978. *The Theory of Economic Policy*. London: The Macmillan Press. First published in 1952.
- Samuelson, Paul. 1965. *Foundations of Economic Analysis*. New York: Atheneum. First published in 1947.
- Samuelson, Paul, and William Nordhaus. 1998. *Economics. Sixteenth Edition*. New York: Irwin/McGraw-Hill. First published in 1948. W. Nordhaus has been the primary author of this classic textbook since the 12th edition.
- Shackle, George. 1972. *Epistemics and Economics*. Cambridge: Cambridge University Press.
- Schumpeter, Joseph. 1934. *The Theory of Economic Development*. Cambridge Mass.: Harvard University Press, First published in German in 1911.
- Schumpeter, Joseph. 1954. *History of Economic Analysis*. London: George Allen & Unwin.
- Schumpeter, Joseph. 1947. "The Creative Response in Economic History." *Journal of Economic History* 7 (2): 149-159.
- Smith, Adam. (1976). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Oxford: Clarendon Press. First published in 1776.
- Smith, Adam. 1980. "History of Astronomy." In *Essays on Philosophical Subjects*, edited by Ian Ross, 33-105. Oxford: Oxford University Press. First published in 1795.
- Smith, Adam. 1981. *The Theory of Moral Sentiments*. Edited by D.D. Raphael and a. L Macfie (Eds.). Indianapolis: Liberty Fund. First published in 1759.
- Weintraub, Roy. 1979. *Microfoundations. The Compatibility of Microeconomics and Macroeconomics*. Cambridge: Cambridge University Press.
- Weintraub, Roy. 1983. "On the Existence of Competitive Equilibrium: 1930-1954," *Journal of Economic Literature* 21 (1): 1-39.

Endnotes

ⁱ In particular, the familiar comparative statics analysis completely ignores the creative response. A glance at Samuelson (1965), particularly Chapter II –entitled *Equilibrium Systems and Comparative Statics*– confirms this point.

ⁱⁱ In the golden edition of *Economics*, Samuelson uses the expression “invisible hand result” instead of “invisible hand theorem.” (Samuelson and Nordhaus 1998, 285).

ⁱⁱⁱ Technological externalities arise when economic activities bestow benefits (or impose costs) that are not paid for in the marketplace. If costless negotiation is possible between the parties concerned, externalities do not prevent efficiency. Externalities –both positive and negative– are an important and pervasive phenomenon in the contemporaneous economy.

^{iv} Assuming away innovation has another ‘desirable’ implication on efficiency grounds. Innovation nearly always engenders technological externalities such as knowledge spillovers. But for a free-market economy to be efficient, there must be no technological external effects.

^v For an admirable treatment of the concept of economic freedom historically contemplated, see (Robbins 1978, Lesson I).

^{vi} This point is forcibly made by D. McCloskey (1983).

^{vii} In the *History of Astronomy*, Smith (1980) introduced a psychological theory of the emergence and development of science as a consequence of a human desire for mental tranquillity. Philosophers and scientists create categories of analysis and formulate links between them through ‘connecting principles.’ (Smith 1980, 45).

^{viii} The explanation of the Smith’s theory appears in the sub-section entitled ‘The Evolution of Ideas and Capabilities’ (Loasby 2002, 1231 -1233). In passing, we note that this sub-section can be thought of as a *proof* that Schumpeter was right in relation to the *original* contribution of Adam Smith.

^{ix} This possibility is explored in Pol (2013).