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Economic cosmology and the evolutionary challenge

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ABSTRACT

The intellectual histories of economics and evolutionary biology are closely intertwined because both subjects deal with living, complex, evolving systems. Because the subject matter is similar, contemporary evolutionary thought has much to offer to economics. In recent decades theoretical biology has progressed faster than economics in understanding phenomena like hierarchical processes, cooperative behavior, and selection processes in evolutionary change. This paper discusses three very old "cosmologies" in Western thought, how these play out in economic theory, and how evolutionary biology can help evaluate their validity and policy relevance. These cosmologies are: (1) "natural man" as a rational, self-sufficient, egotistical individual, (2) competition among individuals can lead to a well-functioning society, and (3) there exists an ideal optimal state of nature. These correspond to Colander et al. (2004) "holy trinity of orthodox economics", rationality, greed, and equilibrium. It is argued below that current breakthroughs in evolutionary biology and neuroscience can help economics go beyond these simple cosmologies.

1. Introduction

Theoretical controversies in biology and economics are remarkably similar: This is so because of the similarity of the subject matter of the two disciplines (evolving complex systems), and because both fields have implicitly adopted core beliefs embodied in "Western Cosmology" (Sahlins, 1996)[1] that have preoccupied theologians, philosophers and social theorists for millennia. However, the last thirty years have seen a revolution in thinking about evolution in biology and in relation to our own species (Hodgson, 1993; Rosser, 2011; Boehm, 2012; Henrich, 2004; Henrich et al., 2004; Jablonka and Lamb, 2006; Manner and Gowdy, 2010; Nowak and Highfield, 2011; Richerson and Boyd, 2005; Wilson, 2012a). The purpose of this special issue of JEBO is to show how these developments can offer guidance for rethinking economic theory. The role

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[1] The term "cosmology" is used by Sahlins and other anthropologists to define a level of analysis that lets us at least partially escape the confines of a highly evolved "mother culture." Applbaum (1998, p. 325) writes: "[T]he term 'cosmology' appears a more flexible and inclusive substitute for culture, indicating a totalizing framework in which culture is given historical and manipulable dimensions while retaining both its totalizing quality and its subjective interpretability through 'key symbols'".

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of this article within the special issue is to show how the developments can help to overcome the limitations and biases implicit in the core beliefs of Western Cosmology. These beliefs include the view that (1) "natural man" is a self-regarding, egotistical individual free from the bonds of human society, (2) despite the self-interest of its members, qua competition among them, society can function well, and (3) there exists an ideal, optimal state of nature.

These three features of the Western cosmology are reflected in canonical economic theory in the form of the self-interested, rational actor assumption, the invisible hand conjecture, and the belief in the existence of a general market equilibrium, respectively. The same three features are reflected in the history of evolutionary biology. Adaptation and natural selection have often been framed in terms of individual self-interest. Higher-level units such as single-species, social groups, and multi-species ecosystems have been assumed to function well, despite the self-interest of their members. And much ecological and evolutionary modeling has assumed the existence of a general equilibrium.

While both economic and evolutionary theory have been influenced by the three cosmologies, evolutionary theory has arguably made more progress going beyond them during the last thirty years. The individual is no longer regarded as a privileged level of the biological hierarchy. Contrary to the invisible hand metaphor, individual self-interest frequently undermines societal welfare unless special conditions are met. And most ecological and evolutionary systems are in a state of disequilibrium.

In the subsequent sections of this article we will explore the three cosmologies in relation to economics and evolution in more detail. One of our goals is to show how both bodies of knowledge have been influenced by ideas that precede them by centuries and even millennia. Another of our goals is to use the advances in evolutionary theory to help economic theory move beyond the three cosmologies. Accordingly, in Section 2 we discuss the concept of individual self-interest a grand explanatory principle. Section 3 is devoted to exploring the notion of the invisible hand, which supposes that societies can function well without members of the society having its welfare in mind. In Section 4 we turn to the idea of the existence of a socially optimal state represented in economics by the general, competitive market equilibrium and discuss how it influences economic policy recommendations. Section 5 concludes.

2. Individual self-interest as a grand explanatory principle

It is always disconcerting to discover that ideas we think are new and fresh have in fact been in the air for hundreds if not thousands of years. Sahlins (1996) refers to this as "intellectual vertigo." The ideas discussed below have been central to the Judeo-Christian world for millennia and are encapsulated and reincarnated in economic theory. These ideas and their associated assumptions continue to shape, and sometimes cloud, our understanding of economy, society, and the relationship of humans to the natural world. A first core belief of the Western cosmology relates to the question of how to interpret human nature, particularly with respect to selfishness. Already in 1431 Lorenzo Valla wrote:

> "And what is the aim of friendship? Has it been sought for and so greatly praised by all ages and nations for any other reasons than the satisfactions arising from the performance of mutual services such as giving and receiving whatever men commonly need? . . .As for masters and servants, there is no doubt their only aim is common advantage. What should I say about teachers and students?...What finally forms the link between parents and children if it is not advantage and pleasure?" (quoted in Sahlins, 1996, 399)[2]

In this view, other people are merely a means to enhance individual utility.[3]

In this logic, the autonomous, self-interested individual is the natural unit of analysis as it was put center stage in economics in the so-called marginalist revolution of the 1870s while abandoning the earlier psychological connotations (see Bruni and Sugden, 2007). Pareto was explicit about this: "It is an empirical fact that the natural sciences have progressed only when they have taken secondary principles as their point of departure, instead of trying to discover the essence of things. . .Pure political economy has therefore a great interest in relying as little as possible on the domain of psychology" (quoted in Busino, 1964). By relying on an economic model composed of self-regarding rational individuals, economics could be reduced to the study of "the mechanics of utility and self-interest" (Jevons, 1871, p. 90).

This cosmological element is enshrined in canonical economic theory to the present day. A necessary feature of the Walrasian model is the self-regarding consumer whose utility function is not affected by the utility of others (Walras, 1874). If this is not assumed, the mathematical proof of the efficiency of competitive equilibrium breaks down (Gowdy, 2004b; Henderson and Quandt, 1980, p. 297).[4]

[2] As Lovejoy (1936) argues, this conception of man has divine origins. He quotes Aristotle (Lovejoy, 1936, p. 42) as follows: "One who is self-sufficient, can have no need of the service of others, nor of their affection, nor of social life, since he is capable of living alone. This is especially evident in the case of God. Clearly he is in need of nothing, God cannot have need of friends, nor will he have any."

[3] The term "reciprocal altruism was coined by Trivers (1971). Fehr and Schmidt (1999) distinguished between "reciprocal altruism" which can be attributed to self-interest and "pure altruism" which cannot. This was criticized by Binmore and Shaked (2010). See the response by Fehr and Schmidt (2010).

[4] To be clear about this, one could certainly construct a utility function where the well-being of consumer A depends on the well-being of consumer B, as in $U_A = F(X,Y,U_B)$. But this form does not lead to the result that the marginal rates of substitution for commodities are the same for the two consumers and thus one cannot go on to prove the Pareto efficiency of competitive exchange (Henderson and Quandt, 1980, p. 297)—*the* major result of canonical welfare economics—the First Fundamental Theorem of Welfare Economics. Utility functions can include "altruism" but they must still be self-regarding—altruism gives *me* utility.

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The focus on the autonomous individual, independent of society, and the way it plays out in economic theory has political and ideological implications. For example, the isolated actor model underlying the marginal productivity theory of distribution—asserting that an individual's contribution to economic output can be isolated from the contributions of others—is frequently presented as a moral justification for the economic status quo. In the canonical model, in an ideal market economy people are paid what they deserve, that is, the amount each person contributes at the margin to economic output. In marginal productivity theory only the addition to economic output counts—the social nature of technology and production is ignored (Miller, 2000; Pullen, 2001). The policy implication is clear—you earned your pay in a competitive market, you get to keep it. As D'Souza (2001) puts it: "The guy who is worth little has probably produced little of value. By the same taken, the guy who's earning twice as much as you is most likely—perish the thought—twice as good as you are." To consider the social nature of production is to suggest a very different political perspective. Elizabeth Warren (2011) makes this clear:

> There is nobody in this country who got rich on his own. Nobody. You built a factory out there—good for you. . .But I want to be clear. You moved your goods to market on the roads the rest of us paid for. You hired workers that the rest of us paid to educate...Part of the underlying social contract is you take a hunk of that and pay forward for the next kid who comes along.

Economic output and current technology is the result of innumerable advances over the course of human history and the evolution of industrial society. Production is a social, not individual, undertaking.

Criticisms of the notion that humans are purely self-regarding go back to the beginnings of modern utility theory. For example, Edgeworth (1881) included a term accounting for pure altruism in his theory of exchange which he called a "coefficient of effective sympathy." Veblen's (1898) criticism of the neoclassical concept of humans as a coldly calculating "homogeneous globules of desire" is still one of the most insightful in the literature. Another early criticism is that of Georgescu-Roegen (1954) who argued that individual utility depends not only on individual well-being but also the well-being of the community to which the individual belongs. Similarly, a long list of authors such as Kapp (1950), Mishan (1967), Scitovsky (1976), Sen (1977), Ostrom (2005), and Witt (2010) to mention just a few have emphasized the social nature of human decision-making.[5] The assumption of self-regarding, perfectly rational behavior is also embedded in the micro-foundations approach to macroeconomics. The avalanche of micro-founded, rational expectations models since the 1970s has accordingly driven out all psychological conjectures still present in Keynesian macroeconomics. Moreover, these models implicitly suggest that causality in economic change moves only upward from the level of the individual to the super-individual level. This simplification ignores that there are also causal effects in the opposite direction. Group level phenomena, for instance, can affect individual behavior, because the presence of groups can change the behavior of individuals interacting with each other. These interactions can, in turn, affect the economic system as a whole. The combination of individuals and groups means that upward and downward causation operate simultaneously (Gowdy and Seidl, 2004; Campbell, 1974; Gowdy, 2004a; van den Bergh and Gowdy, 2009).

The history of thinking on individuals and groups in evolutionary theory can help economic theory move beyond its assumptions about individuals and groups (Wilson, 2002, 2004). Many adaptations are non-social, such as the sharp teeth of the tiger or the keen eyesight of the hawk. They evolve by virtue of some individuals surviving and reproducing better than others, as Darwin outlined in *Origin of Species*.

Social behaviors are another matter. Imagine the traits that are required for a group to function well as a collective unit. Now imagine the traits that are required for an individual to maximize its survival and reproduction, compared to other members of its own group. As a basic matter of tradeoffs, these traits will often be different from each other. How can natural selection favor traits that are "for the good of the group" when they are selectively disadvantageous within groups? The answer is, by a process of between-group selection. Groups of solid citizens outcompete other groups, even if solid citizens are not selectively advantageous within their own groups.

This way of thinking about evolution, which began with Darwin (Sober, 2010), is called multilevel selection theory (Wilson, 1997; Borrello, 2012; Crow, 1955; Okasha, 2006; Sober and Wilson, 1998; Williams, 1966; Wilson, 2011a; Wilson and Wilson, 2007). Nature consists of a nested hierarchy of units: Genes exist within individuals, which exist within groups, which exist within a multi-group population. Natural selection within any given unit favors traits that frequently undermine the fitness of the unit as a whole. Cancer cells outcompete normal cells within the body but result in the death of the individual. Individuals who care only about feathering their own nests outcompete solid citizens within groups, but result in dysfunctional groups. Groups of solid citizens outcompete other groups, but if competition takes the form of warfare it can be dysfunctional at the level of the multi-group population. The general rule is "adaptation at any level of a multi-tier hierarchy requires a process of selection at that level and is frequently undermined by selection at lower levels."

Notice that there is nothing privileged about the individual level of the hierarchy. An individual can become a dysfunctional group of cells and genes, an autonomous agent that maximizes its relative fitness within groups, or an obedient "cell"

[5] A large number of economic models have been constructed to explain altruism, charity, benevolence, and bequests. However, in doing so, many economists and other social scientists have been ingenious in finding explanations for the motives for such behavior precisely in the pursuit of self-interest. Possible selfish motivations leading to apparently altruistic behavior include enlightened self-interest, pursuit of reputation, anticipation of reciprocity, and fear. Further explanations are that personal utility may be derived from someone else's satisfaction, or that benefits may arise from the adherence to a social contract (Arrow, 1987).

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in a group-level "superorganism", depending upon where selection acts in the multi-tier hierarchy (Hölldobler and Wilson, 2009; Maynard Smith and Szathmary, 1995, 1999). This is profoundly different than the status of individuals as self-regarding agents in economic theory.

The concept of multilevel selection has an interesting history. While Darwin appreciated the need for group-level selection to evolve group-advantageous traits (Sober, 2010), other biologists erroneously assumed that adaptations evolve at all levels of the biological hierarchy without requiring special conditions (e.g., Wynne-Edwards, 1962). This position came under scrutiny in the 1960s and a consensus emerged on two points. First, the logic of multilevel selection was affirmed; group-level adaptations require a process of group-level selection. Second, group-level adaptations seldom evolve in nature, even though they can evolve in principle, because between-group selection is almost invariably weak compared to within-group selection (Dawkins, 1989; Williams, 1966).

Today, the first point remains intact but the second point has been overturned. Traits frequently evolve by between-group selection in nonhuman species. Most important for economic theory, humans are a highly group-selected species. To be precise: Many human behavioral and psychological traits evolved not by virtue of increasing the fitness of individuals compared to other members of their own group, but by virtue of increasing the fitness of groups compared to other groups. Humans were selected for teamwork.

The history of multilevel selection theory is complicated by the fact that group-selected traits can be made to appear individually selfish by altering the frame of comparison. Consider a classic multilevel selection model in which a selfish trait is favored by within-group selection and an altruistic trait is favored by between-group selection. If between-group selection prevails, then the altruistic trait evolves in the total population, despite its selective disadvantage within groups. It is easy to conceptualize the altruistic trait as selfish based on its overall advantage—even though between-group selection was required to provide the advantage. By the same token, selection among genes within individuals results in traits such as cancer that are detrimental to individuals. But genes that evolve by between-individual and between-group selection can also be conceptualized as selfish, since any gene that evolves in the total population is more fit than the genes that did not evolve, all things considered.

Multiple definitions of self-interest within evolutionary theory, based on multiple frames of comparison, do not change any of the biological facts that we outlined above in terms of multilevel selection theory. None of them deny the importance of teamwork in human evolution or justify the economic concept of individuals attempting to maximize an absolute utility function that is uninfluenced by other individuals. When we turn to empirical studies of human preferences, from neurobiology to social psychology, the evidence is highly supportive of humans as a highly group-selected species and clearly at odds with the model of a purely autonomous, rational actor. Results from now classic behavioral experiments like the ultimatum games, the public goods game and even the one-shot prisoner's dilemma indicate that economic behavior can to a considerable extent be other-regarding (Henrich et al., 2004).[6] The behavioral evidence is verified by neuroscience confirming the existence in humans of the "social brain" (Frith and Frith, 2010). Humans are capable of putting themselves in the shoes of others, understanding their intentions, and feeling empathy for them (Tomasello, 1999). The degree to which this social intelligence is "hard-wired" into the human brain is almost unique among mammals. New findings about the structure of the human brain show that it is designed for sociality (Wexler, 2006). Evidence from historical and contemporary hunter-gatherer groups indicates strongly that cooperation evolved in the hunter-gatherer phase of human history (Boehm, 2012; Bowles and Gintis, 2011; Gowdy, 1998).

On the other hand, human social intelligence not only helps coordination and cooperation by understanding the intentions of others, it can also be used to out-compete rivals, where competition prevails. Empathy for some fellow citizens may often coexist with antipathy for others—the dark side of the group selection coin (Berreby, 2005). Competitive behavior is a natural attitude in many contexts, and competition between members of society is a pervasive phenomenon. The decisive point is to recognize that self-regarding behavior is neither the only natural attitude nor the exclusive form of human interaction – not even in markets. The balance between cooperation and competition is delicate, but essential for understanding both human sociality and the way in which economies operate.

Put differently, where competitive behavior is in some cases beneficial in activating the human propensity to "truck and barter" (Smith, 1776), in other cases it can trigger welfare losses or even anti-social behavior. For example, as Robert Frank (2011) has argued, status races for the biggest houses or most expensive cars can waste resources without actually raising anyone's welfare. In this case, constraining competition by appropriate policy measures such as progressively taxing consumption may make all people better off. A similar point was made by Layard (2005) who distinguished between competitive and non-competitive goods. Experimental evidence indicates that if everyone receives a higher income, relative position does not change and soon the beneficial effects wear off. Leisure time, on the other hand, is not a competitive good. Layard argues that if everyone receives more vacation time, all are better off.[7]

[6] For decades the classic defense of the rational actor model was that, although the underlying assumptions are unrealistic, it makes good predictions of actual behavior. Since that defense has been demolished, the fallback position is that the model gives "insights." "Faced with a choice between a theory which predicts well but gives us little insight into how the system works and one which gives us insight but predicts badly, I would choose the latter." (Coase, 1995, p. 17).

[7] Ng (1987) has argued that taxing goods purchased for conspicuous consumption (Veblen goods) is a win–win exercise. The people who buy them are happier since the higher price allows them to gain even more prestige and the government gets more tax revenue.

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The consensus among evolutionists that humans are a highly group-selected species (as conceptualized within multilevel selection theory) challenges the individualistic assumption of economics at its core. A more profitable unit to theorize about is the small face-to-face group, whose members are interdependent and capable of suppressing self-serving behaviors at low personal cost (e.g., gossip; Boehm, 2012; Wilson et al., 2000; Kniffin and Wilson, 2005). This was the human social environment for many thousands of generations, prior to the advent of agriculture only about 13,000 years ago. Economic assumptions about human social preferences should be based upon the psychological traits that evolved to enable human groups to function adaptively at this scale. Large-scale social institutions must be understood as a product of cultural evolution in which culturally derived traits interface with genetically evolved psychological traits. Considerable progress along these lines has already been made by economists and members of other human-related disciplines who have become knowledgeable about current evolutionary thought (e.g., Henrich et al., 2004; Richerson and Boyd, 2005).

3. Does self interest lead to social harmony?

The "invisible hand" of the market is one of the best-known metaphors in Western cosmology. The idea is often traced to Mandeville's (1705) *Fable of the Bees or Private Vices, Public Benefits* (Fraud, Luxury and Pride must live/While we the Benefits receive/Hunger's a dreadful Plague, no doubt/Yet who digests or thrives without?) or Alexander Pope's (1734) *Essay on Man* ("Thus God and Nature linked the general frame/And bade Self-love and Social be the same") but the roots of the metaphor are much deeper. Benardino Telesio in 1565 described the organization of the universe as the result the self-interested actions not only of living things but even inanimate objects:

It is quite evident that nature is propelled by self-interest. In fact, nature can tolerate neither vacuum nor anything without a purpose. All things enjoy touching one another, and maintain and conserve themselves by this mutual contact.[8]

The problem with the notion of an invisible hand guiding the common pursuit of self-interest to contribute to the common good, i.e. result in a spontaneous order or harmony, are its tacit presumptions. Too often – but almost always in the general equilibrium version of the invisible hand – a necessary condition for the alleged beneficial outcome is left out: the condition that human sociality and morals must set limits to the individual pursuit of self-interest. These limits are highlighted by the divide between honesty and fairness vs. deception and exploitation in exchange and the division of labor; or by obedience to the rule of law vs. obedience to violent coercion prevailing in the "spontaneous order" created by the mafia. Adam Smith was well aware of the "social capital" on which the beneficial effect of the division of labor rests. He had a sophisticated sense of human psychology and social behavior, developed most fully in his treatise on moral sentiments (Smith, 1759), which is broadly consistent with the modern evolutionary view (e.g., Gintis et al., 2005). In contrast, the version of the invisible hand informing modern general equilibrium economics focuses selectively on Smith's (1776) plea for unfettered markets as a source of wealth and welfare.[9]

Evolutionary theory can help economic theory move beyond its current concept of the invisible hand, along with its current concept of individual self-interest. Nonsocial behaviors that increase the fitness of individuals without harming other individuals evolve straightforwardly by individual-level selection and contribute to the welfare of groups. When it comes to social behaviors, however, the dictum stated in the previous section—adaptation at any level requires a process of natural selection at that level and tends to be undermined by selection at lower levels—is the opposite of the invisible hand. Traits that increase the fitness of genes compared to other genes within the same individual, or the fitness of individuals compared to other individuals within the same group, should not be expected to increase the welfare of the group.

The concept of the invisible hand makes two claims: (1) groups function well as units (2) without members having the welfare of their group in mind. The first claim requires group-level selection to prevail over lower levels of selection, as we have seen. When this happens, traits are selected that cause individuals to coordinate their activities for the good of the group. These traits need not require having the welfare of the group in mind, and do not even require having a mind in the human sense of the word.

It is helpful to examine the invisible hand concept in well-adapted biological units, such as multicellular organisms and social insect colonies, before turning to the human case. These units are miracles of adaptive self-organization. Their parts—cells in the case of multicellular organisms and single insects in the case of social insect colonies–interact in just the right way to enable the whole to function as collective units. The interactions were winnowed by between-individual selection and between-colony selection, respectively, from a much larger set of interactions, the vast majority of which would have led to dysfunctional outcomes at the level of the whole. Neither cells nor insects require minds in the human sense of the word to play their role in the economy of the whole. Instead, they simply respond to local circumstances, as if guided by an invisible hand. The invisible hand *is* selection at the level of the whole.

Returning to the human case, our psychological dispositions have been molded by thousands of generations of between-group selection, operating on both genes and cultures, enabling us to function as coordinated groups at least some of the time, thereby satisfying the first part of the invisible hand concept. The psychological dispositions that evolved by between-group

[8] Quoted in Sahlins (1996, p. 400). The connections between economic theory and fundamentalist religion have been well documented (Hilton, 1986; Cox, 1999; Foley, 2006).

[9] It is worth noting that Adam Smith did not claim that man is unconditionally selfish. Subsequent generations of economists have easily overlooked the caveats he made. See Cartwright (2011) and Smith (1998) for excellent discussions of Smith's interest in behavioral economics.

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selection need not require having the welfare of the group directly in mind, any more than for cells or insects. Instead, individuals might be pursuing their own interests in their own minds, but however they conceptualize their own interests, it is a very small subset of possible conceptualizations, most of which would lead to dysfunctional outcomes at the level of the group.

This is a critical point, because the economic concept of the invisible hand is often interpreted to mean that a single concept of self-interest (such as maximizing wealth) robustly benefits the common good. In the evolutionary concept of the invisible hand, there is an almost infinite variety of concepts of self-interest (ways that individuals respond to their local situation without necessarily having the welfare of the whole group in mind), most of which do not benefit the common good. In addition, among the psychological dispositions favored by between-group selection, some are likely to count as genuinely oriented toward the welfare of others and the group as a whole. Why not, since that is their ultimate purpose (see Wilson and Gowdy, in press for a discussion of ultimate vs. proximate causation in evolutionary theory)?

When we turn from evolutionary theory to the empirical literature on human psychological dispositions, we find a complex mix of self- and other-regarding behaviors that can be interpreted as adaptive at the group level. Norms are essential, which typically emerge by consensus and are enforced by a variety of sanctions ranging in intensity from gossip to execution (Boehm, 2012). Status within the group is achieved by enhancing one's reputation, which requires contributing to the welfare of others (Henrich and Gil White, 2001). Small human groups are highly regulated, just as multicellular organisms and social insect colonies are highly regulated. If this does not appear obvious, it is because many of the regulatory mechanisms take place beneath conscious awareness. We take part in the regulatory process without knowing it. Indeed, this may be the true background of the "invisible hand" effect. The complex regulatory machinery provides the starting point for the cultural evolution of functionally organized societies at a larger scale.

Thus, it is not the autonomous, self-interested individual behavior of economic textbooks that is guided by price and income constraints to social harmony. It is rather the sophisticated mix of self- and other-regarding attitudes with which human agents are endowed that allowed the division of labor and exchange to develop in the first place. The larger the scale and scope of the markets grew, the more cultural and institutional evolution contributed to generalizing the pro-social attitudes to anonymous interactions beyond the small group. In today's world, where new solutions are required to solve new problems at an unprecedented spatial and temporal scale, we need to create a culture that is capable of rapid change more than ever before. Markets that harness the power of competition and self-interest are essential, but unless the negative effects of these forces are held in check, there will be no invisible hand to prevent forms of competition and self-interest that are detrimental to the common good.

4. Do economic systems have an optimal state of being?

The formal model of general equilibrium and Pareto optimality arising from self-interest would not have been possible without the marginalist revolution of the 1870s. But the underlying notion of a harmonious, natural order of the economic world is not a product of thought of the marginalist revolution. The idea that the universe has a harmonious ideal state has a long pedigree and can be found, among others, as early as in the Judaic notion of the (lost) Paradise or Plato's ideal state. It also finds expression in the Newtonian worldview accurately reproduced in Smith's (1795) history of astronomy leading him to adopt the metaphor of the "divine watchmaker". In a sense, thus, this worldview is completed by Walrasian general equilibrium theory when it casts the dynamic and evolutionary energy of capitalism into a purely mechanical, non-human system (Mirowski, 1989).

An instructive example of the deformations of reality due to the mechanic metaphor is the canonical theory of the firm. Firm size, production techniques and employment is shaped by exogenous resources, tastes and technologies. Given the goal of profit maximization and the assumptions of perfect competition, a firm's adjustment behavior resembles the trajectory of a marble thrown into a round bowl which can only end up at the bottom of the bowl. Friedman (1954) used a "survival of the fittest" argument to justify the idea of competitive equilibrium. Given the assumptions of perfect competition and profit maximization, inefficient firms will be driven out of business. Furthermore, any intervention into the natural order of perfectly competitive markets will allow inefficient firms to survive rather than suffering the consequences of their inefficiency.

Taking this idea further, Friedman argued against any notion of corporate social responsibility. "The only responsibility that corporations have is to increase profits... The real social responsibility of the firm is to obtain the highest profits—obviously in an open, correct and competitive market, producing wealth and work for all in the most efficient way possible" (Friedman, 1970). If firms are allowed to deviate from this maxim (e.g. by government intervention), Friedman claims that this will harm the common good by diverting resources from their highest and best use as prescribed by the market.

The concept of a harmonious natural order was also a common belief among biologists during the 19th and much of the 20th century. A "balance of nature" was assumed to exist at the level of large ecosystems and the whole biosphere. Human activity was assumed to be a form of disturbance, with non-intervention the best policy for managing wilderness areas. Ecological succession was supposed to lead to a final "climax" state. Mathematical models of communities and ecosystems focused on equilibrium states.

These expectations have been almost entirely abandoned by ecologists and evolutionary biologists (Kricher, 2009). The dictum "adaptation at any given level requires a process of selection at the same level..." admits functional organization at the level of single-species social groups and relatively small multi-species assemblages, but not large-scale ecosystems,

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much less the whole biosphere. Ecosystem dynamics are exceedingly complex, are frequently out of equilibrium, and seldom tend toward a single equilibrium state. Unmanaged ecosystems do not maximize anything and do not become "healthier" or more "balanced" in any meaningful sense. Management is often required to achieve human objectives, such as maximizing species diversity or preserving a given species. The fact that functional organization in nature does not extend to large ecosystems and the biosphere as a whole is rude shock to any cosmology, religious or secular, that assumes a harmonious natural order at all scales.

As with the concept of individual self-interest and the invisible hand, developments in evolutionary and ecological theory can help economic theory move beyond the cosmology of a harmonious natural order. Friedman's (1954) "survival of the fittest" argument to justify the idea of competitive equilibrium does not withstand modern scrutiny, despite its enormous influence over the last half-century. In the first place, for firm-level selection to work, there must be some superior quality or characteristic of a surviving firm that is passed on from generation to generation (Winter, 1964). Without that, Friedman's argument is a tautology; profit maximizers survive and if a firm survives then it must be a profit maximizer.

Friedman's invocation of firm-level selection (following Alchian, 1950) was evolutionary, but it wasn't evolutionary enough (Wilson, 2012b). It represents an example of naïve adaptationism that Gould and Lewontin (1979) criticized in their classic article titled "The Spandrels of San Marco and the Panglossian Paradigm: A critique of the adaptationist program." Gould and Lewontin chastised their evolutionary colleagues for telling adaptationist "just-so" stories without adequate proof and for failing to appreciate the many ways that non-adaptive traits can persist in a population. A more fully rounded evolutionary approach requires pitting a number of adaptationist and nonadaptationist hypotheses against each other with empirical research. It also requires an understanding of proximate mechanisms, development, and phylogeny (=history for cultural evolution), as outlined in the first article of this special issue (Wilson and Gowdy, in press).

The idea that profit maximization at the level of the firm also maximizes societal welfare cannot be justified from a modern multilevel perspective, unless under highly regulated conditions. One of the elegant features of multi-level selection theory is that the same basic logic applies to all levels of a multi-tier hierarchy. Firms that care only about their own profits are no more likely to benefit large-scale society than individuals who care only about their narrow self-interest within a group. The same checks and balances that are required for a village to function as a collective unit will be required for the global village to function as a collective unit.

In addition, profit maximization might not even be a successful strategy at the level of the firm. Radner and Dutta (1998) showed that firms that focus narrowly on maximizing profit are actually more likely to go out of business. Countering Friedman, numerous studies (Collins and Porras, 1994; Freeman and Reed, 1983; Freeman, 1984; Martin, 2010) document the success of enduring firms, like Johnson and Johnson and Unilever.[10] Such firms challenge the prioritization of profit maximization and, by adopting the more cooperative stakeholder values perspective, take the longer term view instead. Furthermore, the role of co-evolution, symbiosis, and synergy—playing a key role in modern biology for explaining the evolution of eco-systems—should not be underrated for understanding how firms depend on cooperative business networks (Moore, 1996). The fiction of an entirely autonomous decision unit is no less misleading for the firm as it is for the individual economic agent.

Nelson and Winter (1982) raise an important additional objection to Friedman's survival of the fittest argument. The economic selection environment is not necessarily exogenous to the firm. Firms can consciously shape the economic environment.[11] This is obviously the case whenever firms successfully innovate. The innovative response to competition changes the conditions of competition. Nelson and Winter (1982, p. 413) argue that "orthodox theory cannot adequately provide that analysis and understanding because, fundamentally, it is about an ahistorical world in which genuine novelties do not arise." This is probably even more true for the political economy by which big corporations tend to use their economic and political power to alter the rules of the game by political partisanship.

The cosmology of a harmonious, ideal state influences economic theorizing not only via the common perception of the general competitive equilibrium as a "natural" state of the economy coinciding with the social optimum. It also contributes to the frequent view of policy making as an "intervention" that tends to disturb harmony. Like the Garden of Eden, the optimal state of nature can only be disturbed by presumptuous human behavior that thinks it knows better than the market (government regulations or labor unions for example). The apparently straight forward conclusion is: If there is an optimal state for an economy—the stable equilibrium to which the economy will always return if perturbed—then the proper policy is to make sure the parameters are properly set (assign property rights and get the prices right) and then leave it alone. But is it so certain that markets that are left alone accomplish a harmonious outcome under all circumstances? Or is policy "intervention" in many cases exactly the opposite of a disturbing influence, namely something that is necessary to bring economic interactions closer to producing an efficient and/or just outcome? In cases of market failure, e.g. due to external effects, it does not seem controversial that the answer is in the affirmative (Wilson, 2011b). Yet, often enough acknowledgment of this inherent defect is trivialized by claiming that policy making will not be a remedy because of an equally momentous "policy failure".

[10] Unilever was winner of 'Britain's Most Admired Companies Award' 2010, peer-assessed in conjunction with *Management Today*, Saunders (2010).

[11] A critical observation that nonetheless continues to be overlooked by many organization scholars and economists. Characterized as the 'adaptation versus selection' debate (Baum, 1996; Lewin and Volberda, 1999) some researchers challenge the 'selectionists' position (Hannan and Freeman, 1977, 1989) arguing that firm adaptation matters and that it *is* possible to 'change the rules of the game' (Hamel et al., 1989; Baden-Fuller and Stopford, 1992).

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Obviously, in this regard evolutionary biology faces a different situation in its domain. There is no ideal state of nature. Biological evolution is simply a process of adaptation to a continually changing environment—for better or worse as far as the involved species are concerned. This may not always be in the best interest of the human species. For that reason, man-made economic evolution is not simply adaptation to a changing environment. It is an incessant process of tinkering and inventing in order to shift outwards the constraints that nature invokes on the niche of our species (Witt, 2005).

There has undoubtedly been progress in human material welfare. However, while in the richest economies increases in material wealth do not necessarily imply any longer that individual welfare also increases (Easterlin, 1974; Witt, 2011), a significant portion of the world's population still lives in abject poverty. Market competition has had a significant share in increasing material prosperity. But humankind has also increasingly been risk-taking in terms of environmental degradation, resource depletion, and global ecological stability—risks that threaten the stability of its expanded niche. Much of this risk taking may be due to myopia, biased time preferences, and hazardous behavior of individual economic agents. In many other cases it may be due to negligence with respect to negative externalities resulting when the enforcement of property rights on environmental resources is prohibitively expensive. Both causes result in an inability of unfettered markets to protect the stability of the human niche. Trusting the problem-solving capacity of markets with respect to the global risks would therefore amount to counterfactually adhering to the belief that unfettered markets under all circumstances assure harmonious outcomes.

If material prosperity is to be preserved, or even to be expanded to all people, political efforts will have to be taken to get control of the risks. It may well be then that individual myopia, biased time preferences, negligent and hazardous behavior have no less to be faced as a problem in the policy making arena. The obvious failure of politics so far in coping with the complexities of global risks like the human induced climate change cannot be ignored (Rosser, 2002). However, as the work of Ostrom (1990) has shown, there is some evidence that social learning processes and collective decision making can jointly establish constraints on myopia and hazard in the policy arena with its high publicity. Moreover, as argued in the previous section, insight into individual moral responsibility and conscientiousness as a necessary constraint on self-interest within free markets can, and needs to be fostered, not least within economic theory itself. Ostrom emphasized the difficulties and conditions needed for cooperation to emerge to manage the commons (Wilson et al., in press). One condition was the importance of small groups within which communication and trust and agreement and enforcement can occur. There is still some hope, however, that policy regulations can be reached in the public discourse that create the necessary bounds for the free play of the market so as to guide its information processing capacity and incentive character in the sustainable direction that it does not necessarily accomplish by itself. The stakes are high as the lesson from biology teaches: unstable niche expansion by a species sooner or later results in catastrophic breakdown and often the extinction of the species.

5. Conclusions

Many methodological controversies in economics are rooted in basic beliefs embodied in Western cosmologies that go back for millennia. It is argued above that current breakthroughs in evolutionary biology and other disciplines in biology and the social sciences can inform an emancipation of economic theorizing from the latent cosmological influences and their errors and biases. Evolutionary principles and evidence can be used to compare the model of human nature governed by self-interest in canonical economics with the more complex, socially embedded model of human nature in biology, evolutionary psychology, and neuroscience.

Such a comparison shows that economic theory cannot be based on the concept of individuals as atomistic, self-interested agents. The pursuit of self-interest does not robustly benefit the common good. And there is no ideal state of nature or the economy that can be achieved through non-intervention. These ideas may seem self-evident but they point the way to a new synthesis in economics. Examining the three basic cosmologies embedded in economic theory in such a perspective can help evaluate controversies that have raged in economics for two centuries and actually move the debate along.

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