Evolutionary Viewpoint on the Present Crisis

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Abstract. Evolutionary algorithms belong to these rare brands of rigorous fields of science that offer meaningful insights into creative activities of human societies. This contribution is a sketch of a possible study on the causes of the currently developing economic crisis from this perspective. Economy is considered as an adaptive system, which reached a degenerative stage due to mismanagement, resulting from misconception. References to simulated evolution are used to point on several malicious policies.

1. Introduction

In the recent decades thinking about future was largely replaced by a kind of the contemporarian thinking. At the end of 20th century the idea of progress, which accompanied the vigorous developments of 19th century, was practically abandoned. In the imagination of masses it was replaced by the idea of modernization; i.e. of uncritical copying of the coveted attributes of rich and famous. This shift is best exemplified by enthusiasm that greeted the Fukuyama's "end of history" pronouncement. Creators were replaced by imitators from one side and by trend setters from the other. Expectation were concerned with having what others already have, only cheaper, faster and "more modern". Reality was expected to accommodate.

In the recent months this optimistic modernist mindset is taking a tumble. The concepts of business as usual and life as usual are losing their obviousness. In the face of the financial turmoil, more and more of the widely accepted rules of success turn out to be ineffective. Some of them have been evidently promoted as ordinary confidence tricks. The future is suddenly loaded with apprehension and the past is more often recalled for explanation. Many still hope that the matters will settle back to the "normal". Yet, it seems hardly possible that some new speculative bubble might revive economy and produce another happy spell of illusory prosperity (as it has happened when the Internet bubble was replaced by the real estate bubble).

So far, the focus is on treating the symptoms of the crisis — on sustaining circulation of money and on bringing down stock markets fever. Recognition of causes and fundamental corrections are being postponed, but the time is pressing. The three global engines of development: credit, outsourcing and workforce mobility might be spluttering to a stop. What more, resources of intellectual capital in the spheres pertinent to this crisis look badly. The widely recognized authorities have failed. They have endorsed policies and practices that have resulted in crisis, and generated no early warnings. Little good might be expected if the same knowledge base and capacities will be used in attempts to get out of this mess. Something has to be radically wrong with the economic models and with the social and political environment of economy. It is urgent to rethink the modern systemic paradigm established in reaction to the Great Crisis of

1930s. The system based on individualization of profits and collectivization of risks is turning out to be self-destructive.

This situation calls for a wider discussion that would exceed the limits of traditional economic thinking. Except of anthropology and psychology also models and experiences originating in the sphere of evolutionary algorithms might be helpful in explaining what was happening. This idea was already brought to attention of participants of our conference; e.g. [1].

2. Economy as an overlay on developmental processes

Economists tend to treat their subject as a self-standing issue and attribute to their models universal validity. Yet, it might be argued that market economy makes little sense in stagnant societies. In stable conditions, with established technologies and fixed cultural rules, societies tend to a dynamic equilibrium, where the incoming generations take over the functions of the outgoing ones. This was the general practice in the Byzantine Empire, where sons inherited professions after their fathers and performed them in the strictly formalized way. Soviet Union was clearly heading in similar direction but it folded earlier, as innovations from the outer world destabilized the carefully planned socialistic future.

Market economy emerged in the contexts of technological and scientific revolution that was making established solutions obsolete in the time span of one generation. It responded to the need for a system that could use its resources to accommodate advantageously to unexpected changes. It was based on the freely undertaken individual initiatives aimed at improvements. It created social and legal structures in which such initiatives were appreciated and, when successful, rewarded and propagated through the society. In other words, it was an evolutionary system with populations of solutions, random mutations and soft selection. The system was able to exploit profitably new innovation and, at the same time, to explore efficiently the space of opportunities for the still better ones. Its adaptive abilities were implicit in the creative emergence of new industries and services, and in the creative destruction of the obsolete ones.

From the above perspective, economy is an overlay on creative processes spontaneously arising in human societies. As long as these processes run efficiently economy might treat them as free environmental resources. So it might concentrate on its internal trends and equilibria. Some time ago it was realized that classic environmental resources are not at all free. The attempted reversal of climatic changes might become the most expensive of human endeavors. Recently, it becomes apparent that creativity is also a pricey economic factor. Such concepts as intellectual property and knowledge based economy, botched as they are [2], signify the change of perception. The reassessment of creativity results from its unexpected scarcity. It is clear when one looks at the present horizons of science [3] or reflects on economic significance of the present day innovations [4]. Even analysis of statistical trends points this way [5].

3. Some Evolutionary Algorithms Precepts

1. On the Difference between Development and Growth

Evolution of complex life forms is concerned with quality of individuals not their numbers. In Nature, growth leads to overpopulation, scarcity of resources, exploitation of environment and triggers mechanisms that reduce the population density. Evolutionary algorithms, as a rule, do not map these processes and operate on populations with the set number of individuals.

Economic growth is a mantra of our times. Yet, the economy based solely on the idea of growth, is a primitive concept. Growth processes must saturate due to the limits of demand or environment [6]. The real economy must accommodate for qualitative factors; i.e. innovations, which trigger successive waves of substitution on the markets, in which new replace the old. Crisis shows convincingly that the growth for the sake of growth might remind of cancer, both in its exponential dynamics and its consequences to the society.

2. On the Evolution of One

The minimum size of the evolving population is two. With only one individual selection cannot work — the shape of the adaptive surface cannot be probed, and the trajectory of search reduces to the random walk.

Similarly, every domain of the market might evolve only when it is not monopolized, i.e. if there are at least two players. These players, relentlessly experiment with different solutions, manoeuvring into the position of competitive advantage. At the same time, they try to absorb efficient solutions from the others. Such dual action drives development of the whole domain. There is always tendency on the side of the dominant players to end this incessant effort and get a comfort following from the "final victory". These players, like Microsoft, might owe their existence to some crucial innovation. Nevertheless, they abhor possibility of another crucial innovation, or as they call it: disruptive innovation. This tendency has to be countered by stringent antimonopoly practices that are fundamental for the free market functioning. Unfortunately, the recent years have brought into existence a creature that is excluded from evolution. The global economy has no competitors, no viable alternatives, and no way to learn on errors. Consequently, it can drift without warning into dangerous and unsustainable situations. From this perspective even such a wretched competitor as the Soviet Union was invaluable for the West, demonstrating e.g. the fatal effects of excessive nationalization.

3. On Collapse of Diversity

Maintaining sufficient diversity is precondition of the efficient evolutionary algorithms. Not enough diversity leads to premature convergence and inability to reach optima other that the currently explored.

The economy of scale, which dominates on the global markets, enforces efficiency by eliminating diversity, i.e. turning all existing solutions into the clones of the best existing solutions. All kinds of regulations, norms and ISO standards are engaged to this end. This provides a short term advantage, as restriction of diversity is deadly for creativity. It makes adaptation to changing conditions slow and painful and it makes emergence of breakthrough innovations practically impossible. It should be remembered e.g., how the development of PC was stalled because of their premature standardization.

4. On Large Populations

It has been demonstrated that in unrestricted global optimization small populations fare much better than the big ones. This is because they can cross saddles between neighbouring adaptive peaks through the kind of "genetic drift". Such a crossing, once accomplished, constitutes a breakthrough innovation that initiates a new bout of fast adaptive improvements. Large populations are too concentrated around adaptive optima and extort too strong selective pressure, to allow for reproduction of individuals in the regions of distinct adaptive saddles — what makes

drift through such saddles practically impossible. It is well known that efficiency of evolutionary search might be improved by dividing large population is into relatively small subpopulations that evolve on their own, and only occasionally exchange the results.

In the modern day economy a lot is expected from big teams of professionals constantly monitoring processes and exchanging information in the search for the improved solutions. Such teams have proved to be efficient in relatively straightforward tasks involving fine-tuning or integrating the already known solutions. They are generally hopeless in creating original ones. This is because they are too critical and too hasty to let deviant ideas grow and mature. As history of science and technology demonstrates, such ideas fare better in limited environments detached from dominating trends. It is no accident that among the most creative and innovative cultures in history were the highly segmented cultures of Ancient Greece, Renaissance Italy and Baroque Germany. In case of the 19th century Britain and the 20th century USA compartmentalization resulted from the high degree of freedom their more affluent citizens could enjoy and from high social respect for eccentrics obstinate to do things in their own way. These subtleties of creative milieus are badly understood by pragmatics that run modern businesses and administration, and seems completely alien to the proponents of globalization. In the past a degree of creative isolation was occasionally ensured due to inadequacy of information flows. Now, ICTs might assure that almost everybody is dutifully engaged in the strictly defined tasks.

5. On Elimination of Chance

Evolution is based on chance. Chaotic mutation and random selection, with a bias toward better individuals, define the basic process. The decisive emergent property is saddle crossing that is all but totally unexpected.

Modern economy is pervaded by the risk avoiding obsession. Chance cannot be stopped. The supposedly risk reducing financial engineering is at the heart of the present financial catastrophe. It was able to inhibit individual, local disasters but packaged them into the global disaster. Nassim Taleb, once a stock market risk analyst himself, notes that our atavistic, hunter-gatherers minds are badly equipped to deal with chance. We will rather delude ourselves with bogus certainties than face the unexpected [7]. He recommends suspicion toward data, especially if they pretend to be computed probabilities (all kind of forecasts, especially financial).

6. On Restricted Mutations

One of the main concerns of evolutionary programming is in providing adequate penetration of the search space by mutations. Intensifying search in some directions or excluding some domains from search makes sense during uphill evolution, when enough evidence about the local gradient of the adaptive surface is gathered. It makes no sense, when populations are in stasis, trapped around local optima, and saddle crossing is the only chance of further progress. At this phase of evolutionary search there is no discernible evidence on the whereabouts of the saddles.

Modern economy abounds with restrictions imposed on the innovators' freedom of action. Some of them result explicitly from guesses, often called "strategic choices" or priorities that declare the proper direction of development in particular domains. One of such choices delayed development of personal computers for several years, as it was arbitrary decided that the future belongs to the remotely accessed super-computers. Another group of explicit limitations comes from the intellectual property laws, which exclude contenders from some areas of research. This might be profitable for particular players, but it deadly for the market system as a whole. Plenty of restrictions result implicitly from the overload of regulations and norms, which tend to be easy

to introduce and difficult to prune. In effect, the today's freedom of the free market initiatives (as well as the acclaimed Western freedom of thought) is a parody of what it used to be.

7. On the Hardened Selection

The key factor in evolutionary algorithms is soft selection. The next generation descends from the previous one in a way, which favours the better but does not exclude the worse individuals. It follows from recognition that the locally perfect solutions are extremely unlikely to be improved in one step. Evolution must be liberal enough to allow for saddle crossing; i.e. long and convoluted series of mutations of mutated mutants that originate at margins of dominant solutions and proceed with no sign of progress on the way.

The headword of the modern economy is perfection. Institutions, industries and laboratories are fixated on excellence. Only the best products and practices are developed. The compulsive urge to get the best reminds of sports were a millisecond or a millimetre decide who is the winner and who is a looser [8]. Yet it has to be reminded that such attempts go against the grain of the Western Culture. This was individualistic culture, based on freedom rather than perfection. Creativity resulting from freedom provided Europe, and its offshoots, with a leading position in the world. Perfection was a trait of sophisticated but stagnant cultures epitomized by Chinese and Japanese Empires. Focus on excellence breeds stagnation and makes the once creative West to compete disadvantageously with the traditional masters of perfection.

8. On the Misleading Criteria

Using evolution for computer optimization is a bit misleading. Evolution is about adaptation. Adaptive landscape is not declared — it is discovered. It takes time. The evolutionary fitness becomes apparent not earlier than the next generation replaces the old one.

Experience shows that the time span from conception to fruition of an innovative idea can be quite long. Modern economy is hasty. It wants to evaluate before the effects are known. So the evaluations are based on inputs rather than outputs, expectations rather than results, money spent rather than money earned, points gained rather than competences acquired. When the fantastic promises are paraded before the amazed public, the potentially clever propositions look like ugly swans and almost never win. Developmental decisions are now driven not so much by adaptive landscapes reflecting the real human needs, as by illusory landscapes reflecting mostly adolescent illusions about happiness (in Poland: Euro 2012 and motorways) .

9. On Learning from Experience

The repetitive attempts to tune up evolutionary algorithms were only locally successful. The experience that might be gathered during evolution relates only to the local layout of adaptive landscape along the path of evolution — it dissolves when an adaptive peak is reached.

Economy is full of attempts to extrapolate locally valid experiences into general rules and sell them out as success recipes. Ability to generalize fast is a very useful in the natural entourage of our hunter-gatherer ancestors. It fails us consistently when used in the context of modern extended societies. Nature might be complicated but not vicious, the people are not that limited. Inclination to generalize drag suckers to all kinds of Ponzi schemes, where the increasingly positive effects of intermediate stages lead to into the final collapse (housing market). It makes us also unaware that predictions concerning development end with saturation of existing trends or with a sudden emergence of some disruptive technology (e.g. telecoms and cell phones).

10. On Setting of Grand Objectives

Evolution has no predefined targets. It identifies its targets progressively as it moves, from one peak to another, along the ridges of its adaptive landscape. There is nothing that would justify the opinion that the next target might be extrapolated from the preceding ones.

Economy tends to overinterpret history and produce fascinating narrations out of casual sequences. Marxist projection of communism was based on such overinterpretation of the earlier systems. Kondratiew waves, ultimate triumph of globalization, new economy driven by ICTs, ever rising real estate prices, all follow from unjustified extrapolation of transitory trends. It is better for economy to facilitate spontaneous development then deciding what should develop.

4. Conclusions

The supposition is that the present crisis results from distortions of the market system adaptive machinery. They led to growing deficiency of breakthrough innovations, which used to fuel the long spells of economic growth based on substitution. These distortions were introduced unwittingly. The intentions were to maximize exploitation of the already mastered technologies, to remove risk from enterprising and to bring pragmatic order into innovative ventures.

The present crisis is going to demonstrate the eternal evolutionary rule: fitness is not concerned with abilities that make the good times more enjoyable but with abilities that help to survive deprivations. It is time to get rid of the unintelligent idea that it is enough to please consumers and make fast money, to provide for sustainable existence of the present civilization. To survive, this civilization has to sober up and adopt a perspective of at least one generation ahead in assessing its priorities [9].

Bibliography

[1] Galar, R. Some evolutionary algorithms inspired insights into evolutionary drive of developmental processes. In *Proceedings of the 8th Conference on Evolutionary Algorithms and Global Optimization*, Korbielów, May 30 – June l, 2005. Warsaw: Faculty of Engineering and Information Technologies, 2005.

[2] Galar, R. Knowledge Economy and Evolutionary Traps, In Kukliński A, Orłowski W.M., eds., *The knowledge based economy*, Warsaw: Rewasz, 2000.

[3] Horgan, J. The End of Science, Facing the Limits of Knowledge in the Twilight of the Scientific Age, Addison-Wesley, 1996.

[4] Gordon, R. J. Does the "New Economy" Measure up to the Great Inventions of the Past? *Journal of Economic Perspectives*, August 2000.

[5] Huebner, J. A Possible Declining Trend for Worldwide Innovation, *Technological Forecasting & Social Change*, October 2005.

[6] Meadows, Donella H. et al. The Limits of Growth. A Report for The Club of Rome's Project on the Predicament of Mankind. New York: Universe Books, 1972.

[7] Taleb, N.N., The Black Swan. *The Impact of the Highly Improbable*, Random House, 2007.

[8] Galar, R. Conflicting visions: Colas Breugnon versus Baron de Coubertin. In Kukliński A. and Skuza B., eds., *Europe in the perspective of global change*. Warsaw, Rewasz, 2003.

[9] Galar, R. Restarting the evolutionary drive. In Kidd P. T., ed., *European Vision for the Knowledge Age*. Cheshire Henbury, 2007.