3

How and Why Our Conventional Economic Thinking Causes Global Crises

This chapter first appeared as FuturICT blog on April 8, 2013, see http://futurict.blogspot.de/2013/04/how-and-why-our-conventional-economic_8.html, and is reproduced here with minor stylistic improvements. An extended version has been published as a paper by Dirk Helbing and Alan Kirman (2013) Rethinking economics using complexity theory. Real-World Economics Review 64, see http://www.paecon.net/PAEReview/issue64/HelbingKirman64.pdf.

This discussion paper challenges a number of established views of mainstream economic thinking that, from the perspective of complexity science, seem to require a thorough revision. As Albert Einstein pointed out: "We cannot solve our problems with the same kind of thinking that created them." Therefore, the new perspective offered here might help to identify new solutions to a number of old economic problems.

I believe it's no wonder that our world is in trouble. We currently lack the global systems science that would allow us to understand the world, which is now changing more rapidly than we can collect the experience required to cope with upcoming problems. We also cannot trust our intuitions, since the complex systems we have created behave often in surprising, counter-intuitive ways. Frequently, their properties are not determined by their components, but by their interactions. Therefore, a strongly

D. Helbing, *Thinking Ahead—Essays on Big Data, Digital Revolution, and Participatory Market Society,* DOI 10.1007/978-3-319-15078-9_3

coupled world behaves fundamentally different from a weakly coupled world with independent decision-makers. Strong interactions tend to make the system uncontrollable—they create cascading effects and extreme events.

As a consequence of the transition to a more and more strongly coupled world, we need to revisit the underlying assumptions of the currently prevailing economic thinking. In the following, I will discuss ten widespread assertions, which would work in a perfect economic world with representative agents and uncorrelated decisions, where heterogeneity, decision errors, and time scales do not matter. However, they are apparently not well enough suited to depict the strongly interdependent, diverse, and quickly changing world, we are facing, and this has important implications. Therefore, we need to think outside the box and require a paradigm shift towards a new economic thinking characterized by a systemic, interaction-oriented perspective inspired by knowledge about complex, ecological, and social systems. As Albert Einstein noted, long-standing problems are rarely solved within the dominating paradigm. However, a new perspective on old problems may enable new mitigation strategies.

3.1 "More Networking Is Good and Reduces Risks"

Many human-made systems and services are based on networking. While some degree of networking is apparently good, too much connectivity may also create systemic risks and pathways for cascading effects. These may cause extreme events and global crises like the current financial crisis. Moreover, in social dilemma situations (where unfair behavior or cheating creates individual benefits), too much networking creates a breakdown of cooperation and trust, while local or regional interactions may promote

cooperation. The transformation of the financial system into a global village, where any agent can interact with any other agent, may actually have been the root cause of our current financial crisis.

Countermeasures Limit the degree of networking to a healthy amount (e.g. by a link-based progressive tax) and/or introduce adaptive decoupling strategies to stop cascading effects and enable graceful degradation (including slow-down mechanisms in crisis situations). Support the evolution and co-existence of several weakly coupled financial systems (to reduce systemic vulnerability, stimulate competition between systems, and create backup solutions). Reduce the complexity of financial products and improve the transparency of financial interdependencies and over-the-counter transactions by creating suitable information platforms.

3.2 "The Economy Tends Towards an Equilibrium State"

Current economic thinking is based on the assumption that the economic system is in equilibrium or at least tends to develop towards a state of equilibrium. However, today's world changes faster than many companies and policies can adapt. Therefore, the world's economic system is unlikely to be in equilibrium at any point in time. It is rather expected to show a complex non-equilibrium dynamics.

Therefore, a new economic thinking inspired by complex dynamical systems, ecosystems, and social systems would be beneficial. Such a perspective would also have implications for the robustness of economic systems. Overall, beneficial properties seem to be: redundancy, variety, sparseness, decoupling (separated

communities, niches), and mutually adjusted time scales (which are required for hierarchical structures to function well).

Countermeasures Invest into new economic systems thinking. Combine the axiomatic, mathematical approach of economics with a natural science approach based on data and experiments. Develop non-equilibrium network models capturing the self-organized dynamics of real economic systems. Pursue an interdisciplinary approach, taking into account complex, ecological and social systems thinking. Develop better concepts for systemic risk assessment, systems design, and integrated risk management.

3.3 "Individuals and Companies Decide Rationally"

The homo economicus is a widely used paradigm in economics. It is the basis of a large and beautiful body of mathematical proofs on idealized economic systems. However, the paradigm of a strictly optimizing, perfect egoist is a model, which is questioned by theoretical and empirical results.

Theoretically, the paradigm assumes unrealistic information storage and processing capacities (everyone would need to have a full 1:1 representation of the entire world in the own brain and an instant data processing of huge amounts of data, including the anticipation of future decisions of others). Moreover, it has recently been found that not just a self-regarding homo economicus, but also an other-regarding homos socialis may result from the merciless forces of evolution. In fact, empirically one finds that people behave in a more cooperative and fair way than the paradigm of the homo economicus predicts. In particular, the paradigm neglects the role of errors, emotions, other-regarding preferences, etc. This implies significant deviations of real human behaviors from theoretically predicted ones.

Countermeasure Use a combination of interactive behavioral experiments, agent-based modeling, data mining, social supercomputing and serious multi-player on-line games to study (aspects of) real(istic) economic systems.

3.4 "Selfish Behavior Optimizes the Systemic Performance and Benefits Everyone"

Another pillar of conventional economic thinking is the principle of the invisible hand, according to which selfish profit maximization would automatically lead to the best systemic outcome based on self-organization. It is the basis of the ideology of homogeneous unregulated markets, according to which any regulation would tend to reduce the performance of economic systems.

However, models in evolutionary game theory show that self-organized coordination in markets can easily fail, even when market participants have equal power, symmetrical information etc. Moreover, even if the individually optimal behavior also maximizes system performance and if everybody behaves very close to optimal, this may still create a systemic failure (e.g. when the system optimum is unstable). Therefore, it is highly questionable whether the systemic inefficiencies resulting from competitive or uncoordinated individual optimization efforts can always be compensated for by greedy motivations (such as trying to get more than before or more than others).

Countermeasures Measure the system state in real-time and respond to this information adaptively in a way that promotes coordination and cooperation with the interaction partners. Create

a 'Planetary Nervous System', i.e. an information and communication system supporting collective (self-)awareness of the impact of human actions on our world. Pluralistic reputation systems should be part of this. Increase opportunities for social, economic and political participation.

3.5 "Financial Markets Are Efficient"

One implication of the principle of the invisible hand is the efficiency of financial markets, according to which any opportunity to make money with a probability higher than chance would immediately be used, thereby eliminating such opportunities and any related market inefficiencies.

Efficient markets should not create bubbles and crashes, and therefore one would not need contingency plans for financial crises (they could simply not occur). Financial markets would rather be in equilibrium as the conventional Dynamic Stochastic General Equilibrium Models suggest. However, many people believe that bubbles and crashes do occur. Flash crashes are good examples for market inefficiencies, which have repeatedly occurred in the recent past. Also, many financial traders do not seem to believe in efficient markets, but rather in the existence of opportunities that can be used to make disproportional profits.

Countermeasures Develop contingency plans for financial crises. Modify the financial architecture and identify suitable strategies (such as breaking points) to stop cascading effects in the financial system. Introduce noise into financial markets by random trading transactions to destroy bubbles before they reach a critical size that may have a disastrous systemic impact.

3.6 "More Information and Financial Innovations Are Good"

One common view is that market inefficiencies result from an unequal distribution of power, which partially results from information asymmetries (knowledge is power). Therefore, providing more information to everyone should remove the related inefficiencies.

However, too much information creates a cognitive information overload. As a result, people tend to orient at other people's behaviors and information sources they trust. As a consequence, people do no longer take independent decisions, which can undermine the "wisdom of crowds" and market efficiency. One example is the large and unhealthy impact that the assessments of a few rating agencies have on the global markets.

It is also believed that financial innovations will make markets more efficient by making markets more complete. However, it has been shown that complete markets are unstable. In fact, leverage effects, naked short-selling (of assets one does not own), credit default swaps, high-frequency trading and other financial instruments may have a destabilizing effect on financial markets.

Countermeasures Identify and pursue decentralized, pluralistic, participatory information platforms, which support the "wisdom of crowds" effect. Test financial instruments (such as derivatives) for systemic impacts (e.g. by suitable experiments and computer simulations) and certify them before they are released. Such certification is common in other economic sectors. (Special safety regulations apply, for example, in the electrical, automobile, pharmacy and food sectors.)

3.7 "More Liquidity Is Better"

Another wide-spread measure to cure economic crises are cheap loans provided by central banks. While this is intended to keep the economy running and to promote investments in the real economy, most of this money seems to go into financial speculation, since business and investment banks are not sufficiently separated.

This can cause bubbles in the financial and real-estate markets, where much of these cheap loans are invested. However, the high returns in the resulting bull markets are not sustainable, since they depend on the continued availability of cheap loans. Sooner or later, the created bubbles will implode and the financial market will crash (the likelihood of which goes up when the interest rates are increased). This again forces central banks to reduce interest rates to a minimum in order to keep the economy going and promote investments and growth. In other words, too much liquidity is as much of a problem, as is too little.

Countermeasure Separate investment from business banks and introduce suitable adaptive transaction fees at financial markets.

3.8 "All Agents can Be Treated as if Acting the Same Way"

The 'representative agent approach' is another important concept of conventional economic thinking. Assuming that everyone would behave optimally, as the paradigm of the homo economicus predicts, in equivalent situations everybody should behave the same. It is therefore common to replace the interaction of an economic agent with other agents by interactions with average agents, in particularly if one assumes that everyone has access to the same information and participates in perfect markets.

However, the representative agent model cannot describe cascade effects well. These are not determined by the average stability, but by the weakest link. The representative agent approach also neglects effects of spatial interactions and heterogeneities in the preferences of market participants. When these are considered, the conclusions can be completely different, sometimes even opposite (e.g. there may be an outbreak rather than a breakdown of cooperative behavior).

Finally, the representative agent approach does not allow one to understand particular effects of the interaction network, which may promote or obstruct cooperativeness, trust, public safety, etc. Neglecting such network effects can lead to a serious underestimation of the importance of social capital for the creation of economic value and social well-being.

Countermeasures Protect economic and social diversity. Allow for the existence of niche markets and for the consideration of justified local advantages. Avoid competition on one single dimension (e.g. economic value generation) and promote multi-criterion incentive systems. Develop better compasses for decision making than GDP per capita, taking into account environmental, health, and social factors. Make social capital (such as cooperativeness, trust, public safety, ...) measurable.

3.9 ''Regulation can Fix the Imperfections of Economic Systems''

When the self-organization of markets does not work perfectly, one often tries to fix the problem by regulation. However, complex systems cannot be steered like a bus, and many control attempts fail. In many cases, the information required to regulate a complex

system is not available, and even if one had a surveillance system that monitors all variables of the system, one would frequently not know what the relevant control parameters are. Besides, suitable regulatory instruments are often lacking.

A more promising way to manage complexity is to facilitate or guide favorable self-organization. This is often possible by modifying the interactions between the system components. It basically requires one to establish targeted real-time information feedbacks, suitable rules of the game, and sanctioning mechanisms. To stay consistent with the approach of self-organization, sanctioning should as far as possible be done in a decentralized, self-regulatory way (as it is characteristic for social norms or the immune systems).

Countermeasures Pursue a synergetic approach, promoting favorable self-organization by small changes in the interactions between the system elements, i.e. by fixing suitable rules of the game to avoid instabilities and suboptimal systemic states. (Symmetry, fairness, and balance may be such principles.) Introduce a global but decentralized and manipulation-resistant multi-criterion rating system, community-specific reputation system, and pluralistic recommender system encouraging rule-compatible behavior.

3.10 "Moral Behavior Is Good for Others, but Bad for Oneself"

Species that do not strictly optimize their benefits are often assumed to disappear eventually due to the principles of natural selection implied by the theory of evolution. As a consequence, a homo economicus should remain, while moral decision-making,

which constrains oneself to a subset of available options, should vanish.

This problem certainly occurs, if one forces everybody to interact with everybody else on equal footing, as the concept of homogeneous markets demands. In fact, evolutionary game-theoretical models show that these are conditions under which a tragedy of the commons tends to occur, and where cooperation, fairness and trust tend to erode. On the other hand, social systems have found mechanisms to avoid the erosion of social capital. These mechanisms include repeated interactions, reputation effects, community interactions, group competition, sanctioning of improper behavior etc. In particular, decentralized market interactions seem to support fairness. Recent scientific breakthroughs even show that biological evolution can create a homo socialis' with other-regarding preferences.

Countermeasures Promote value-sensitive designs of monetary systems and of information and communication systems. Reputation systems, for example, would be an important element of these. They can also be used to define a new kind of money, so-called 'qualified money'. Moreover, it would be wise to introduce several co-existing, interacting, competitive exchange systems: one for anonymous (trans)actions (as we largely have them today) and one for accountable, traceable (trans)actions (creating social money or information). Additionally, one should create incentives for accountable, responsible (trans)actions and for ethical behavior.

3.11 Summary

We are now living in a strongly coupled and strongly interdependent world, which poses new challenges. While it is probably unrealistic to go back beyond the level of networking and

globalization we have reached, there is a great potential to develop new management approaches for our complex world based on suitable interaction rules and adaptive concepts, using real-time measurements.

Our current financial and economic problems cannot be solved within the current economic mainstream paradigm(s). We need to change our perspective on the financial and economic system and pursue new policies. The following recommendations are made:

1. Adjust the perspective of our world to the fundamentally changed properties of the globalized, strongly interdependent techno-socio-economic-environmental system we have created and its resulting complex, emergent dynamic system behavior.
2. Make large-scale investments into new economic thinking, particularly multi-disciplinary research involving knowledge from sociology, ecology, and complexity science.
3. Support diversity in the system, responsible innovation, and multidimensional competition.
4. Recognize the benefits of local and regional interactions for the creation of social capital such as cooperativeness, fairness, trust, etc.
5. Require an advance testing of financial instruments and innovations for systemic impacts and restrict destabilizing instruments.
6. Identify and establish a suitable institutional framework for interactions (suitable rules of the game) in order to promote a favorable self-organization.
7. Implement better, value-sensitive incentive systems to foster more responsible action.
8. Establish a universal, global reputation system to promote fair behavior and allow ethical behavior to survive in a competitive world.

9. Create new compasses for political decision-making, considering environment, health, social capital, and social well-being.
10. Develop new tools to facilitate the assessment of likely consequences of our decisions and actions (the social footprint).

These tools may, for example, include

- a Planetary Nervous System to enable collective awareness of the state of our world and society in real-time,
- a Living Earth Simulator to explore side effects and opportunities of human decisions and actions,
- a Global Participatory Platform to create opportunities for social, economic and political participation,
- exchange systems that support value-oriented interactions.

The socio-economic system envisaged here is characterized by the following features: it is

1. based on individual decisions and self-organization,
2. using suitable incentives to support sustainability and to avoid coordination failures, tragedies of the commons, or systemic instabilities,
3. recognizing heterogeneity and diversity as factors promoting happiness, innovation, and systemic resilience.

Further Reading

1. D. Helbing, A. Kirman, Rethinking economics using complexity theory. Real-World Econ. Rev. **64**, 23–52 (2013)
2. D. Helbing, S. Balietti, Fundamental and real-world challenges in economics. Sci. Cult. **76**(9–10), 399–417 (2010)

3. D. Helbing, Accelerating scientific discovery by formulating grand scientific challenges. EPJ Special Top. **214**, 41–48 (2012)
4. T.C. Grund, C. Waloszek, D. Helbing, How natural selection can create both self-and other-regarding preferences, and networked minds. Sci. Reports **3**, 1480 (2013)
5. D. Helbing, Economics 2.0: the natural step towards a self-regulating, participatory market society. Evol. Institutional Econ. Rev. **10**(1), 1–39, see http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2267697 (2013)
6. D. Helbing, A new kind of economy is born—social decision-makers beat the 'homo economicus', see http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2332692 (2013)
7. D. Helbing, Globally networked risks and how to respond. Nature **497**, 51–59 (2013)