ISSN 2049-3274

Volume 3, Issue 4

August 2013

World Economics Association Newsletter

To *plurality*. The Association will encourage the free exploration of economic reality from any perspective that adds to the sum of our understanding. To this end it advocates plurality of thought, method and philosophy.

Inside this issue:

The latest on WEA Conferences

October and November will see our next conference:

Neoliberalism in Turkey: a Balance Sheet of Three Decades

http://turkeyconference2013.worldeconomicsassociation.org/.

The theme is very timely given the recent and current events in Turkey. We hope that this encourages experts on Turkey and on neoliberalism to contribute papers. All interested members should contribute comments to the papers and to the conference in general. This will be the fourth and last conference for 2013.

WEA Books

We are hopeful to be able to develop edited books from two of this year's conferences: the one on ***The economics curriculum: towards a radical reformation*** and the one on ***Inequalities in Asia***. The volumes will contain some of the papers from the conferences and may also contain commissioned papers not part of the conference. These volumes will be edited by the conference leaders of the respective conferences. The books will be published by College Publications in collaboration with WEA.

Discussions about a conference on *Brazil* in 2014 are ongoing.

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Interview with Ping Chen

Retired Professor of National School of Development at Peking University in Beijing; Senior Research Fellow of the Center for New Political Economy at Fudan University in Shanghai; And Foreign member of the Center for Capitalism and Society at Columbia University in New York; Main book:

Chen, Ping. (2010) *Economic Complexity and Equilibrium Illusion: Essays on Market Instability and Macro Vitality,* London: Routledge.

He recently answered the following questions for the WEA Newsletter:

1. How would you briefly state your perspective on economics?

My perspective is complex dynamics and evolutionary economics. Complexity implies nonlinear interactions and non-equilibrium changes, which is the driving force for life and division of labor. The linear and equilibrium models in neoclassical economics can be considered as the first approximation of complex systems.

I am a physicist by training. I graduated in physics in 1968 at the University of Science & Technology of China in Beijing. My college physics was taught by leading scientists from the Chinese Academy of Sciences, not by teaching professors. I learned how to identify fundamental issues and test competing theories by experiments, not by the beauty of mathematics or concepts. This is a valuable lesson in doing research.

I got a Ph.D. in physics in 1987, and continued to study nonlinear economic dynamics at the Ilya Prigogine Center for Statistical Mechanics and Complex Systems, University of Texas at Austin for 22 years. Prigogine was a pioneer in non-equilibrium physics and complex systems. I was Professor in economics and finance at Peking University in Beijing from 1997 until retirement in 2013. Currently, I am a senior research fellow at the Center for New Political Economy at Fudan University in Shanghai and a foreign member at the Center on Capitalism and Society at Columbia University led by Edmund Phelps.

My understanding of economics does not come from textbooks, but from real experiences in historical waves and original research in complex economics.

The discovery of deterministic chaos had changed the way of thinking in physics, chemistry, biology, and meteorology in the 1970s and 1980s, but met strong opposition from mainstream economics. Our works on economic chaos and market instability can be found through my book: *Economic Complexity and Equilibrium Illusion: Essays on Market Instability and Macro Vitality*, London: Routledge (2010).

Briefly speaking, five issues in complex economics may change economic thinking in quantitative analysis and theoretical modeling. Let me briefly discuss them below:

(I). Economic Chaos and the Illusion of Self-Stabilizing Market

Neoclassical economics was grounded on a mathematical belief rather than empirical analysis of market movements. Neoclassical theories of self-stabilizing markets are based on the 1933 Frisch model of noise driven cycles. The so-called efficient market hypothesis is based on two linear stochastic models: the random walk and geometric Brownian motion. Laissez faire policy only works when negative feedback rules the market. This is possible when social interaction or herd behavior can be ignored. All these pretty models in neoclassical economics would be killed by one ugly fact: the existence of nonlinearity in economic movements. New tools from physics and complexity science have helped us to identify nonlinear patterns from economic time series, which goes against the predictions from neoclassical theories.

I found empirical and theoretical evidence of economic chaos from monetary data in 1988. Wide evidence of color chaos was found from macro and stock market indexes in 1996. Here, color means life periods from 2 to 10 years in business cycles. The noise component from stock indexes is only about 40%. These results directly challenged the orthodox theory of efficient markets based on the random walk and Brownian motion models in economics, but confirm Schumpeter cycles in the "economic organism". The existence of monetary chaos leads us to reject Milton Friedman's theory of exogenous money, but supports Hayek's theory of endogenous money. In response to this financial crisis, we can see that the use of monetary policy without structural reform has a weak effect. Two breakthroughs in methodology are essential in studying chaos in economics. First, we found a Copernicus problem in economics and finance. There are two competing reference systems for observing economic dynamics. An econometric system based on short-term rates of change (i.e. first differencing time series) produces an equilibrium illusion of white noise, which is similar to the motion of a geocentric system of planets. Alternatively, a macro reference system based on smooth moving trend, such as the HP filter, would show complex cycles with a narrow frequency band (1-10 years) and erratic amplitude. This is the typical feature of "color chaos" or Schumpeter's "biological clock". Second, time-frequency analysis is a more powerful tool for diagnosing complex dynamics, since real economic time series are nonlinear, non-stationary, and non-integrable. There is little hope for regression analysis in macro and finance. Our work triggered an intensive de-

bate among econometricians and economists.

I am looking for reasons why mainstream economists find it hard to accept the new science of deterministic chaos. I found their barrier is rooted in the Frisch model of noise-driven cycles. This was an unproved claim in a conference speech in 1933 by Ragnar Frisch, the editor of newly founded *Econometrica*. During the peak of the Great Depression he proposed the idea that a self-stabilizing market could be modeled by a pendulum with friction. Frisch claimed that random shocks could keep the pendulum alive, which is the very foundation of noise driven model in business cycle theory. He promised that his analytical paper would soon appear in his journal. Frisch shared the first Nobel prize in economics because of this model. I solved the historical puzzle in 1999 when I considered the Frisch model as a perpetual motion machine in physics. There was an identical model in physics known as the "the Brownian motion of a harmonically bound particle" first published in 1930 (Uhlenbeck and Ornstein), confirmed again in 1945 (Wang and Uhlenbeck). Physicists proved that harmonic oscillation would rapidly decay in Brownian motion. I tested the Frisch model with the US data. The Frisch model predicted that the US business cycle would disappear within 10 years! Now we understand a better alternative to a self-sustained biological clock, the nonlinear oscillator. I searched the literature and made a surprising finding: Frisch quietly abandoned his model in 1934 and did not mention a word about it in his Nobel speech in 1969. However, the noise-driven model formed the foundation of work on neoclassical business cycle theory, including that of Milton Friedman, Robert Lucas, and the Real Business Cycle (RBC) school, and Ben Bernanke's financial accelerator. The equilibrium school in macroeconomics may have been going down the wrong track for eight decades. Nonlinear dynamics provides tools for diagnosing and preventing crises, while noise-driven models create the equilibrium illusion of self-stabilizing markets.

(II). Micro versus Meso Foundation of Macro Fluctuations

The central idea in physics and biology is the relation between interaction and structure. Gas, liquid, and solid states are distinguished by the strength of interacting forces and molecular structure. Biological species are classified by their structure and function. However, there is no structure in macro and institutional economics. Reductionism in neoclassical economics is dominated by the concept of price and costs. Through an analysis of business cycles we re-discovered the role of structure.

Paul Krugman (2009) criticized the dark age in macroeconomics, but did not point out what went wrong with microfoundations and rational expectations, which reversed the Keynesian revolution in 1970s. Robert Lucas (1972) destroyed the usefulness of government policy in job creation by a fancy idea that independent fluctuations at the level of households (e.g., the inter-temporal substitution between work and leisure) would generate large fluctuations at the aggregate level. We tested the Lucas model by the Principle of Large Numbers in 2002. The Principle says that the more micro agents there are, the smaller the aggregate fluctuations when independent fluctuations cancel each other out. We found weak evidence of microfoundations from macro indexes: less than 5% of observed US business cycles may be explained by the microfoundations, i.e. fluctuations generated by households. We found that the main source of business cycles comes from meso foundations, namely the finance sector. They may generate large fluctuations in investment, which is several times larger than fluctuations in consumption and GDP. This conclusion is confirmed by the 2008 financial crisis. Fluctuations in currency and commodity markets are several times larger than those in stock markets. The only possible source is due to financial oligarchs. The policy implications are also clear. Competition policy is critical for macro stabilization. We demonstrate that 2008 crisis was caused by excessive speculation by financial oligarchs. We must have international anti-trust law and break up financial oligarchs to prevent financial crises. My proposals have been well received at international meetings on the financial crisis, including the pre G20 meeting at Mexico City in May 5, 2012.

...the two-level model of a micro-macro economy is over-simplified for modern economies. We propose a three-level model of a micro-meso-macro economy since the finance sector and industry structure at the meso-economy level is the key to generating innovation, instability, business cycles, and crisis.

We have two important lessons for macroeconomics.

First, the two-level model of a micro-macro economy is over-simplified for modern economies. We propose a three-level model of a micro-meso-macro economy, since the finance sector and industry structure at the meso-economy level is the key to generating innovation, instability, business cycles, and crisis.

Second, methodological individualism is not capable of explaining macro fluctuations. Lucas made two fundamental mistakes. One, he did not realize that relative prices always move in pairs. If many people choose leisure when the average wage declines, the leisure price would also go up and create an arbitrage opportunity for those who postpone leisure instead. Their arbitrage activities could offset the intertemporal substitution effect of the vacation group. Therefore, the rational expectations hypothesis is a self-defeating prophecy. Lucas' critique should apply to his rational expectations theory. Two, Lucas made an elementary mistake in stochastic calculation. He did not know the numerical difference between the population model of an island economy and the representative agent model with only one agent in calculating its variance. Economists should learn an important lesson from the Lucas mistake, namely that many do not behave as one. Our analysis is based on a

population model of the birth-death process. We provide strong evidence that methodological individualism in the form of a representative agent or a Robinson Crusoe economy cannot explain macro fluctuations. This is a useful lesson that new classical macroeconomics needs a more advanced mathematics, not simple and wrong math.

(III). The Birth-Death Process and the Limit of Methodological Individualism

Our work on the birth-death process re-shaped the foundation of finance theory. We found that the neoclassical model of asset pricing has a fundamental flaw. The two stochastic models that are widely used in finance theory, random walk and geometric Brownian motion, are both representative models with only one agent and unstable in nature. We found that a random walk is damping while geometric Brownian motion is explosive in time. The proper model is the population model of the birth-death process with N agents, which is sustainable through market instability and crisis. We warned in 2005 that the Black-Scholes model is explosive for longer than a three-month time-horizon. During the 2008 financial crisis, AIG was nearly bankrupt because of the collapse of the Credit Default Swap market. All derivative pricing was based on the representative agent model of geometric Brownian motion. In 2012 we developed a more generalized model for option pricing and crisis regime-switch, which is based on the birth-death process.

(IV). Transaction Costs and the Reductionism in Institutional Analysis

When I read the Coase (1937) paper on the firm, I was puzzled how the firm size could depend solely on transaction costs. From a physics perspective, transaction costs are similar to heat, wasted energy, or entropy, which has little information on its structure and complexity. The so-called transaction cost theory is a false analogy of a frictionless world in physics. Can you compare the stone physics with the animal physics? Certainly not! Planet motion can be approximated by a frictionless world (we call this a conservative system with conservation of energy). But people's life depends on constant dissipation of energy (we call this a dissipative system with time asymmetry). Coase claimed that the ideal form of firm and social institution can be understood by the Coasian world of zero transaction costs. Its implication is simple: history or time evolution is irrelevant in institutional economics. This assumption leads to the Coase belief: all kinds of institution would converge to the unique optimal form, regardless uneven initial conditions. This is the central message in his social cost paper in 1960. In contrast to a biological theory of species evolution, the Coase theory is extreme reductionism, similar to Ostwald's energism in late 19th-century physics as an alternative to the matter-based approach of atomic theory. The size of the firm cannot be determined solely by an internal balance between transaction and coordination cost, regardless the competitor's scale and the size of the market niche. Coase made a hidden assumption that market competition would drive down transaction costs. Technological progress may reduce the unit transportation cost and communication cost. However, aggregate transaction costs as a whole had a clear increasing trend in the history of the industrial revolution and division of labor, which was driven by increasing network complexity and innovation uncertainty. The Coase belief of reducing transaction costs in social evolution is simply against the second law of thermodynamics, since entropy production increases in biological and social evolution. The Coasian world is another example of a perpetual motion machine in equilibrium economics (Chen 2007). The most controversial assertion in his article on social costs is that any social conflicts could be resolved by bilateral bargaining without the third party (law, government, or civic society) intermediation (Coase 1960, 1988). His argument was based on the symmetry between polluter and victim, and more generally, the symmetry between consumption and investment (Coase 1960, 1988, Cheung 1998). The problem is that the origin of division of labor means symmetry breaking in time and space. Power and conflicts are the price of industrialization. That is why we study political economy and social economics. If the Coase theory is valid, there would be no power, no conflicts, no war, no government, and no regulations. This is not true in the history of industrialization. Coase made the claim of observing the real world. After careful examination, we found out that no single case studied by Coase could support his claim. Reducing transaction costs is the main argument for financial deregulation, which is the root of current financial crisis. Coase often argues that government effect is hard to judge when transaction costs are high. Clearly, the only agenda of transaction costs theory is its use for laissez-fair policy. The question is: can you find any modern industry that could run without regulation? Manufacture? Airline? Food and Drugs? Or Finance? In policy debate, the concept of transaction costs has limited use in practice, since no one knows how to compare existing regulation costs with potential risk and uncertainty. Our work demonstrates the role of a selection mechanism is more important than transaction costs in institutional design.

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(V). Knowledge Accumulation vs. Metabolic Growth

Chapter 1 of Book 1 of Adam Smith's *An Inquiry Into the Nature and Causes of the Wealth of Nations* was on the division of labor, a process of increasing complexity in economic systems. Smith's theorem, (the term was coined by George Stigler in 1951) in his third chapter, states that the division of labor is limited by the extent of the market. Theoretical biology explicitly described the biological niche by a logistic equation with an S-

shaped growth curve. Population or output growth always has a resource ceiling. We introduced learning competition in 1987 and developed the metabolic growth theory in 2012. Arrow's theory of learning by doing implies a theory of knowledge accumulation. So-called endogenous growth theory implies a permanent divide between rich and poor countries. In the history of science, knowledge development is a metabolic process. Partial old knowledge is replaced by new knowledge. Otherwise, we cannot understand the fall and rise of industries and civilizations. Schumpeter's "creative destruction" can be described by a species competition model and "logistic wavelets" in theoretical biology. Both Adam Smith and Schumpeter can be integrated into evolutionary dynamics without optimization.

Now, we have the main building blocks to develop an alternative paradigm for economics, a vision first realized by Paul Samuelson in 1995. From our perspective, the problem of neoclassical economics is not too much mathematics, but too narrow mathematics. As Keynes once pointed out: they believe in Euclidean geometry but live in a non-Euclidean world. Complexity science provides new tools for evolutionary economics, which is beyond the dream of Schumpeter and Hayek.

2. How does this compare to the mainstream?

Complex economics has several aspects that radically differ from neoclassical economics.

First, there is no economic man who has perfect information and is capable in optimizing resource allocation under limited resources and in a changing environment. Two nonlinear features characterize all living and social systems: i) limited resources and market extent (constrained by technology capability, population size, and ecological constraints), and ii) limited life time and living space. Therefore, people have only limited freedom and opportunity for trial and error. No purely selfish social animal could survive in a fiercely competitive world. Division of labor demands coordinated hands in modern society.

Second, human beings are social animals by nature. Social interactions are major sources of market fluctuations and learning competition. Both negative and positive feedback exists in economic dynamics and these lead to both variability and resilience. The general equilibrium optimization approach is only a static picture and it omits innovation, uncertainty, and life cycles. A representative agent model is useful only as the first approximation in a short-term time window in analyzing time series. Methodological individualism has severe limits in understanding social as well as structural issues in economics.

The mathematical framework of neoclassical economics is the Hamiltonian mechanics in a closed system. Its problem is that optimization implies time symmetry. That is why neoclassical economics ignores historical information in economic analysis. This is the fundamental difference between the equilibrium school and the evolutionary school. Any economic activity is based on dissipation of energy in open systems. Unrealistic concepts in neoclassical economics, such as perfect information, rational expectations, a frictionless world, unlimited resources, long-run equilibrium, etc., are simply contrary to the basic laws of physics. New concepts in complex evolutionary economics are consistent with these and with biological constraints. For example, resource constraints, time horizons, life cycles, innovation, chaos, uncertainty, multiple equilibria, moving trends, evolutionary history, climate change, and geography are important in studying economic issues. Interactions, correlations, and two-way evolution occur in open systems.

There is no such thing as unique supply-demand equilibrium in microeconomics or uni-directional causality in IS-LM models. When a central bank lowers the interest rate, you may face not one but three outcomes: you may increase investment in a normal economy; you may hold cash during uncertain times; or there may be capital flight to foreign countries with better growth potential. Monetary and fiscal policies are not simple in the global era. Economic policy and organizational design should be based not on blackboard economics in a utopian economy, but on applied engineering in a mixed economy. Economic analysis cannot be separated from political, social, and historical perspectives. This is the end of economic imperialism, but the beginning of a unified science, integrating natural and social science as well as humanity.

3. What are the main lessons resulting from your experiences with the Chinese economy?

My view of economics is shaped by intellectual storms and historical waves, not by formal training in mainstream economics. Many ideas in evolutionary economics came from my observation of the changing Chinese economy.

First, comparative history is important for understanding civilization bifurcation: the western mode of division of labor is characterized by labor-saving but resource-consuming technologies, such as dairy-farming and industrialization, while the Chinese mode of division of labor is characterized by resource-saving but labor-consuming technology such as small-scale intensive farming. These two features are essential to understanding the ecological foundation of Smith's theorem. Scale economies simply destroy old jobs much faster than they create new jobs. That is why co-existence of scale and scope economies is the key to understanding the foundation of biodiversity and mixed economies. Social stability and economic efficiency must be balanced to achieve sustainable growth.

Second, different industries have different investment and product cycles. This is central to understanding why the speed of price convergence varies greatly over industries. The products in the Arrow-Debreu model have infinite life. Therefore, general equilibrium theory is incapable of understanding price instability in an industrial

economy. That is why the Washington Consensus failed in East Europe. China's open-door policy was conducted through an experimental approach. China's dual-track price reform, special economic zones, and decentralized experiments ensured both innovation and stability. Keynes and Frank Knight realized the difficulty of uncertainty arising from change. Chinese reformers deal with these problems by pragmatic wisdom, not by ideological doctrine.

Third, market share competition is more important than price competition in an information economy. There is no empirical evidence of marginal cost pricing. China's state, collective, and private firms are rapidly catching up in learning to compete through advancing technology. This is because they are thinking strategically, aiming to upgrade technology and expand market-shares, rather than maximizing short-term profit. Leadership and collective spirits are essential both in government management and corporate governance. These observations reveal the limits of new institutional economics.

Fourth, herd behavior is visible in emerging stock market and consumer behavior. Social interaction and public opinion play a larger role than individual rationality in market behavior. These observations inspired me to study collective models first in public opinion, then in finance. The power and beauty of the population model in theoretical biology and the birth-death process in chemical reactions can be seen when they replace representative agent models of random walks and Brownian motion in macroeconomics and finance.

Fifth, holism is rooted in Chinese agriculture, while reductionism is rooted in Greek commerce. Analytical thinking has made tremendous progress in physics when controlled experiments can test competing theories. However, the analytical approach has increasing difficulty in dealing with living and social systems, since the whole is much more than the sum of the parts. Holistic approaches are deeply embedded in Chinese medicine and classical thinking, such as Taoism. I consider the future of complexity science to be a synthesis of analytical structures and evolutionary perspectives. Complex economics could be an integration of western methodology and oriental wisdom.

4. Do you think that a more pluralist approach to economics might gain traction? What factors constrain and support such a development?

We live in an open society under globalization, so a pluralistic world is a reality. People have many choices of life styles and institutions, subject to ecological and cultural constraints. There exist several models of market economies, including Anglo-Saxon, German, Japanese, Scandinavian, and Chinese.

I learned a lot from readings in cultural anthropology, biology, psychology, philosophy, and history. For quantitative analysis and mathematical modeling, economists can borrow a lot of tools from science and engineering.

Evolutionary economics and complexity science originated in the US and Europe, but they are rapidly developing in Japan, Australia, and China. The platform of the World Economic Association will accelerate the pluralistic trends in economics.

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The World Economics Association Newsletter is published in the UK by the World Economics Association.