
REVIEWS AND NOTES

THE BUILDING OF BRIDGES: HISTORICAL DYNAMICS AND MATHEMATICAL MODELING

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The new almanac with a very clear name *History & Mathematics* was established not long ago. So by this time three volumes of the new almanac have appeared in English.

The motto which the editors have chosen could be explained by their own words as ‘the building of bridges’ (Grinin, de Munck, and Korotayev 2006b: 4). First of all these are the bridges between historical dynamics and mathematics.

In this short review I would like to make a brief presentation of the issues of the almanac that have already been published in English. The limits of this review do not give me a chance to give consideration to all papers in equal measure. And even for the most fortunate few I would only have been able to provide a description rather than an analysis.

The first issue of the almanac subtitled *Analyzing and Modeling Global Development* opens with the article by Leonid Grinin that suggests a model of periodization of the historical process. The author divides the historical process into four major stages; as a basis for such division he proposes the *production principle* (Grinin 2006: 14). According to the author, ‘the proposed periodization is based on the idea of recurrent developmental cycles (each of them includes six phases); however, each subsequent cycle is shorter than the previous one due to the acceleration of historical development. No doubt that these are recurrent cycles...’ (*Ibid.*: 26). These conclusions are supported by results of mathematical analysis (*Ibid.*: 28–32). The analysis demonstrates that ‘the curve of historical process acquires a hyperbolic rather than exponential shape ... which indicates that we are dealing here with a blow-up regime’ (*Ibid.*: 27).

The next article by Andrey Korotayev continues the discussion of the historical process periodization and, first of all, proves Grinin's conclusion about ‘blow-up regime’ with some adjustments (Korotayev 2006a: 39–40). These ‘adjustments’ refer to the notion of the ‘world history periodization’. The author believes that here ‘we are dealing with the phases of development of quite a real system that seems to have originated in West Asia in the early Holocene in direct connection with the Agrarian (“Neolithic”) Revolution...’ (*Ibid.*: 42). He suggests a rather novel approach to the World System analysis also, using the ‘softer’ information-network criterion (*Ibid.*: 44).

Coming to the analysis of historical dynamics of the World System, Korotayev proves the model of Michael Kremer (*Ibid.*: 57). The second part of this article (*Ibid.*: 58–95) presents a detailed argumentation of Korotayev's model of global macrodynamics. It is impossible to describe it here, so, I would like to cite only one conclusion. His ‘empirical test has provided unequivocal support for the Kuznets – Kremer Hypothesis’ (*Ibid.*: 77).

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I would like to point out here that in my opinion Korotayev's models and approaches are extremely productive in the study of historical macrodynamics. However, my explanation of causes of historical macrodynamics differs from the Kuznets – Kremer Hypothesis (Romanchuk 2006, 2008; Romanchuk and Medvedeva 2009). Thus, my opinion with respect to the present-day divergence of the world population growth from the blow-up regime differs significantly from Korotayev's explanation (Romanchuk and Medvedeva 2009). The explanation that is closest to mine (but based on different grounds) was presented quite a long time ago by Lester Thurow (1993: 205–207).

The article by Arno Tausch deals with global terrorism and world political cycles. Re-thinking Kondratiev's cycles, Tausch shows that 'the long Kuznets and Kondratiev swings and cycles of capitalist world development that play such an important role in the analysis of the global war since 1495 have indeed not ended after the end of Communism, and that instability, and not stability, characterize the world economy, and that there is an indented "W" shaped pattern of global conflict since 1495 that did not end with the end of the Cold War' (Tausch 2006: 100).

The topic of violence continues in the article by Akop Nazaretyan, who suggests a hypothesis of techno-humanitarian balance. Still Nazaretyan's interesting idea needs a more profound argumentation. Many points of his appraisal do not correspond to present-day conceptions of biology and history.

The next article concerns so-called *deep history*. Basing upon two statistical methods (correspondence analysis and the quadratic assignment procedure) the authors show that there exists a correlation between the type of social structure of a society and its language family membership (Burton, Romney, and Moore 2006: 164).

The last article of the first issue suggests an evolutionary model of grammatical communication. As the author writes, 'the key result here is a "coherence threshold" that relates the maximum complexity of the search space to the amount of linguistic input available to the child and the performance of the learning procedure. The coherence threshold represents an evolutionary stability condition for the language acquisition device: only a universal grammar that operates above the coherence threshold can induce and maintain coherent communication in a population' (Komarova 2006: 178–179).

The second issue of the almanac, *Historical Dynamics and Development of Complex Societies*, starts with an article by Peter Turchin, who considers the problem of scientific prediction in historical sociology. He argues that successful scientific retrodiction is possible and (more importantly) productive in historical sociology (Turchin 2006: 15). After that he comes to the 'prediction exercise' using Saudi Arabia as an example. His test proves that 'the Saudi state trajectory is generally on track postulated by the demographic-structural theory' (*Ibid.*: 25).

The next article discusses logical and explanatory characteristics of evolutionary theories. In the author's opinion, simulations *per se* are not sufficient to prove the final truth of the theory of sociocultural evolution (Klüver 2006: 41).

The World System urbanization dynamics is described by Andrey Korotayev in the following article. He detects a system of attractors and phase transitions at work in the long-term macro-urbanization of the world (Korotayev 2006b: 57).

In considering the political development of the World System Leonid Grinin and Andrey Korotayev begin the next article with a discussion of the relevant set of definitions regarding the evolutionary sequence of state types. They argue about the necessity to 'insert' the stage of **developed statehood** between the early and mature state (Grinin and Korotayev 2006: 64). They base their argument on a conceptual comparative scheme of characteristics of the early, developed, and mature states (*Ibid.*: 80–105).

In the concluding part they present a preliminary mathematical analysis of the dynamics of the territory controlled by developed and mature states and their analogues

(Grinin and Korotayev 2006: 110–117). The conclusion is that the general dynamics of the size of the territory controlled by the developed and mature states and their analogues should be not exponential, but rather hyperexponential (*Ibid.*: 115).

The next article logically continues the subject of the discussion. It presents a comparative quantitative analysis of the processes of urbanization and political development of World System. In general, the authors suppose that ‘with respect to the dynamics of the territory controlled by developed and mature states and their analogues, we find the same system of attractors and phase transitions that was found earlier... with respect to the world's urban population, literacy, and political centralization’ (Korotayev and Grinin 2006: 124).

The analysis of dynamics of the world megacities' population and the territory of the developed and mature states and their analogues till 1900 AD (*Ibid.*: 136) shows the synchronism of the phase transitions that is expressed here even more clearly. They believe this synchronicity is not coincidental at all. The point is that the preindustrial megacities were, to a considerable degree, a creation of the developed statehood (*Ibid.*: 137–138).

The article of Victor de Munck presents an analysis of political, economic and social change in a Sri Lankan village. He describes how three variables – the influx of cash into the local economy, government regulations, and population increase – have affected chena cultivation practices in Kutali (de Munck 2006: 155).

The next article asks the question ‘why was Monte Albán unable to subjugate the other two subvalleys for so long?’ (Spencer 2006: 185). To answer the question the author applies Rashevsky's model of expansion and resistance. The analysis shows that the data he has examined are consistent with the expectations of Rashevsky's model (*Ibid.*: 195).

The last article of the issue presents a mathematical model of the Silk Road. The model describes mathematically the oscillations of the Silk Road's activity induced by the rise and demise of large empires such as Roman, Parthian, Mongol, Han and Tang powers *etc.* (Malkov 2006: 201).

Proceeding the review we come to the last issue, *Processes and Models of Global Dynamics*. It starts with an article which deals with the trajectory of World System over last 5000 years. The main statements about the trajectory of World System over the last 5000 years made by the author (Harper 2010: 79–80) are as follows:

1. The World System clearly exhibits a non-random pattern or trajectory over the last 5000 years.
2. The World System exhibits periods of oscillation punctuated by periods of continuous change.
3. The World System is a non-equilibrium system.

A group of researchers continue the analysis of the global dynamics, focusing on changes in the scale of settlements and polities since the Bronze Age. The project is assembling an inventory of all the instances of the types of scale change of city population sizes and the territorial sizes of states and empires for the regions and state-system networks for which we have quantitative data (Chase-Dunn *et al.* 2010: 67). Operating with the iteration model for the purposes of explaining upward sweeps they have reformulated this model to focus on state-based systems by adding trade, marcher states, capitalist city states, cities and empires (*Ibid.*: 75). They propose that the revised iteration model explains upsweeps in the past and continues to be relevant for understanding the present and the future (*Ibid.*: 93).

The ‘Lisbon process’ is the subject of the next article. This paper contributes to the growing literature by parametrically estimating a multidimensional index of the ‘Lisbon progress’ and decomposing it into underlying components and quantifying each compo-

ment's contribution and the relationships within and between the components, as well as their differences across countries. The authors conclude that 'the neo-liberal political concept, so relevant for many of the EU's present policy makers, will not lead Europe towards more growth, stability, and social convergence. Rather, at the end of the day, the opposite could be the case, *i.e.* the neo-liberal strategy of lowering comparative price levels at all costs will inhibit the very aims of the Lisbon Process' (Tausch, Heshmati, and Bajalan 2010: 152–153).

The following article presents a verbal and mathematical model of medium-term business cycles (with a characteristic period of 7–11 years) known as Juglar cycles.

The authors think that the current recurrence of some features of Juglar's cycle is connected with the following manifestations of anarchy and arrhythmia in the non-regulated market economy: 1) Subjects of international law (and their economic agents) largely behave the same way as subjects of national law previously did by using foreign currency and foreign currency rates in their dealings. This invariably leads to sharp distortions in international trade, devaluations *etc.* 2) In the last decades, capital movement between countries has become 'free', *i.e.* it is relatively weakly regulated by national law and almost completely unregulated by international law. This causes huge and exceedingly fast capital movements, which lead to very rapid growth in some places followed by a sharp decline and economic crisis. 3) In the modern economy not only new financial technologies have been developed, but the modern economy itself largely started producing values namely in the financial sphere (financial services). Thus, the financial component of crisis has increased dramatically (Grinin, Korotayev, and Malkov 2010: 198).

The article by Michael Golosovsky focuses on demographic problems arising from the growing human population of the Earth and on the quantitative estimates of the future growth of the Earth's population. In particular, he demonstrates that the world's demographic transition is actually a phase transition that has been affecting all aspects of our life (Golosovsky 2010: 204).

The following paper presents the concept of history as the domestication of a sequence of nested geoclimatic zones. According to the authors, these zones – specific social institutions – are organized into a system of feeding chains. The mathematical model of historical development presented in the article describes development as a fundamentally nonlinear process – imbalances are compensated for by passing impulses that they generate further along the 'chain' (Badalian and Krivorotov 2010: 228).

And, the last article presents a new theory of a deictic minimalist self – its function is to attach an 'I' or 'me' to identities. The theory solves classical problems of how the self, cognition, culture and the social environment articulate with each other in a dynamic rather than static way (de Munck 2010: 261).

The productivity of mathematical modeling in history is evident and the articles published in the almanac *History & Mathematics* particularly prove this.¹ Thus, one may say that the almanac occupies a very important niche in the present-day humanities. The paradigm of cliodynamics (the term suggested by Peter Turchin for this new approach and research school), I believe, will have a strong influence on the subsequent evolution of the humanities, in general, and of globalization studies, in particular.

NOTE

¹ Though, I think we should not forget Karl Menger's words: 'mathematics could not help us to understand such basic categories as value, profit and rent' (Bunkina and Semenov 1998: 48). I suppose that the editors feel the same. That's why they maintain that 'Modeling of any particular empirical system is as much art as science' (Turchin, Grinin, and Korotayev 2006: 5).

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