Structural Change and Economic Dynamics 39 (2016) 17–30

Contents lists available at ScienceDirect

Structural Change and Economic Dynamics

journal homepage: www.elsevier.com/locate/sced

The mature stage of capitalist development: Models, signs and policy implications

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ARTICLE INFO

Article history:
Received 1 August 2015
Received in revised form 27 May 2016
Accepted 7 June 2016
Available online 15 June 2016

Keywords:
Complex adaptive systems
Autocatalysis
Capitalism
Development stages
Economic growth

ABSTRACT

We investigate the possibility that capitalist economies – those that industrialized first and the whole OECD group – may be reaching the growth plateau naturally, in a similar way to other complex systems in nature. In the system model of autocatalytic growth we introduce endogenous and exogenous variables that provide negative feedbacks to material growth and push the economic system into the mature stage of development. Based on general developmental stages for dissipative systems, we identify variables that would uniquely mark the transition to maturity: p.c. energy consumption, GDP and energy consumption distribution, and sector composition of labor and GDP. Empirical findings suggest that the observed groups of economies may have terminated their historic phase of intensive economic growth and are entering the mature stage. This provides a tentative explanation of the observed slow-down of long-run rates of GDP growth in the G7 economies and in Western Europe.

1. Introduction

Global economic growth is a phenomenon that started about 1000 years ago, accelerated in the West since 1820 (Maddison, 2007, 73) and, again, in the post WWII period (International Bank for Reconstruction and Development (IBRD, 2008). The scale and speed of growth of the global socio-economic system since the mid- 20 century has been phenomenal—humanity has become a planetary-scale geological force in a single lifetime (Steffen et al., 2015a). Recently, some economists pointed out that long-run rates of growth have been declining in some of the largest and most advanced world economies—the so called G7 Group: US, Canada, Germany, UK, France, Italy and Japan (Diaz et al., 2014a,b; Schmelzer, 2015) and, more generally, in Western Europe (Chancel et al., 2013).

While it is widely recognized that modern economic growth, based on capitalist institutions, reduced poverty and raised the standard of living to unprecedented levels in the Western world, it has also caused depletion of natural resources and energy at the planetary scale. The pressure of economic activity on natural sources and sinks brought to critical condition many ecosystems globally (Millennium Ecosystem Assessment, 2005; Foley et al., 2005), and transgressed or approached the boundaries of several critical earth-system processes (Rockström et al., 2009a,b; Running, 2012; Steffen et al., 2015b). According to Burger et al. (2012) we have already surpassed the capacity of the earth to supply enough of essential resources to sustain even the current world population at the current levels of socioeconomic development in the West. These worrying developments are pointing not only at the physical limits of growth (Meadows et al., 2004) but rekindle an old debate whether capitalism[1] can be sustainable or not (O'Connor, 1994) and could it operate in a steady state (Smith, 2010; Lawn, 2011)—a condition that is generally accepted as a paradigm for sustainability.

This phenomenon of simultaneous approaching of planetary biophysical limits and declining long-run growth rates prompts the question if some systemic, endogenous, causes in concert with pressing global bio-physical constraints may put a long historic

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[1] We understand capitalism as a market driven economy with varying dose of state intervention and where private ownership over tangible and intangible capital prevails.

http://dx.doi.org/10.1016/j.strueco.2016.06.001

phase of capitalist growth to a definitive halt. More precisely, we are posing two research questions: (1) can a capitalist economy reach maturity naturally, in a similar way to other complex systems in nature, and (2), how observed decline in long-run growth rates may fit into this process. We propose a theoretic framework that relates the ending of economic growth to a mature stage of capitalist development and identify a set of variables that likely mark the transition to maturity, as well as negative feedbacks – environmental and economic – that are instrumental in that stabilizing process. Then we apply this theoretic framework at the group of economies that industrialized first and the OECD group and look for signs of transition to maturity. This ought to be the major contribution of the present work.

By looking at the market economy from a naturalist perspective, as an energy and matter transforming system that serves the purpose of providing for human material needs (Annila and Salthe, 2010; Herrmann-Pillath, 2015) we open the door of the socioeconomic domain to a general developmental theory of dissipative structures. By exporting theories from natural sciences we stress the view that all phenomena that concern the transformation of energy and matter on small or large scales, including humans and their organizations, should be viewed as reflecting certain general principles. From the practical perspective, we believe that if we reach a more natural understanding of a system's developmental tendency, then we can hope to achieve a better informed platform for policy making.

The paper is organized as follows: in the second section we present our theoretical framework and discuss systemic aspects of economic growth and development; the third section presents empirical data on the signs of maturity in a selected group of economies; the fourth and the fifth and sections close with discussion and conclusions respectively.

2. Theoretical framework

We are grounded in the understanding that economies are members of two large classes of natural systems: (1) dissipative systems (Prigogine, 1980) wherein order is temporarily created by using a free energy source while exporting entropy to the environment, and (2) its particular subclass—complex adaptive systems (Holland, 1995) wherein the process of order creation is additionally mediated by a large number of diverse, interacting agents which are capable of storing and transmitting information in time, and thus possess the ability to adapt and evolve.

We shall place economic growth[2] within a developmental framework, inasmuch as evolution is really not predictable (Salthe 1993; Longo et al., 2012), and use autocatalytic dynamics (Ulanowicz and Hannon, 1987; Ulanowicz, 1997) as the basic mechanism for growth and a source of negative feedbacks arising within the system itself.

Our discourse, therefore, is not about the evolution of societies, which is an unpredictable and open-ended process. We start from a general definition of development as 'predictable irreversible change', which has the properties of being directional, systematic and progressive (Salthe, 1993). Economic science does not provide a clear-cut definition of economic development which it is often equated with growth or confused with economic evolution. However, developmental economics points at some common features of development like changes in output distribution and economic structure (as, for example, a decline in agriculture's share of GDP and a corresponding increase in the GDP share of industry and services), self-sustaining growth, technological advances, social, political, and institutional modernization, and widespread improvement in human conditions (Herrick and Kindleberger, 1983, 49; Adelman, 2000; Cornwall and Cornwall, 2001, 7; Nafziger, 2006, 15).

Finally, determinism, as in historic materialism, is ruled out from this discourse: a developmental trajectory can branch because a current situation could be the basis for more than one subsequent situation. Therefore, we are talking about developmental *propensities* sensu Popper (1990).

Table 1
General developmental stages for dissipative systems.

Immature stage
Relatively high energy throughput per unit mass
Relatively small size and/or total matter/energy throughput
Growth rate high
Changing internally rapidly with high persistence
Stability to same-scale perturbations high
Mature stage
Declining energy density throughput still sufficient for recovery from perturbations
Size and total matter-energy throughput typical for the kind of system
Definitive form for the type of system acquired
Internal stability adequate for system persistence
Homeostatic stability to same-scale perturbations adequate
Senescent stage
Energy throughput per unit mass gradually dropping below functional requirements
Overall matter/energy throughput high, but its increase is declining
Increasing accumulation of deforming marks
Internal stability of system approaching inflexibility
Stability to same-scale perturbations declining

Note: modified from Salthe (2010).

2.1. General developmental stages for dissipative systems

We will apply a naturalistic perspective, sometimes referred to as "cycling models" (Abel, 2007, 65–67), to the development of capitalist economies. Natural developing systems follow three predictable stages: *immature*, *mature*, and *senescent*,[3] each characterized by its specific energy/matter flow rates and differential homeostatic stability to perturbations, as summarized in Table 1 and Fig. 1 (Salthe 1993, 2003, 2010).

Table 1 shows an overview of characteristic features of developmental stages that relate to energy flows, material growth, structural changes, and a system's stability. By identifying corresponding variables in the economic system it is possible to estimate its developmental stage and to propose some tentative predictions about its near future. What may be the likely unfolding in the per capita energy consumption in a socioeconomic system is presented in Fig. 1, which shows how entropy production changes across the three developmental stages of dissipative systems.

The hypothesis that a capitalist economic system (from a national to the global level) may follow three general developmental stages is grounded in the following premises. All living systems grow by degrading available energy gradients and in the early stages, like in the early successional stage of an ecosystem development, this growth is intense (Schneider and Sagan, 2005, 199). We

[2] Under economic growth we refer to its physical dimension only. See the distinction between matter and energy, versus monetary aspects of economic growth in Ekins (2009).

[3] Note that within the developmental perspective the growth stages are neither vitalistic nor value-laden—they are technical as they relate to theoretical specifics of energy flows, material growth, structural changes, and system stability. The terms themselves have been used in similar context before: see, for example, Rostow's (1960) fourth stage of growth - "Drive to Maturity" - and Baskin's (2013) "senescence", referring to a state's condition when it fails to adapt to changes driven by population growth.