PART I Political Economy and Complex Systems
I Great Transitions in Economic History

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The United States and its European and Asian allies were enjoying stable economic growth. There was no depression on the horizon and no war between global powers (who were waging the Cold War by proxies, far removed); and advances in technology were bringing about higher wages, social mobility, better health and quality of life. Small wonder then that social scientists looked to apply their models of international development through bilateral and multilateral assistance. They held that the processes of change, often referred to as modernization, would produce rising incomes, improved health, economic openness and cooperation, and greater pluralism and tolerance. The culmination, the end of history as it were, would be a broad convergence of the world’s nations, operating with free markets and limited government, into the most productive and desirable mode of social order.

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have brought about massive flows of refugees and internally displaced populations. The global economic crisis of 2007–2009 was the worst since the Great Depression. A black market in enriched uranium and other nuclear materials has evolved from the breakup of the Soviet Union. More telling has been the retreat from democracy in the developing world, and the rising populist hostility to notions of free trade and globalization, reflected among voters of the world’s leading economies.

The upheaval of the first two decades of the twenty-first century has shocked social scientists, in great part because they continue to update their development models, still hoping to portray a world of converging ideals. But their models are failing in the real world to predict important patterns in the development of the global economy. In truth, they worked best for closed systems near or at equilibrium. The convergence that modernization was expected to produce worldwide was predicated on the belief that the global system in which it would occur was also edging toward some state of equilibrium.

It is now clear that the equilibria of liberal political and economic convergence is not inevitable. Prosperity appears alongside nationalism and intolerance. It coexists with religious violence. It can be found coincident with nuclear proliferation and heightened risk of war. It thrives in authoritarian states as readily as in full-fledged democracies. Meanwhile, convergence seems to float just out of reach, over some ever-shifting horizon. What becomes clear as well is this: global societies are not part of a single, overarching, convergent social order that can be fine-tuned and managed with equilibrium models. Instead, global societies are, as they have always been, parts of open, adaptive, complex systems. Not only are their dynamics less predictable than we are comfortable acknowledging, but they are subject to large cyclic swings and cascades of change.

Here is the great disconnect: contemporary social thought in the West uses the ideas of “globalism,” “world order,” “modernization,” and “models of development” as if these were synonymous, reflecting a continuum in which one instantiates the other. Yet once we start to
recognize that global society is a complex adaptive system, we must begin to consider the dynamics to which such systems are prone, dynamics that can, on account of their own internal stresses, veer into conditions of criticality. This also raises a question upon which this book rests: Is change best conceived in terms of mechanical or organic processes?

The complex systems approach has greatly expanded our understanding of the natural, self-organizing processes of change. It utilizes a number of concepts, including imitation, herding, self-organized criticality, and positive feedback, which are captured by network analysis. In addition, and most important, is the realization that a system’s behavior depends on its network structure. This helps us understand how behavior can vary greatly from system to system. If researchers don’t account for network patterns of interactions, they will overlook such variables as how information, ideas, and technology spread; how relationships with peers, friends, neighbors, and acquaintances influence our decisions; behavioral shifts; and the role of explosive percolation (Jackson 2014). The chapters that follow apply complex systems thinking to help us understand great transitions in economic history, particularly the divergence of China and the West, through network models. They explore how China has attained global leadership and why the West is struggling to maintain its own global influence. They address future risks and explain why we must prepare for them.

Throughout history, those living in the midst of each great transition were rarely aware of its breadth or import, and this is also true today, meaning that wholesale shifts are not apparent from a personal, or microscopic, perspective. Yet because we can apply to past shifts the concepts of complex adaptive systems, we are better able to observe their dynamics and draw inferences about the future.

This study of five great transitions in economic history attempts to apply the science of complex networks to historical economic development, with a particular focus on network topology (structure) and its contribution to the differing trajectories of Asian and European societies. Will the technology wars of the future be won by China or by
the West? This question is often asked, although it cannot be answered. Yet Chapters 4–6 demonstrate how network science applied to history can help us to identify crucial variables and to think about patterns that might otherwise be overlooked.

I. I NETWORKS IN ECONOMIC TRANSITIONS

A key concern is how network dynamics determine the type of stability displayed by each system. The first great transition, addressed in Chapter 4, is the gradual formation and sudden demise of dynastic lordship as the pivot of social organization. Solving the problem of leadership succession was critical to the economic progress of both Europe and China, and a significant contributor to the accumulation and transmission of social and technological capital over a wide geographic area. This transformation, characterized by the emergence of clear rules for dynastic succession, emerged in stages, with its onset varying from region to region.

Despite their fundamentally different origins, the monarchical systems in Western Europe, Russia, and China endured for a thousand years before they abruptly declined in the same decade of the twentieth century. To understand the resilience that ensured the duration of dynastic lordship, we delve into the endlessly rewoven relationships between the macro and the micro as part of a coevolutionary dynamic, in which macro- and microsystems each operate under their own sets of laws and cannot be simultaneously determined. Being able to define one does not necessarily allow us to define the other. It is widely acknowledged among scientists who study complex systems that many systems exhibit identical large-scale behaviors, although their microscopic descriptions can diverge significantly.

The second great transition, addressed in Chapter 5, comes from the formation of Western law through the confluence of Germanic custom and the Roman codified system of laws. Western law offered adaptive mechanisms to ensure obligations and protections, and made it possible for communities to channel cooperation and resolve conflicts in parallel with their societies' growing economic complexities.
The evolution of law parallels Brian Arthur’s description of technology: that every new development of technology opens up opportunities for new uses, new supporting technologies, or new ways to organize, distribute, maintain, or enhance its performance (2009). Just as each novel element creates opportunity niches for supporting technologies, as new laws or rulings are brought in, new opportunities appear for further combinations. Social relations adjust to the new legal protocols and change accordingly. Thus the Western legal tradition can be described as self-creating.

The legal system, in fact, predated the European tradition of nation states and aided in their formation. In this role, as a subculture and integral partner of the continent’s cultural, economic, and political elites, it enabled a synthesis of Germanic customs, Roman law, and canon law. Like the Church itself, the legal system operated as a hub in the wider network assemblage. It gained increasing density over time and in parallel with key developmental processes that contributed to the unique character of European civilization.

As the legal platform grew in importance, its use by various parties also grew. The legal tradition took hold between 1050 and 1150, at a time when Europe was a mosaic of hundreds of different political structures. During this period, the character of Europe was being shaped by a number of factors, including the First and Second Crusades in Spain, the conflicting ambitions of the princely nobility and the bishops; the spread of commerce and competition within the urban centers; the power structures of rural lordship; and the Herrenfrage and restructuring of the gender system. The law was partner to a social process, the rise of an independent merchant class; to an economic process, the rise of both towns and private enterprises; and to a political process, the rise of the monarchical state. The feudal lords turned to the law to obtain constraints on royal prerogatives and to contain royal discretion. Merchants turned to lawyers for contract law and risk mitigation, and to ensure their towns remained free of the grasp of the feudal lords. Monarchs turned
to Roman law precepts so as not to be bound by law and custom, and to
obtain absolute rights and power, like the *dominus* over his estate. This
included gaining permanent powers of taxation and jurisdiction over the peasantry. They were resisted by advocates of popular sovereignty, who used the same language of *dominium* (ownership) to assert popular resistance to the monarch’s unlawful actions. Eventually, even peasant communities resorted to the legal system to gain liberation from feudal exactions.

Law played a crucial role in all of these episodes, and in each, the status of the law in society mattered as much as its actual content. An important feature of the Western network architecture is that it could grow organically by the addition of new “nodes.” This capability enabled the law to acquire the status of an interdependent “hub” within a small-world system in which it had multiple connections with other principal hubs, such as networks of royal families, aristocratic land owners, and the elites of the principal trading centers. As a hub that served a much wider set of interests than those of political leadership, the Western legal tradition permeated and perpetuated the small-world properties of the system.

Yet while this adaptive process of blending legal theory and local context continues to animate the Western legal tradition, it is the notion that law transcends politics and holds the lawmakers and the state itself accountable that most contributed to the unleashing of Western Europe’s economic potential. Together, the creation of rules for orderly succession and the binding of elites to law are foundational to the rapid growth of the Western economies, and are among the main reasons for their distinctive pattern of development. Europe’s legal tradition developed the unique capacity to commit the monarch and other elites to a system of legal limits on their power, and this in turn molded the West’s journey to wealth. At each stage of its enlarged use, we see increasing returns at work.

Crucial to the formation of Western firms, markets, and economic institutions was the linkage of economic and political freedom: the freedom to create or join enterprises, acquire and maintain goods
for profit or sale, determine the activity or sector in which to operate, and test or ignore different ideas. As well, assets are taxed at predetermined rates and protected from outright confiscation. Each linkage represents a grant of freedom from political and religious authority, contributing to a third great transition.

We can observe this linkage of enterprise and freedom in trends from the 1670s that led to this third great transition, the industrialization of the means of production that began in earnest in the late eighteenth century (Mokyr 2017). The Industrial Revolution, addressed in Chapter 6, is frequently understood simply as an expansion in the means of production. Nevertheless, there was also an ideational backdrop, in the formation of a cultural ethos that encouraged scientific and technological innovation. Administrative trends also surfaced, in the formation of nation states, and sociological trends helped to form a Europe-wide civil society. After almost two millennia of mediocre growth and gradual technological change, industrialization stimulated the pace of urbanization and greatly augmented overall wealth. That dramatic shift in productive capacity is linked to the network structure of Europe that allowed new hubs to form in an orderly manner without causing the demise of the network’s underlying structure, as was to occur in China.

The dynamics of this great economic transition were hardly linear. Indeed, the transition showed all the behavioral characteristics of a phenomenon found in complex systems. Called self-organized criticality, it can be understood as a two-part process. The first stage, self-organization, refers to the development of structures and patterns without the direct influence of an external agent; examples can be seen in the flocking of birds, the synchronicity of fireflies, the coordination of bees, the formation of an embryo. The second stage, called a phase transition, occurs when the system crosses a critical point at which its dynamics change abruptly and irreversibly. Again in the natural world, we find examples: the stresses caused by the movement of tectonic plates build up over thousands of years but are released in just a few moments during an earthquake. Self-organized criticality
can involve a phase transition during which something extraordinary occurs: the components that normally interact indirectly suddenly all transition together, and the transition spans the entire system, with all members of the system influencing one another. Indeed, during the late eighteenth century, criticality affected the European economy as a system-wide cultural phenomenon whose many interacting parts and currents abruptly coalesced to create an environment that valued and competed for innovation.

Western firms matured in an environment where ideas were protected, interweaving innovation with freedom and making it the essential driver of growth. This environment nurtured diversity in product development and in firm organization. During the nineteenth century, as the links between science and industry became more systematic, much of the West’s industrial research capacity was privately funded. Leaders in private enterprise had basic decision-making power over the innovation process, making firms the basic units for organizing innovation. Government innovations were generally limited to military applications, public health, or the food supply. With this freedom came accountability. Markets determined winners and losers, rewarding innovation according to an innovator’s ability to recoup an investment until it could be improved upon by someone else. Innovators depended on legally sanctioned priority over imitators or successors, making patent laws and an efficient legal system essential. Investment in innovation became the cause of capital formation, rather than its consequence. Even political control over science, art, literature, music, and education relaxed. In other words, freedom in the economic sphere was coupled with other mutually reinforcing freedoms with the legal system reaching all facets of life, including the rise of labor unions to protect workers.

1.2 A Complexity Transition that May Reshape the World

The fourth transition (the topic of Chapters 7–8) has been by far the shortest, spanning just a few decades, and is not yet complete. This is