

Chapter 1. Introduction: The Theoretical Background

1.1 Development of ideas about demographic cycles

The modern science of population dynamics begins with the publication in 1798 of *An Essay on The Principle of Population* by Thomas Robert Malthus. Malthus pointed out that when population increases beyond the means of subsistence food prices increase, real wages decline, and per capita consumption, especially among the poorer strata, drops. Economic distress, often accompanied by famine, plague, and war, leads to lower reproduction and higher mortality rates, resulting in a slower population growth (or even decline) that, in turn, allows the subsistence means to “catch up”. The restraints on reproduction are loosened and population growth resumes leading eventually to another subsistence crisis. Thus, the conflict between the population’s natural tendency to increase and the limitations imposed by the availability of food result in the tendency of population numbers to oscillate. Malthus’s theory was extended and further developed by David Ricardo in his theories of diminishing returns and rent (Ricardo 1817).

According to the Malthusian argument, the oscillation in population numbers should be accompanied by systematic changes in certain economic variables, most notably food prices. Fortunately, data on prices is reasonably abundant in historical sources, and it is possible to construct time series documenting price fluctuations over very long periods of time. Compilations of price trends appeared as early as the sixteenth century. For example, Ruggiero Romano (1967) reports that a time series of grain prices between 1500 and 1593 appeared in an appendix of *La Patria del Friuli Restaurata* by Jacopo Stainero, published in 1595 in Venice. The data on prices in the Medieval and Early Modern England were made available to historians by Thorold Rogers (Thorold Rogers 1862). By the 1930s the empirical material has accumulated to the point where it became very clear that European prices have gone through a number of very slow swings between 1200 and 1900 (Simiand 1932, Griziotti-Kretschmann 1935, Abel 1980).

A most important and lasting contribution was made by Wilhelm Abel’s *Agrarkrisen und Agrarkonjunktur*, the first German edition of which was published in 1935. Abel compiled a rich data set containing time-series information about prices, wages, rents, and population movements in Western and Central Europe from the thirteenth to the twentieth centuries, ensuring that the empirical importance of his work would remain high to this very day. The most striking pattern to emerge was the wave-like movement of grain prices (expressed in terms of g silver). There were three waves or “secular trends” (Abel 1980:1):

1. An upward movement during the thirteenth and early fourteenth centuries followed by a decline in the late Middle Ages.
2. Another upsurge in the sixteenth century followed by a decline or apparent equilibrium (depending on the country) during the seventeenth century.
3. A third increase during the eighteenth century, followed by irregular fluctuations during the nineteenth century eventually converging to an early twentieth century minimum.

The twentieth century saw another (fourth during the last millenium) period of price inflation (Fischer 1996).

On the basis the observed patterns Abel argued that the fluctuations in the circulation of money could not adequately explain the long-term trends in the price of grain. By contrast, population moved, more or less, in the same direction as the food prices and in an inverse ratio to wages (Abel 1980:292-293). Abel concluded that the Malthusian-Ricardian theory provided a better explanation of the data than the monetarist theory. Furthermore, the Malthusian-Ricardian theory predicted that growing population would result in a specific progression of effects. Rents rise first with grain prices lagging behind rents, the price of industrial goods lagging behind grain

prices, and workers' wages bringing up the rear. The evidence showed that this was precisely what happened (until the whole system was dramatically changed in the nineteenth century).

Abel's conclusions were soon supported and extended by other historians, with the most influential contributions made by Michael Postan working in England and Emmanuel Le Roy Ladurie in France. In a talk given in 1950 Postan rejected a monetarist explanation of long-term price movements during the Middle Ages, and firmly asserted the primacy of the demographic factor (Hilton 1985). Le Roy Ladurie was an even more consistent follower of Malthus. In *The Peasants of Languedoc*, first published in French in 1966, he argued that southern France went through a great agrarian cycle lasting from the end of the fifteenth century to the beginning of the eighteenth (Le Roy Ladurie 1974:289). Although Le Roy Ladurie did not completely ignore the social and political aspects of the cycle, his explanation of the causes underlying the cycle was firmly Malthusian. Speaking in 1973 he said, "it is in the economy, in social relations and, even more fundamentally, in biological facts, rather than in the class struggle, that we must seek the motive force of history" (quoted in Hilton 1985:4).

Such a radical Malthusian position could not but provoke a reaction from scholars working within Marxist tradition. Although some Marxist historians doubted the very fact of a drastic and prolonged population decline from 1350 to 1450 (Kosminsky 1956), others accepted it, but preferred to explain it as the "crisis of feudalism." In an influential book first published in 1946 Maurice Dobb argued that the cause of the crisis was the inefficiency of feudalism as a system of production, coupled with the growing needs of the ruling class for revenue (Dobb 1963:42-47). The "feudal lust for expanded revenue" was a result of two processes: the growth in the size of the parasitic class and the increasing extravagance of noble consumption. These two tendencies working synergistically resulted in an intensification of feudal pressure on the peasantry to the point where it destroyed the goose that laid golden eggs. Dobb's theory occasioned an extensive discussion (Sweezy et al. 1976). One interesting contribution to the theory was Paul Sweezy's proposition that the growing extravagance of the feudal ruling class was a result of rapid expansion of trade from the eleventh century onward, which brought an ever-increasing variety of goods within its reach (Sweezy et al. 1976:38-39). Thus, Sweezy sees the root cause of the fourteenth century crisis in the impact of this exogenous force on the structure of feudalism (Sweezy et al. 1976:106).

Robert Brenner's 1974 critique of Postan's and Le Roy Ladurie's theories might be regarded as a continuation of the Dobb-Sweezy debate of the 1950s (the "Brenner debate" papers are collected in Aston and Philpin 1985, Hilton 1985). Brenner did not deny that the Malthusian model had a certain compelling logic (Brenner 1985a:14). However, its attempt to explain long trends in economic growth and income distribution were doomed from the start because it ignored ("abstracted away") the social structure, most importantly, the surplus-extraction relationship between the direct producers and the ruling class (Brenner 1985a:10-11).

One deficiency of the Malthusian theory, according to Brenner, was the empirical observation that different societies within Europe starting from similar demographic and economic conditions obtaining after the Black Death subsequently followed divergent trajectories. For example, serfdom completely disappeared from certain Western European countries (England, France) while making a strong comeback in Central Europe (Poland, Prussia). Thus, different property structures (the landholding system) and different balances of power (the cohesiveness and organization of the ruling class) could result in different paths followed by societies after the demographic catastrophe.

The second, and even more damaging, argument against the Malthusian model is the observation of continuous stagnation of most of the traditional European economies in the late medieval period (Brenner 1985a:18). For example, the Black Death removed about one-third of the English population in the mid-fourteenth century, and by the end of the century, population was further reduced to one-half of its 1300 peak. According to the Malthusian logic, such a drastic population decrease should have led to a higher agrarian productivity, low food prices and high real wages, and resumption of vigorous population growth. Indeed, the dynamics of prices and wages was largely in line with the Malthusian predictions. Yet, population stagnated for more than a century, with growth resuming only in the late fifteenth century. Brenner argued that such episodes of long-term stagnation could only be understood as the product of established structures of class relations (Brenner 1985a:18). A decline in the number of direct producers reduced the income of the lords. In order to maintain their income, the lords attempted to extract a greater amount from each peasant, as well as to try to dispossess one another (via brigandage and internal warfare). The result was the disruption of production leading to further demographic decline, rather than a return to equilibrium as the Malthusian model would predict (Brenner 1985b:224).

In their responses to Brenner's critique, Postan and Le Roy Ladurie were unable to effectively account for the prolonged post-Black Death depression phase within the Malthusian theory. Postan and Hatcher acknowledged the problem: "Indeed the reason why the recovery was so belated and so sluggish is still one of the incompletely resolved difficulties inherent in the medieval hypotheses Brenner disagrees with" (1985:69). On the other hand, the extreme version of the Marxist thesis (perhaps found in the purest form in Sweezy), assigning class relations the all-determining role in the economic development of medieval and early modern Europe, would also fail to account for empirical facts. For example, such a purely class-struggle based theory is unable to explain the secular cycles in population, prices, and wages, as well as why exploitation of peasants also fluctuated cyclically.

In the end, the critique of Brenner and certain others, most notably, Guy Bois (1984), played a constructive role by pointing out that the Malthusian model neglects an important explanatory variable. What we need is a synthetic theory that encompasses both demographic mechanisms (with the associated economic consequences) and power relations (surplus-extraction mechanisms). Note that in the dynamical systems framework, it does not make sense to speak of one or the other as "the primary factor". The two kinds of variables interact dynamically, both by affecting each other and being affected by each other. We pursue this idea in the next section.

It is curious that both sides in the Brenner debate almost entirely ignored the role of the state. This omission is understandable. The Marxists tend to treat the state as merely a vehicle for conveying interests of the ruling class, while the Malthusians' focus has been on the economic variables. There is, however, a significant movement among historical sociologists "to bring the state back in" (Skocpol 1979). States are not simply created and manipulated by dominant classes; they are agents in their own right, and compete with the elites in appropriating resources from the economy.

Historians have long recognized that there were recurrent waves of state breakdown and political crises in European history: the "calamitous" fourteenth century (Tuchman 1978), the "iron century" of 1550–1660 (Kamen 1971), and the "age of revolutions" of 1789–1848 (Hobsbawm 1962). Each of these periods was preceded by a period of sustained and substantial population growth. In a path-breaking book Jack Goldstone (1991) argued that there is a causal connection between population growth and state breakdown. The seeds of this theory were

already contained in the work of Malthus. Goldstone, however, does not argue that population growth is a direct cause of state collapse (in fact, he carefully distances himself from the strict Malthusian doctrine). Instead, population growth causes social crisis *indirectly*, by affecting social institutions, which in turn affect sociopolitical stability. For this reason, Goldstone refers to his theory as demographic-structural: *demographic* because the underlying driving force is population growth; *structural* because it is not the demographic trend itself that directly causes the state crisis, but its impact on economic, political, and social structures (Goldstone 1991:xxvi). We will discuss this theory in more detail in the next section, but here we should mention that the verdict on Goldstone's work among historical sociologists has been highly positive (see, for example, Collins 1993, Wickham-Crowley 1997, Li 2002).

To summarize, it is becoming increasingly clear to specialists from very diverse fields—demographers and historical economists, social historians, and political scientists—that European societies were subjected to recurrent long-term oscillations during the second millennium CE (Braudel 1988, Cameron 1989, Fischer 1996). Furthermore, the conception of oscillations in economic, social, and political dynamics was not discovered by the Europeans. Plato, Aristotle, and Han Fei-Tzu connected overpopulation to land scarcity, insufficient food supply, poverty, starvation, and peasant rebellions (Parsons 2005). The Chinese, for example, have traditionally interpreted their history as a series of dynastic cycles (Reischauer 1960, Meskill 1965, Usher 1989, Chu and Lee 1994). The fourteenth century Arab sociologist Ibn Khaldun developed an original theory of political cycles explaining the history of the Maghreb (Inayatullah 1997). Are these, at the first glance, very diverse phenomena related? In this book we examine the hypothesis that secular cycles—demographic-social-political oscillations of a very long period (centuries long) are the rule, rather than an exception in the large agrarian states and empires.

1.2 A synthetic theory of secular cycles

The brief review in the previous section focused mainly on the controversies between advocates of various processes as dominant influences. In the heat of the debate, however, the opposing sides tend to simplify and caricature the views of each other. For example, it is clear that neither purely demographic, nor purely class-conflict explanation of secular cycles works very well when confronted with data. On the other hand, a synthetic theory, which incorporates both of these (and some other) processes may provide us with a viable hypothesis that can be tested with data. The idea is that secular cycles can only be understood as a result of the interaction between several interlinked variables—economic (including demography), social structure (particularly, how the elites interact with the producing population and the state), and political (state stability or collapse). In the following paragraphs we sketch the outlines of such a synthetic explanation. Our explicit focus is on agrarian societies, that is, those in which more than 50% of population (and typically above 80–90%) is involved in agriculture.

The demographic component

The demographic component of the theory is based very much on the original insights of Malthus and Ricardo, further developed by neo-Malthusians such as Le Roy Ladurie and Postan. The key variable is the population density in relation to the carrying capacity of the local region. The concept of *carrying capacity* was developed by ecologists in the context of the logistic model, invented by Paul Verhulst and popularized by Raymond Pearl (1920). Carrying capacity is defined as the population density that the resources of habitat can support in the long term (for an excellent discussion of human carrying capacity from an ecologist's point of view, see Cohen 1995). The *resources* usually refer to food, although in some environments the limiting resource may be the availability of water or fuel. Carrying capacity, thus, is an upper ceiling on population

growth. From the economics point of view, this limit arises because labor inputs into production suffer from the diminishing marginal returns.

It is clear that the carrying capacity of a specific region is strongly affected by its physiographic features (the availability of land suitable for agriculture, water supply, soil characteristics, length of the growing season, etc). It is also affected by year-to-year fluctuations in the temperature and the amount of rainfall, as well as gradual changes in the climate. In other words, carrying capacity is a variable that changes in both space and time. Finally, and most importantly, carrying capacity is affected by both the existing level of agricultural technology, and how this technology is employed. As Ester Boserup (1966, 1981) famously argued, population growth can have a positive effect on economic innovation.

Although Boserup is widely regarded as being anti-Malthusian, both her insights and those of Malthus can be comfortably combined within the same general theoretical framework (Lee 1986, Wood 1998). Thus, adverse effects of population growth on the standard of living can provide strong inducements for the adoption of new means of production. However, in agrarian societies economic change can win only a temporary respite from marginal immiseration (Wood 1998, Clark 2007). For example, a society that approaches the current limits of population growth can invest in clearing forests, draining swamps, irrigation, and flood control. All these measures will result in an increase of the carrying capacity. However, at some point there are no more forests to cut or swamps to drain, and if population continues to grow, then eventually it will again begin pressing against the Malthusian limits.

As population density approaches the carrying capacity, a number of related changes affect the society. There are shortages of land and food, and an oversupply of labor. As a result, food prices increase, real wages decline, and per capita consumption, especially among the poorer strata, drops. Economic distress leads to lower reproduction and higher mortality rates, resulting in a slower population growth. Should population density reach the carrying capacity, there would be just enough food to sustain and replace one individual; birth and death rates would equalize, and population density would be at an equilibrium. At least, this is what simple models such as the logistic predict; in actuality, other factors not taken into the account by a purely demographic model would preclude a stable equilibrium, as we discuss below.

Population growth in excess of the productivity gains of the land has a fundamental effect on society's structures. The typical changes accompanying population growth are high rents and land prices, increasing fragmentation of peasant holdings and/or high numbers of landless peasants, and increased migration of landless peasants to cities. Urbanization (measured by the proportion of population inhabiting towns and cities) increases. Cheap labor results in a flowering of trades and crafts. The demand for manufactures increase, because the elites profit from high rents on land and/or lower labor costs. Increased urbanization and conspicuous consumption by the elites promote regional and international trade. The gap between the well-to-do and the poor grows. In rural areas overpopulation means that no food reserves are available in case of crop failure. Accordingly, years of poor harvest that would be hardly noticed in better times now result in significant mortality and, at worst, in catastrophic famines. Chronic undernourishment creates conditions conducive to the spread of epidemics.

The cities accumulate landless peasants and jobless artisans, who join the growing ranks of paupers and vagrants. Food riots and wage protests become frequent. Eventually, deepening economic misery leads to peasant and urban uprisings. However, as long as the elites are united and the state maintains control of the military, such popular uprisings have small chances of success. This fundamental point was recently reiterated by Jack Goldstone: "It is a profound and

repeated finding that the mere facts of poverty and inequality or even increases in these conditions, do *not* lead to political or ethnic violence (Gurr 1980, Goldstone 1998, 2002b). In order for popular discontent or distress to create large-scale conflicts, there must be some elite leadership to mobilize popular groups and to create linkages between them. There must also be some vulnerability of the state in the form of internal divisions and economic or political reverses. Otherwise, popular discontent is unvoiced, and popular opposition is simply suppressed” (Goldstone 2002a).

Social structure: commoners, elites, and social mobility

One important consequence of the law of diminishing returns is that the amount of surplus produced by cultivators is nonlinearly related to their numbers. Surplus is the difference between the total production and what is needed for subsistence (that is, the minimum amount of resources needed to support and reproduce each peasant household multiplied by the number of households). The amount of resources needed for subsistence increases linearly with population, while the total product grows slower than linearly as a result of the law of diminishing returns (see Figure 1.1a). As a result, at a certain critical population density, which we have defined as the carrying capacity above, the two curves intersect. This is the point where the surplus becomes zero (and should population increase beyond the carrying capacity, the surplus becomes negative, with the consequence that peasant households do not get enough resources to reproduce themselves, and population density must decline).

Figure 1.1 The effect of population growth on total production, subsistence needs, and the production of the surplus. K is the carrying capacity.

The curve relating the amount of surplus produced to population density crosses zero both where population density equals zero and where it equals carrying capacity, and there is a hump somewhere between these two critical points (Figure 1.1b). Thus, when population increases from a low level, initially the amount of surplus increases (more peasants means more surplus). At some intermediate density, however, the surplus reaches a maximum: this is where the effects of diminishing returns on labor inputs into agriculture begin to be felt. After that point, the surplus begins to decline.

The surplus produced by peasants is not made available to the elites (and the state) automatically—left alone, peasants would happily consume it themselves (or simply work less—“consume” it as extra leisure time). How much of the production ends up in the hands of the elites depends on many economic and political factors. One important dynamic is that the elites are usually able to extract a larger amount of surplus during the late stages of population growth. Specific mechanisms depend on the landholding system. For example, an oversupply of rural labor elevates rents and, therefore, increases landowner’s profits. In a serfdom-based system lords can set the level of extraction almost arbitrarily high, because oppressed serfs have nowhere to flee—the whole surrounding landscape is at the saturation level, and the only alternative is the life of a vagabond or a bandit, which has always been brutish and short. Thus, most serfs have no realistic alternative to submission.

Prospects are equally bleak for free, but landless laborers who must secure employment to support themselves and their families. Oversupply of labor leads to depressed wages and chronic unemployment or underemployment for a substantial part of population. On the other hand employers, both rural and urban, profit greatly from this economic situation.

These considerations suggest that during the late stages of population growth, when commoners are already suffering from economic difficulties, the elites are enjoying a golden age. Both the reproduction of the existing elites and recruitment of new elites from commoners will be fastest when the amount of extractable surplus is greatest. The expansion of elite numbers should take place during the “stagflation” phase (see below for the definitions of the phases of a secular cycle), after general population growth came to an end. As a result, the peak of elite numbers generally lags behind that of general population (the important exception of societies with widespread polygyny will be discussed in Section 1.3).

Such a happy state of events (for the elites) cannot continue for long. First, expansion of elite numbers means that the amount of resources per elite capita begins to decline. This process would occur even if the total amount of surplus stayed constant. But, second, as general population grows closer to the carrying capacity, surplus production gradually declines. The combination of these two trends results in an accelerating fall of average elite incomes.

The dynamic processes described above also have a socio-psychological aspect. During the good times the elites become accustomed to, and learn to expect a high level of consumption (this is the “growing extravagance of noble households” of Dobb and Sweezy). An additional element, as pointed out by Sweezy, is the ever-increasing quantity and variety of goods available to the elites, which results from urbanization, growth of crafts, and expansion of trade (themselves a consequence of population growth, as discussed above). Modern studies of consumption level expectations suggest that people generally aim at matching (and if possible exceeding) the consumption levels of their parents (Easterlin 1980, 1996). Thus, what is important is not the absolute level of consumption, but the level in relation to the previous generation. In other words, expected “living standard” is a culturally determined *inertial* variable (inertial because it changes slowly, on a generation time scale). If we can extrapolate results obtained by studying modern consumers to pre-industrial elites (at least, this may be a reasonable working hypothesis), then we would predict that during the good times the elites would easily become accustomed to elevated levels of consumption, and this expansion would occasion little social comment. By contrast, should their level of consumption decrease in relation to the previous generation, the elites would be expected to react vehemently to this development. This argument suggests that there is no contradiction between the bitter critique of the elites for their luxurious and wasteful way of life by contemporary social commentators, while the elites themselves may be equally bitterly complaining of poverty and indebtedness.

Deteriorating economic conditions of the elites during the late stagflation phase of the secular cycle do not affect all aristocrats equally. While the majority are losing ground, a few lineages, by contrast, are able to increase their wealth. The growing economic inequality results from the operation of what some sociologists call the “Matthew Principle” (Merton 1968). The poor aristocratic lineages tend to get poorer because they attempt to maintain their elite status on an inadequate economic basis. This forces them into growing indebtedness, which eventually has to be addressed by selling some of their assets (such as land). A wealthier lineage, by contrast, can maintain the level of consumption necessary for preserving its elite status, and have some resources left over to acquire land from their impoverished neighbors. As a result, the poor get poorer while the rich get richer. The same dynamic operates on peasants during the stagflation phase. During the periods of economic hardship, poor peasants must sell land, or starve. As a result, at the same time that the majority are sliding into the absolute misery, a small percentage of thrifty, hardworking, or simply lucky peasants are able to concentrate increasing amounts of land in their hands. At some point, such successful peasants usually attempt to translate their wealth into higher social status. This demand for upward social mobility is an important

contributing factor to elite overproduction that develops after prolonged periods of demographic expansion.

During the stagflation phase, thus, economic inequality increases within each social stratum—peasants, minor and middle-rank nobility, and the magnates. Growing inequality creates pressure for social mobility, both upward and downward. Increased social mobility generates friction and destabilizes society. The growing gap between the poor and rich also creates breeding grounds for mass movements espousing radical ideologies of social justice and economic redistribution.

Dynamics of surplus extraction

Declining incomes of the majority of aristocrats have two important consequences: intensifying oppression of the peasants by the elites and increasing intralite competition for scarce resources. The elites will attempt to increase the proportion of resource extracted from the producers by whatever means that are available to them, both economic and extra-economic (coercive). Their success will depend on the structural characteristics of the society: the relative military strength of the elites with respect to the producers and the state, legal and cultural limits on surplus extraction, etc. If successful, elites may not only deprive the commoners of the surplus, but also cut into the subsistence resource, resulting in a negative growth rate of the commoner population. “Thus the lord’s surplus extraction (rent) tended to confiscate not merely the peasant’s income above subsistence (and potentially even beyond) but at the same time to threaten the funds necessary to refurbish the peasant’s holding and to prevent the long-term decline of its productivity” (Brenner 1985a:31). It appears that this stage in the secular cycle may be what is known among dynamicists as a “bifurcation point”, in which the system may follow one of several alternative trajectories. A classic example of such divergent trajectories is the disappearance of serfdom in post-medieval England and France and, during the same period, the rise of new serfdom in Prussia and Poland. Which of the alternative trajectories the system follows may depend on its structural characteristics, or be a result of a chance event. We are essentially rephrasing, in dynamical systems terms, the point made by Brenner in his critique of the Malthusian theory.

This thesis is illustrated by the recent study of Stuart Borsch (2005), which compared the effects of the Black Death in England and Egypt. In post-Black Death England wages rose, rents and grain prices dropped, unemployment decreased, and per-capita incomes grew. Although the economic recovery of England occurred later than would be predicted by the Malthusian model, by the year 1500 it was in full swing. The consequences of depopulation in Egypt were profoundly different. Wages dropped, land rents and grain prices rose, and unemployment levels increased. No economic recovery was anywhere in sight by 1500. In fact, agricultural output declined between 1350 and 1500 by 68%. Borsch argues convincingly that the persistent stagnation of the post-Black Death Egypt is explained by its landholding system. After 1250 Egypt was ruled by a particularly cohesive group of elites: specialized slave-warriors known as Mamluks. After the Black Death, Mamluks were able to use their tremendous collective power to maintain the pre-plague level of resource extraction from a greatly diminished rural population. Extremely high levels of exploitation of individual peasants precluded any demographic revival. The system, thus, was caught in a “vicious equilibrium” that was apparently stable with respect to internal perturbations; it was finally destroyed by external conquest (the Ottomans in 1517).

The second consequence of plunging elite incomes is increased intralite competition. The forms that this competition takes will depend (again) on the structural characteristics of the society. Probably the most important factor is the capability of the state to suppress overt violence. Here we consider the forms of intralite competition in the presence of the state, when

internal order is maintained, while the situation after the state collapses, or is seriously weakened, will be taken up below.

One recourse to the elites facing declining incomes from agriculture was to seek employment with the state or church bureaucracy. Because training improved one's chances, a curious side-effect of increased competition for such positions is the "credentialing crisis" (Collins 1979)—a rapid expansion of enrollments at the educational institutions (at least, in those societies that offered formal training to aspirants for elite positions). Thus, we can use trends in higher education as an index of intralite competition (Goldstone 1991:123). Another useful index of intralite conflict is the level of civil litigation (Goldstone 1991:120).

Impoverished elites could also improve their incomes by attaching themselves to the retinues of powerful magnates. In the fifteenth century England this trend resulted in what is known as "bastard feudalism" (Dyer 1989:35). A large retinue was necessary to advance the lord's interests in government, litigation, and even civil war. However, limits on available land, civil and ecclesiastical offices, and royal patronage lead to increasingly polarized factional battles between patron-client groups for available spoils (Goldstone 1991:119). As a result, the elites tend to lose their unity and become split along numerous fission lines: new elites versus old, one religious faction against the other, regional elites against the center, and so on. Because there are not enough resources for everybody, certain segments of elites, or groups aspiring to the elite status, inevitably end up as the losers. We will refer to them as the anti-elites, or dissident elites. Usually, the anti-elites do not constitute a true sociological group, because there is little that unifies them apart from the hatred for the existing regime, and burning desire to bring it down. Incidentally, we are not implying here that motivations of the anti-elites are purely economical. The late stagflation phase, as we argued above, is typically characterized by a harsh oppression of the productive segments of the society and extreme social inequality, offering ample ideological justification for revolutionary action.

State breakdown

Social trends resulting from demographic growth—declining surplus production, popular immiseration, intralite competition, etc—have a profound impact on the ability of the state to maintain internal order, or even to survive (Goldstone 1991). Population growth leads to expansion of armies and bureaucracies, resulting in rising state expenditures. An increased number of aspirants for elite positions puts further fiscal strain on the state. Thus, states have no choice but to seek to expand taxation, despite resistance from the elites and the general populace. Yet, the amount of surplus production declines (as discussed in the previous section), and the state must compete for this shrinking surplus with increasingly desperate elites. As a result, attempts to increase revenues cannot offset the spiraling state expenses, and even though the state is rapidly raising taxes, it is still headed for fiscal crisis. Note that declining *real* revenues may be masked by persistent price inflation, and it is therefore important to express all fiscal flows in real terms.

As we discussed in the previous section, population growth leads to rural misery, urban migration, falling real wages, and increased frequency of food riots and wage protests. After a certain lag time, negative effects of population expansion begin to affect the elites, who become riven by increasing rivalry and factionalism. Another consequence of rapid population growth is the expansion of youth cohorts. This segment of population is particularly impacted by lack of employment opportunities. Finally, growing economic inequality, elite competition, and popular discontent fuel ideological conflicts. For example, in early modern Europe, dissident elites and dissatisfied artisans were widely recruited into heterodox religious movements.

As all these trends intensify, the end result is state bankruptcy and consequent loss of the military control; elite movements of regional and national rebellion; and a combination of elite-mobilized and popular uprisings that manifest the breakdown of central authority (Goldstone 1991:25). Internal war among political factions is only one aspect of increased interpersonal violence. Breakdown of social order is also accompanied by increased banditry, homicides, and other kinds of violent crimes. On the ideological level, the feeling of social pessimism is pervasive and the legitimacy of the state authority is at its lowest point. The society approaches a condition that may appropriately be called “Hobbesian” (Hobbes himself lived during such a period). Collectively we will refer to these condition as high sociopolitical instability.

The effect of sociopolitical instability on population dynamics

In the previous sections we focused on the manifold effects of population growth on various structures of the society, including a bundle of variables that we call sociopolitical instability. Here we consider the feedback effect: how does instability affect population dynamics? We can envision two general (and, actually, interrelated) ways: the effect on the demographic rates and on the productive ability of the society (Turchin 2003b:120-1).

Most obviously, when the state is weak or absent, the populace will suffer from elevated mortality due to increased crime, banditry, and internal warfare (civil war). External war may also play a role. Although external warfare between states has been a constant feature of agrarian states, its effect on demography should change with the phase of the secular cycle. When the state is strong, warfare is directed outwards and areas that suffer most are the state frontiers as well as areas outside, which are targeted for conquest. Collapse of the state and the ensuing civil wars reduce the resistance of the society to external invasion. As a result, internal warfare and external invasions by groups ranging from small groups of raiders to rival great powers can become hard to separate (this is, for example, what happened during the Hundred Years War in France). Warfare has also an indirect effect on mortality, because movements of rebel or invading armies spread epidemics.

The times of trouble also cause increased migration: refugees flee from war-afflicted areas, or areas whose productive potential has been destroyed. Migration has several effects. First, it can lead to emigration (and we can simply add that to mortality). Second, people on the move cannot afford to have children. Thus, birth rates decline. Third, migration leads to epidemics. Increased vagrancy spreads the disease by connecting areas that would stay isolated during better times. For example, in Ireland during 1810–44 (the period just before the Great Famine), harvest failed or partially failed in 15 years out of 35. These failures did not lead to starvation, but they were followed by outbreaks of “famine fevers” (typhus, dysentery, scurvy, cholera, etc), which were spread throughout the isle by beggars and vagrants seeking charity and employment (Grigg 1980:138).

Additional factors facilitating the spread of disease are the movements of armies (alluded to above) and the expansion of international trade. The latter factor should be qualified by noting that international trade expands in the pre-crisis period (stagflation phase) and then gradually declines after the society has descended into anarchy. Thus, the rise of widespread epidemics—pandemics—is actually most probable during the late stagflation phase. In fact, the arrival of a pandemic is one of the most frequent triggers of the demographic-structural collapse.

On a more local scale, vagabonds and beggars aggregate in towns and cities, increasing their population size. This may tip the local population density over the epidemiological threshold (a critical density above which a disease spreads and below which it dies out).

Finally, political instability causes lower reproduction rates, because personal consumption plummets (as a result of lowered production capacity, see below). Absence of organized ways to store surplus does not allow peasants to weather short-term subsistence crises. What stores are accumulated by individual households are easy prey to the marauding armies and other predators. In addition, during the times of uncertainty people choose to marry later and to have fewer children. Incidentally, people's choices about their family sizes may be reflected not only in birth rates, but also in the rates of infanticide. Thus, family limitation practices may be disguised as increased infant mortality.

The second, and perhaps even more important effect of sociopolitical instability is on the productive capacity of the society (the carrying capacity). Vigorous states often invest in increasing the agricultural productivity by constructing irrigation canals and roads, by implementing flood control measures, by clearing land from forests, organizing colonization of underpopulated regions, etc. The end result of these measures is mainly the increase in cultivated area, although some measures also increase productivity of land.

The other general mechanism is that the state offers protection. In a stateless society people can live only in natural strongholds, or places that can be made defensible, such as walled cities. For example, at the height of the Roman Empire the overwhelming majority of Italian population would be found in the lowlands where most productive land was concentrated. After the collapse of Rome settlements were moved to hilltops (Wickham 1981). An even more striking illustration comes from the Wanka hillfort chiefdoms in the Mantaro Valley of Peru (Earle 1997). Prior to Inka pacification of the region, the Wanka lived in crowded hilltop fortresses. After the conquest, the population moved down to lower elevations where the best agricultural land was located. As a result, the diet and lifespan of both elite and commoner was dramatically improved (Johnson and Earle 2000:327).

The third example comes from *Histoire de Charles VII* by the Norman bishop Thomas Basin, who described the northwestern France during the 1420s, after a particularly virulent outbreak of the Hundred Years War: "... a state of devastation such that from the Loire to the Seine, and from there to the Somme, the peasants having been killed or run off, almost all fields were left for a number of years not only uncultivated, but without people ... All that could be cultivated at that time in that region was only around and inside towns or castles, close enough so that, from the top of the tower or watchtower the eye of the lookout could perceive the attacking brigands. Then, with the sound of a bell, or horn, or some other instrument, he gave all those working in the fields or vineyards the signal to withdraw to the fortified place" (from a long quotation in Dupâquier et al. 1988:368). In other words, lack of effective suppression of internal violence by the state imposes a "landscape of fear", in which a large proportion of agriculturally suitable lands is abandoned because they are too far from a place of security. By contrast, the strong state protects the productive population from external and internal (banditry, civil war) threats, and thus allows the whole cultivable area to be put into production.

Elite dynamics during the depression phase

Socio-political instability affects elite numbers in a fashion that is similar to its effect on commoners, although the relative importance of specific mechanisms can be quite different. Thus, the elites may be little affected by subsistence crises. They also tend to escape more lightly the effect of epidemics. This is partly due to their better nutrition and the likelihood of getting better care during disease, but even more important is their higher mobility. Urban elites could withdraw to their country estates at the first sign of incipient epidemic (as in Boccaccio's *Decameron*). Higher nobility with estates in multiple provinces could similarly avoid an epidemic striking a particular region.

On the other hand, by virtue of their more active participation in politics, the elites ran a much higher risk of violent death. The death toll in some conflicts was quite extraordinary. For example, Dupâquier et al. (1988:342) quote an estimate by Philippe Contamine that around 40% of the French elite may have been slaughtered in the battle of Poitiers (1356) and the same proportion at Agincourt (1415). During the Wars of Religion of the late sixteenth century, 20,000 Huguenots were killed in just one day, the St. Bartholomew's massacre (Kamen 1971:39).

Loss of life or elite status could also result from state purges. For example, the first Ming emperor purged 100,000 Chinese officials (Tignor et al. 2002:62). Sulla's proscriptions eliminated a third of the Roman ruling class, senators, and another third was eliminated by proscriptions following Caesar's death (see Chapter 6).

A much less spectacular, but perhaps ultimately more important process reducing the elite numbers is downward mobility. The plunge in the elite incomes, which begins in the pre-crisis period and is greatly exacerbated by the general population decline, affects most strongly the status of the lowest noble stratum. A specific example is given by Christopher Dyer for the late medieval England. An esquire or gentlemen living on £10–20 a year who was employing only three servants and lived in one house, and whose meals were devoid of much luxury in terms of wine and spices, had little room to maneuver when his income plunged by up to 50% in the middle fifteenth century. "They must have cut back, or even cut out completely, their occasional wine-bibblings, and avoided travel whenever possible, but too many economies of this kind might force them to drop out of the aristocracy and accept yeoman status" (Dyer 1989:108).

End of instability and the beginning of the new cycle

Because the three main factors driving the rise of sociopolitical instability are general overpopulation, elite overproduction, and state insolvency, all these trends must be reversed before the disintegrative phase can end. Such trend reversal can occur in a variety of ways, depending on the characteristics of the society, its geopolitical environment, and various other exogenous factors. As a result, the last stages of the secular cycle are particularly rife with bifurcation points, and the sociopolitical trajectory can behave in a very non-deterministic fashion.

The problem of overpopulation is usually "dealt with" during the crisis phase. One of the most common proximate mechanisms of population collapse is disease, but not all population declines are accomplished by catastrophic epidemics. Prolonged periods of civil war can also cause drastic drops in population levels, although typically requiring more time. Finally, the external conquest of a disunited society on many occasions resulted in a demographic catastrophe.

An alternative to population collapse is the increase in the carrying capacity—after all, overpopulation results not from the absolute numbers being too large, but from too high population density in relation to the carrying capacity. The carrying capacity can increase as a result of technological progress. This is probably what happened in the early modern England. During the crisis of the seventeenth century, the English population hardly declined, while average yield of grain per acre probably doubled. The end result was a two-fold decline in the population pressure on resources.

The carrying capacity may also increase as a result of conquest of new underpopulated territories. An example is the conquest of Kazan and Astrakhan khanates by Muscovy in the

sixteenth century, which opened vast areas along the Volga river for Russian colonization during the succeeding centuries. Theoretically the carrying capacity can also increase as a result of a substantial amelioration of the climate, although at this point we cannot point to a well-documented, convincing example of this mechanism in action.

The processes leading to the reduction in the elite numbers and appetites have been discussed in the previous section. The manner in which elite overproduction is abated depends very much on the military strength of the aristocracy. A non-militarized ruling class can be expropriated *en mass* by warlords, such as rebel generals or even peasant bandits. A rapid and comprehensive elite turnover results in a relatively short period of sociopolitical instability that follows state collapse. This is apparently what happened on several occasions during the Chinese imperial period, where the ruling class was dominated by the literate administrative elites, rather than military specialists. A rapid elite turnover can also result when there is a ready external source of potential elites, such as was the case in the Maghreb described by Ibn Khaldun (we will discuss Ibn Khaldun cycles in the next section).

A ruling class that enjoys a preponderance of military power over both internal and external rivals can be reduced only after by internecine fighting between various elite factions. This can result in very prolonged periods of sociopolitical instability, or “depression” phases in our terminology.

Thus, in order for a new secular cycle to get going, the pressures of the general population on resources and of the elites on commoners must be substantially reduced from their pre-crisis levels. There is also a third condition. Not all societies are capable of the broad-scale cooperation that is required to construct a functioning state, and some societies with previous imperial history can also lose this ability with time (Turchin 2003b, 2006). Thus, it is entirely possible for the civil warfare to gradually die out, but a centralizing, integrative trend nevertheless failing to take hold. In this case, the area in question may persist indefinitely (or until it is conquered from the outside) in a fragmented state as a collection of small-scale polities. The potential explanations of this failure to build a functioning state lie beyond the scope of our book. Here we just need to indicate that it is yet another possible bifurcation point.

Phases of the secular cycle

Oscillatory dynamics do not go through truly discrete phases with clearly marked breakpoints, but for convenience of talking about each secular cycle, we need to divide it up in phases. Our classificatory scheme is given here with the understanding that transitions between phases are rarely abrupt so that any particular year that we designate as an end to one phase and the beginning of another is to some degree arbitrary (for this reason, we usually round the date to the nearest decade).

Most broadly the cycle can be divided into two opposite trends. In the literature these are sometimes called the positive “A phase” and the negative “B phase”, but we prefer more descriptive terms: *integrative* and *disintegrative* trends. Politically the integrative phase is characterized by a centralizing tendency, the unified elites, and the strong state that maintains order and internal stability. Internal cohesion often results in a vigorous prosecution of external wars of conquest that may result in the extension of the state territory (assuming that there are weaker neighbors at whose expense the state can expand). The disintegrative phase, by contrast, is characterized by a decentralizing tendency, divided elites and weak state, internal instability and political disorder that periodically flare up in civil war. External wars of conquest are much more difficult to prosecute during the disintegrative phase. If they happen, they usually take place during the intervals between civil wars and at the expense of equally weak opponents. More

frequently, it is the external enemies that profit from the internal weakness of the state and society, resulting in increased frequency of raids, invasions, and loss of territory.

Population tends to increase during the integrative phase and decline or stagnate during the disintegrative one. Climatic fluctuations, epidemics, or being overrun by an external enemy can cause short-term (even if very significant) population losses. However, vigorous population growth resumes as soon as such exogenous forces stop acting. During the disintegrative phase, by contrast, population losses due to epidemics, famines, or wars are not made up by sustained population growth. Even when the proximate Malthusian forces (epidemics, famines, and wars) are in abeyance, population often fails to increase, despite being much below the carrying capacity.

It is useful to further divide the broad periods of integrative and disintegrative trends into subphases. Population growth is particularly vigorous during the first, *expansion* phase of the integrative trend. However, as the population density begins to approach the limits set by the carrying capacity, growth slows down or even stops—this is the “stagnation” or “compression,” or even more descriptively, *stagflation* phase because it is characterized by rampant inflation. Although general population grows slowly, if at all, during the stagflation phase, and the majority of commoners experience increasing economic difficulties, the elites enjoy a golden age and their numbers continue to expand.

The stagflation phase (and the overall integrative trend) are ended by a general crisis. Whereas expansion grades smoothly into stagnation, the transition between stagflation and crisis is often (but not always) abrupt. Discrete events signaling the arrival of crisis can be pandemics, extreme episodes of famine, or state collapse followed by intense civil war (or any of such events in various combinations). The crisis phase in our terminology is not a discrete, brief event (which is one meaning of the word *crisis*), but an extended period that can last for one or more human generations. The decline of population numbers during crisis results in a situation when per capita resources become plentiful. However, this does not necessarily end the disintegrative trend, because there are usually too many elites and elite aspirants. The intraelite conflict continues to generate internal instability. Thus, the crisis grades smoothly into a *depression* phase, characterized by endemic civil warfare. Population may grow during the intervals between intense civil wars, but such increases typically do not last, and are followed by declines (although not as catastrophic as those typical of the crisis phase). The depression phase ends when the ranks of elites are pruned by internal conflict to the point where the disintegrative trend can reverse itself, and a new secular cycle begin. Alternatively, if no functioning state can get going, then the depression phase grades smoothly into an *intercycle* of indeterminate length.

We wish to emphasize again that the classificatory scheme advanced above is an “ideal type”. There is a lot of variation in the trajectories followed by actual societies. Still it is helpful to be able to indicate the rough state of the dynamical system with a single word.

1.3 Variations and extensions

Factors affecting characteristic lengths of secular cycles

Our exposition and illustration of the general theory of secular cycles in Section 1.2 was Western European-centric, but the theory should, in principle, be applicable to any agrarian society. In this section we discuss how certain structural and cultural characteristics of societies should affect the demographic-structural dynamics, with a focus on one of the most important characteristics of oscillatory dynamics, the average period of a cycle.

Secular cycles are not periodic in the strictly mathematical sense, when each succeeding cycle repeats exactly the preceding one. Although the secular rises and falls are generated endogenously by interactions between various components (subsystems) of the agrarian state, macrosocial dynamics of agrarian states cannot be strictly periodic. There are at least three reasons for that. First, nonlinear dynamic feedbacks can in theory generate not only strictly periodic (cyclic in the mathematical sense) dynamics, but also aperiodic chaos—erratic-looking behavior that is nevertheless produced entirely by internal, endogenous reasons. The more complex is the system (the more components it has) and the more nonlinear are interactions between the components (e.g., presence of threshold responses), the higher is the likelihood that its dynamics will be characterized by sensitive dependence, the hallmark of chaos. Social systems are complex and feedback loops are nonlinear, so the possibility of chaos cannot be discounted (Turchin 2003b).

Second, dynamics of agrarian states are affected not only by their internal workings, but also by exogenous forces, such as changes in their geopolitical and ecological environment. *Exogenous* factors, unlike the endogenous ones, are those that are not part of feedback loops (Turchin 2003a): they affect societal dynamics, but are not themselves influenced by societal dynamics.

Finally, individuals possess free will and can act in unpredictable ways. In principle, even an act of a single person occurring “in the right place at the right time” may be able to influence the trajectory of the whole society. For lack of better theoretical approaches, we can model actions of individuals at the micro level as a stochastic process, a kind of Brownian motion, which also results in erratic unpredictable changes in the macrosocial trajectory.

For all these reasons, we do not expect a strict periodicity in secular dynamics. Instead, dynamics should have an average period, a characteristic time scale, with a substantial degree of variation around this average. The mean period of a single—boom and bust—secular cycle is determined by the characteristic lengths of its phases, which in turn depend on various social, economic, and political parameters. Thus, the typical length of the expansion phase is primarily determined by (1) the per capita rate of population increase and (2) the population density in relation to carrying capacity at the beginning of the cycle. For example, if population grows at the rate of 1 percent per year, it takes 70 years for it to double. This is, actually, not a bad estimate of a typical expansion phase (we will present summary statistics on the lengths of secular cycle phases in the concluding chapter).

Expansion phases are also affected by geopolitical environment. States enjoy the greatest ability to mobilize the society for a war of external conquest during the middle parts of integrative secular trends. Abnormally long expansion phases result from successful territorial conquest, especially when it is accompanied by colonization of conquered territories, which serves to reduce population pressure in the metropole.

The length of the crisis phase is much less predictable, because while there is a definite biological limit on how fast a human population can grow, there is no comparable limit on how fast it can decline. Depending, thus, on the agent of change, population can decline very rapidly, as in a pandemic, or more slowly due to incessant civil warfare.

The characteristic lengths of the stagflation and depression phases depend more on the state and, particularly, elite dynamics, than on what the general population does. In particular, the military strength of the elites has a large effect on the length of the depression phase, or even if there is such a phase at all, as explained above. Models tailored to the characteristics of Western

European societies (largely monogamous elites enjoying preponderance of military power over their internal and external enemies) suggest that the typical periods of secular cycles in these societies should lie in the range of two-three centuries (Turchin 2003b:138).

Ibn Khaldun cycles

A very different situation obtains in certain Islamic societies. The paradigmatic example is the sociopolitical dynamics in the medieval Maghreb brilliantly described by Ibn Khaldun (1958). From the point of view of the demographic-structural theory, the Maghrebin states differ from Western European ones in two important respects: (1) these Islamic societies permitted polygyny and (2) there was a ready source of militarily powerful elite aspirants nearby.

Polygyny is important because the number of wives is the most significant predictor of male reproductive success in humans (Betzig 1986). Because aristocratic males could afford to support several wives and concubines, the rate of elite population growth in Islamic societies was (and is even today) much greater than that for elites in Christian societies. It is true that some degree of elite polygyny was practiced in Western Europe, where aristocrats often increased their biological fitness by having multiple mistresses and then acknowledging their bastards. Nevertheless, the fact remains that the biological reproduction rate of Islamic elites was several times higher than that of Christian elites.

The second factor is the location of Maghrebin societies in the rather thin strip of arable land squeezed between the Mediterranean sea and the desert. The “desert” (or rather dry steppe and semi-desert zone between the agrarian societies of the Mediterranean littoral and the extremely arid central regions of the Sahara) was occupied by nomadic pastoralists, primarily the Berbers. These desert chiefdoms were not a significant military threat as long as the agrarian states maintained their internal cohesiveness. But as soon as a Maghrebin society experienced state collapse it became extremely vulnerable to conquest from the desert.

When demographic-structural models are modified to account for these two factors they exhibit very different dynamics (Turchin 2003b). High reproductive rate of the elites means that they increase much faster than general population. Elite numbers, in fact, increase so rapidly that commoner overpopulation plays a much lesser, or even no role in bringing about the state collapse. As a result, the integrative trend of the secular cycle is over much faster than in the standard model, developed for the Western European situation. Once the collapse occurs, there is usually no lengthy depression phase, because it does not take much time to organize a coalition of desert tribes to pick up the pieces and establish a new dynasty.

As a result of shortened integrative trend and missing depression phase, models predict a much faster secular cycle for Maghrebin-type societies, on the order of one century (rather than two-three centuries for Western European states). This prediction is in agreement with the observation of Ibn Khaldun that the dynastic cycle in the Maghreb extends, on average, over four generations (a generation time in humans lies typically between 20 and 30 years). Note that this is a true theoretical prediction: models were not fitted in any way to the Maghrebin data. Shorter cycle period follows directly from the structural assumptions of the models of faster elite reproductive rate and rapid elite turnover after state collapse.

Not all Islamic polities are predicted to exhibit Ibn Khaldun cycles. The key parameter, identified by the theory, is the rate of growth of elite numbers. Islamic societies that controlled the elite growth rates, in one way or another, are predicted to exhibit slower cycles, with periods similar to those observed in Western Europe. For example, in the Ottoman Empire the sultans had access to essentially unlimited supply of wives and concubines. However, when the old ruler

died, only one son was allowed to replace him; all others were killed. Furthermore, top levels of bureaucracy and army leadership were recruited not from native elites, but by means of *devshirme*. In other words, the state, not biology, controlled the size of the high rank elite stratum. Only lower-rank landed elites were permitted to increase “biologically”, and being not very wealthy they could not afford too many wives. As a result, we can predict that secular cycles in the Ottoman polity should be much longer than those in the Maghreb.

An even more extreme case is the Mamluk polity in medieval Egypt. Its ruling class was recruited entirely from the slave markets. Children of Mamluks could not be Mamluks, and thus automatically dropped out of the ruling class. In principle, this arrangement should have stopped dead the Ibn Khaldun’s dynamic and, barring exogenous perturbations, lead to a stable equilibrium.

The fractal nature of historical dynamics

In general, different social processes operate at a variety of temporal scales. The shorter scales include daily, weekly, monthly, and annual cycles. Beyond that we have human generations, processes occurring on the time scale of centuries (including secular cycles), and longer-term phenomena such as social and biological evolution. As an example, consider the stock market, as measured by the Dow-Jones Industrial Average (DJIA). DJIA fluctuates on a variety of scales: daily (because the stock exchange shuts down at night), weekly (no activity on weekends), annual (fiscal year accounting affects trader behavior), multi-annual (business cycles), and multi-decadal (the Kondratieff cycle, although not all economists accepts the reality of such long cycles). The DJIA trajectory looks “fractal,” because the amount of fluctuation depends on the time-scale at which the trajectory is viewed.

If we are interested in understanding the effect of business cycle on the stock prices we really do not care about short-term fluctuations. We certainly should ignore price movements within a single day, and probably even within a week. Thus, the time-series with which we would want to investigate multi-annual oscillations would probably use the values of Dow-Jones averaged for each week. Averaging is the simplest kind of smoothing, so what we have done is essentially smoothed away all “uninteresting” short-term fluctuations—uninteresting, that is, from the point of view of the main question of analysis. On the other hand, if we want to know how holiday periods affect stock price movements, we would certainly want to retain within-week fluctuations, and perhaps go down to hourly movements (to see how trading patterns behave during the short pre-holiday days). Now the variation due to the business cycle becomes a nuisance, and it might be a good idea to remove the effect of multiannual and longer-term fluctuations by detrending. The point is that different questions require approaching analysis at different time scales.

Turning now to population dynamics, we observe that they also occur on a variety of scales: monthly (female menstruation periods), yearly (subsistence and epidemic cycles), generational (somewhere between two and three decades), and secular (one, two, or three centuries, according to the theory of secular cycles). If we are interested in the dynamics of childhood diseases, then the appropriate time scale would be weeks or months, to capture the within-year course of each epidemic (the incidence of measles, for example, begins to grow after children are brought together at the beginning of the school year, and gradually builds up towards a peak in winter).

If we want to understand how secular cycles unfold, on the other hand, we certainly do not need to know how mortality fluctuates on a weekly or monthly time scale. Or that there may be a deficit of births nine months after the Lent, as a result of devout Christians avoiding sexual

intercourse. All such within-year, or even year-to-year fluctuations are irrelevant to the purposes of our investigation. The appropriate time step is one human generation, and we need to average over smaller-scale fluctuations. We also need to do something about very long trends driven by social evolution. This requires some kind of removal of millennial trends (Turchin 2005:153), for example as was done for the early-modern English population (see appendix of Chapter 3). By smoothing within-decade fluctuations and removing millennial trends we retain two temporal scales of interest. The longer one is the average period of the secular cycle—this is what needs to be explained. The shorter one is the human generation time—this is the time step of the dynamical process that is postulated to be the explanatory mechanism of secular cycles.

It is important to remember that population numbers are a dynamic variable that has a lot of inertia on temporal scales shorter than a human generation. This is particularly true with respect to population increase—it can occur only slowly as babies are born and raised to enter the adult population. Even under ideal conditions human population needs at least one generation to double. On the other side of the demographic balance, mortality, it is theoretically possible for a population to collapse to a very low level (or even go extinct) in a very short time. However, most typically annual variation in death rates, due for example to crop failures, can be quite substantial, but is largely smoothed out—buffered—at the level of total population numbers.

This buffering ability of total population numbers is important in understanding how climate variability affects population dynamics. Annual variation, even if quite extreme, may have little effect on population change. If population is well below carrying capacity, peasants may have sufficient stores to weather a year or two of bad crops without any demographic effect. In contrast, a long-term cooling, even if by less than one degree centigrade, may have a much more substantial effect on population dynamics by lowering carrying capacity. (This argument is just an illustration of why temporal scales are important; in real world, the effect of climate change will depend on the phase of the cycle, the alternative crops that peasants can switch to, and many other factors.)

Generation cycles

The preceding discussion should make it clear that we are far from adopting a monocausal view of human history. The main hypothesis of this book is that demographic-structural processes are very important in historical dynamics, but we would be the last to argue that they are the only thing that goes on. However, it is not a good research strategy to include everything one can think of in the model. The history of science shows, over and over again, that an attempt to incorporate too many explanatory factors into theories is self-defeating. As Einstein said, a theory should be as simple as possible, but no simpler than that.

One particular process, which is not part of the demographic-structural theory, but has to be taken into account when studying secular cycles, is the “fathers-and-sons” dynamic (Turchin 2003b, 2006). This mechanism operates during the prolonged disintegrative secular trends, which are characteristic of secular cycles in Europe. The empirical observation is that disintegrative trends are not periods of continuous civil war; in fact, there are periods when sociopolitical instability is particularly high, interspersed with periods of relative pacification.

To illustrate this dynamic, note that during the disintegrative trend of late-medieval France (“the Hundred Years of Hostility”), good reigns alternated with bad ones. The reign of John II (1350–64) was the period of social dissolution and state collapse, while that of his son Charles V (1364–1380) was the time of national consolidation and territorial reconquest. The next reign, that of Charles VI (1380–1422) was another period of social disintegration and collapse. It was followed by the period of internal consolidation and national resurgence under Charles VII

(1422–61), which finally lifted France out of the late medieval depression. This is a general dynamical pattern of alternation between very turbulent and relatively peaceful spells that is observed again and again during the secular disintegrative phases. A possible explanation of such swings in the collective mood lies in the social psychology.

Episodes of internal warfare often develop in ways similar to epidemics or forest fires. In the beginning of the conflict, each act of violence triggers chains of revenge and counter-revenge. With time participants lose all restraint, atrocities become common, and conflict escalates in an accelerating, explosive fashion. After the initial explosion, however, violence drags on and on, for years and sometimes even for decades. Sooner or later most people begin to yearn for the return of stability and an end to fighting. The most psychopathic and violent leaders get killed off, or lose their supporters. Violence, like an epidemic or a forest fire, “burns out.” Even though the fundamental causes that brought the conflict on in the first place may still be operating, the prevailing social mood swings in favor of cessation of conflict at all costs, and an uneasy truce gradually takes hold. Those people, like the generation of Charles the Wise, who directly experienced civil war, become “immunized” against it, and while they are in charge, they keep things stable. The peaceful period lasts for a human generation—between twenty and thirty years. Eventually, however, the conflict-scarred generation dies off or retires, and a new cohort arises, people who did not experience the horrors of civil war, and are not immunized against it. If the long-term social forces, which brought about the first outbreak of internal hostilities, are still operating, then the society will slide into the second civil war. As a result, periods of intense conflict tend to recur with a period of roughly two generations (40–60 years).

These swings in the social mood may be termed “generation cycles” because they involve alternating generations that are either prone to conflict, or not. Another example of such social mood dynamics has been noted, for example, by Arthur M. Schlesinger Jr. (1986). Furthermore, generation cycles keep cropping up in other contexts. The birth rates in the twentieth century America oscillated with a period of approximately 50 years (Easterlin 1980, Macunovich 2002). Many economic indicators oscillate with roughly the same period, a phenomenon known as the Kondratieff cycle (Kondratieff 1984). The Kondratieff and Schlesinger cycles may be related to each other, or at least they often seem to oscillate in synchrony (Berry 1991, Alexander 2002). The Kondratieff wave may also be correlated with the war cycle (Goldstein 1988). Our understanding of Easterlin, Schlesinger, and Kondratieff cycles is very deficient, and many researchers doubt the reality of these dynamics. This is not the place to try to make sense of this vast and confused topic, and in the rest of the book we will focus only on the dynamics of sociopolitical instability. Even that focus is forced on us by the need to understand why disintegrative phases in certain types of societies tend to have multiple peaks of sociopolitical instability.

1.4 Empirical approach

The main goal of this book is to determine how well the predictions of the demographic-structural theory map onto empirically observed patterns in the studied historical societies. The synthetic theory, described in Section 1.2, has four fundamental variables: population numbers (in relation to the carrying capacity), social structure (specifically, the numbers and consumption levels of the elites), the state strength (typically measured by its fiscal health), and sociopolitical instability. These variables are fundamental in the sense that it is the reciprocal interactions between them that generate secular cycles (in the parlance of the dynamical systems theory, these are the *endogenous* variables). In each empirical case study our aim is to collect data describing how each of these variables changed during the period of study.

Ideally, we wish to have time-series data—accurate measurements of a particular variable collected at regular time intervals (the ideal time step is one decade, but a human generation—20–30 years—serves almost as well). This ideal is rarely approached in historical applications. First, there is usually a substantial degree of measurement noise. This is not a fatal problem, because we can use statistical methods to estimate how much useful information is contained in the data. Even the worst case, when we lack quantitative data, and all that we can say is that a variable is increasing, decreasing, or staying roughly constant, can be quite useful as a test of model predictions.

Second, we may have reasonable quantitative measures, but only for a few irregularly spaced points in time. Again, such data can be quite informative, especially if they are supplemented with qualitative indications about the dynamics of change between the “anchor points”. Reconstructions by knowledgeable historians can be surprisingly accurate, as happened in the case of estimates of population dynamics in the early modern England that were later confirmed by the formal population reconstruction methods. Incidentally, there are statistical methods for time-series analysis that can help us to utilize data to their utmost, even when they are irregularly spaced, although we will not be employing them in this book.

It is frequently the case that although we lack direct measurements of some variable, with a little ingenuity we can come up with another one that could serve as a *proxy* for the variable of interest. For example, climatologists made great strides in reconstructing past climate variations by studying such proxy variables as tree rings, varves in lake deposits, and isotope compositions of air bubbles trapped in ice. Certain kinds of archaeological data, such as estimated numbers of dwellings during different time periods, can be quite good indicators of population dynamics. The population history of Novgorod is revealed by the density of leather shoe remains in cultural layers. Note that such archaeological data often cannot tell us what was the absolute level of population (in people per km²). But having quantitative data on relative fluctuations of a variable is almost as good for testing theory. In fact, it is much better to have a time series on relative fluctuations than an excellent absolute estimate, but at one point in time. The demographic-structural theory is about dynamics, that is, change with time, and it is impossible to measure change with a single time slice.

Many quantitative data sources are available for testing theories about historical dynamics, and few of them have been systematically exploited. For example, the intensity of public building (most notably, temples or churches) shows remarkable fluctuations in time. This index may reflect the amount of resources at the disposal of the state, the elites, or both, depending on the specific arrangements prevailing in the society.

Another underutilized indicator is the temporal distribution of coin-hoard finds. Michael Crawford suggested in 1969 (see Crawford 1993:162) that there is a close correlation between concentrations of coin hoards and periods of internal war and disturbance in the Roman Republic. Another study documented a similar pattern in the late Carolingian period (Armstrong 1998).

Proxy variables have to be used carefully, because they may not be perfectly correlated with the variable of main interest. Thus, we expect that the number of people per building, or per room, should vary with time. As a result, in order to estimate the total population within a certain area, the estimated number of rooms obtained with archaeological methods needs to be multiplied by the average number of people per room, which is usually unknown. Similarly, the number of coin-hoards per decade is affected not only by instability, but also by the degree of monetization of the economy, and by how much time has passed since the period when the hoards were

interred (the farther this is in the past, the more chances that the hoard would be found before modern times).

Although proxy variables need to be treated carefully, it would be madness to completely ignore them, because they are often the best quantitative information that we have about historical dynamics. One way to make sense of the proxies is to build an explicit model of the various factors that may affect them, estimate the model parameters, and then “impute” the values of the variable of interest. Statistical methods for doing this have been developed and applied to many natural science problems. After all, even in physics we usually cannot measure directly a quantity of interest, such as temperature—we have to infer temperature by a proxy variable, such as the expansion of a small amount of mercury in a glass tube. In complex geophysical applications, such as locating underground oil, nothing can be measured directly, but has to be estimated by building a complex model of the underground geological layers. We will not be attempting such exercises in this book, but it is certainly something that can be tried in the future.

There are many other endogenous variables in addition to the fundamental ones and their proxies. *Endogenous* variables are those variables that are part of the various feedback loops, postulated by the theory. Their dynamics are largely determined by other endogenous variables (but there also can be an element of noise), and they, in turn, influence how other endogenous variables change with time. *Exogenous* variables, by contrast, are those that affect the state of the dynamical system, but the state of the system has no effect on them. An example of an endogenous variable is the real wage. According to the Malthusian-Ricardian theory, it is primarily determined by the population numbers in relation to the productive capacity. It can also be influenced by other variables. For example, intense internal war may disrupt grain production and drive up food prices, with a deleterious effect on the real wages. Real wages, in turn, influence other variables, such as demographic rates, which then affect the rate of population change. The point is that endogenous variables as a set describe the various feedback loops that drive the complex dynamics of the social system. A number of such variables, and predictions of the demographic-structural theory on how they should change with cycle phases, are given in Table 1. In the chapters that follow our goal is to document the dynamics of as many as possible of these variables.

Table 1.1 Empirical predictions of the demographic-structural theory

<i>SECULAR TRENDS=></i>	<i>INTEGRATIVE</i>		<i>DISINTEGRATIVE</i>	
<i>PHASES=></i>	<i>Expansion (Growth)</i>	<i>Stagflation (Compression)</i>	<i>Crisis (State breakdown)</i>	<i>Depression=> Intercycle</i>
<i>Fundamental Variables</i>				
population dynamics	Population increases from the nadir; the rate of growth accelerates	Population is high and continues to increase but the rate of growth decelerates	Population declines from the peak; the rate of decline accelerates	Population is low; it either declines at a decelerating rate or stagnates; periods of increase possible, but do not lead to sustained growth
elite dynamics	low to moderate	“Golden Age”	high numbers;	reduction of elite

	numbers; decline of elite/commoner ratio; modest consumption levels	increasing numbers; increased competition for elite positions; conspicuous consumption by some segments; appearance of anti-elites	factionalization and conflict; high corruption; high income inequality; impoverishment of service elites	numbers as a result of civil war and downward mobility; collapse of elite consumption levels
state strength and collective solidarity	Increasing; social unity among the elites that may extend to commoners	High, but declining	Collapse; social disintegration	Periodic attempts to restore state, followed by repeated breakdown
sociopolitical instability	Instability decreases to a low point	Instability is low but increasing	Instability increases to its peak	Instability is high, but begins declining
<i>Other endogenous variables</i>				
Number of rural settlements	increases	slow increase or stagnation	decline; settlement abandonment	lack of increase
Land, cultivated	increase; assarting	slow increase or stagnation	decline; settlement abandonment	at a low equilibrium
Land, free	initially abundant, but decreasing	in short supply	increasing	abundant
Land/peasant	high, but declining	low	low, increasing	high
Land prices	low, increasing	high	falling	low
Grain prices	low	increasing	high, very variable	decreasing, variable
Real wages	high	declining to the lowest point	increasing, but with much variability	high, but variable; contingent
Rents	low	high; high exploitation by the landowners	declines, but with fluctuations	low, variable contingent
Personal consumption; subsistence level	high; infrequent crop failure incidents have no lasting effect	declining; poverty, misery, vagrancy	subsistence crises	contingent (depends on instability levels)
Grain reserves	high	declining	nonexistent	variable
Urbanization	low	increasing, growth of cities	high	high, but declining
Artisanship and handcrafts	low	increasing landless peasants become artisans	high	declining
Trade	at a low level, local trading	increasing in volume and	Declining; variable:	local; long-distance

	networks	spatial scale	interrupted by political unrest	networks disrupted
Usury	absent	increasing peasant indebtedness	high	declining
Large private landownership	absent, low, or medium	increasing	high concentration of land in the hands of few large landowners	declines
Economic inequality	low	increasing	high	high, but declining
Incidence of epidemics	rare; population bounces right back	increasing; post-epidemic population increases sluggish	Often catastrophic; population does not make up losses	high, but declining
Internal peace and order	increasing; a golden age	high, but gradually unraveling; increasing resistance to taxation	Crisis: peasant uprisings, urban uprisings, interelite conflicts, regional/nationalist rebellions	Recurrent civil war, political fragmentation; high susceptibility to external invasions
Incidence of coin hoards (an indicator of sociopolitical instability)	Declining to low levels, unless there is a catastrophic external invasion	Low, unless there is a catastrophic external invasion	Rapidly increasing to a peak due to state breakdown and civil war	Peaks when state breakdown and civil war recurs
State finances	increasing revenues and stable expenditures, leading to budgetary surpluses	declining real revenues, increasing expenditures due to growth of the army and bureaucratic apparatus	state bankruptcy loss of control over the army and bureaucracy	Finances generally in poor state, but high variability and contingency
Taxes	increasing	stagnate or even decline in real terms; heavy tax burdens on the peasantry	tax system in a state of crisis	Variable. Periods of high taxes alternate with collapse of the tax system
Ideology	Positive, optimistic ideologies rule the day	growth of social pessimism; criticism of powers-that-be; ideological and social conflicts	popular movements for social justice and abolishment of debts, and for land redistribution	Pessimistic ideologies; the cult of death
State policy	internal policy is	increasing	social reforms	retrenchment;

	<p>non-interventionist, laissez-faire; externally increased interest in conquest</p>	<p>attempts at social reforms, construction of irrigation and other infrastructure; colonization of borderlands; external aggression for acquisition of new territories</p>	<p>sometimes leading to social revolutions</p>	<p>weakening of the state often results in external invasion</p>
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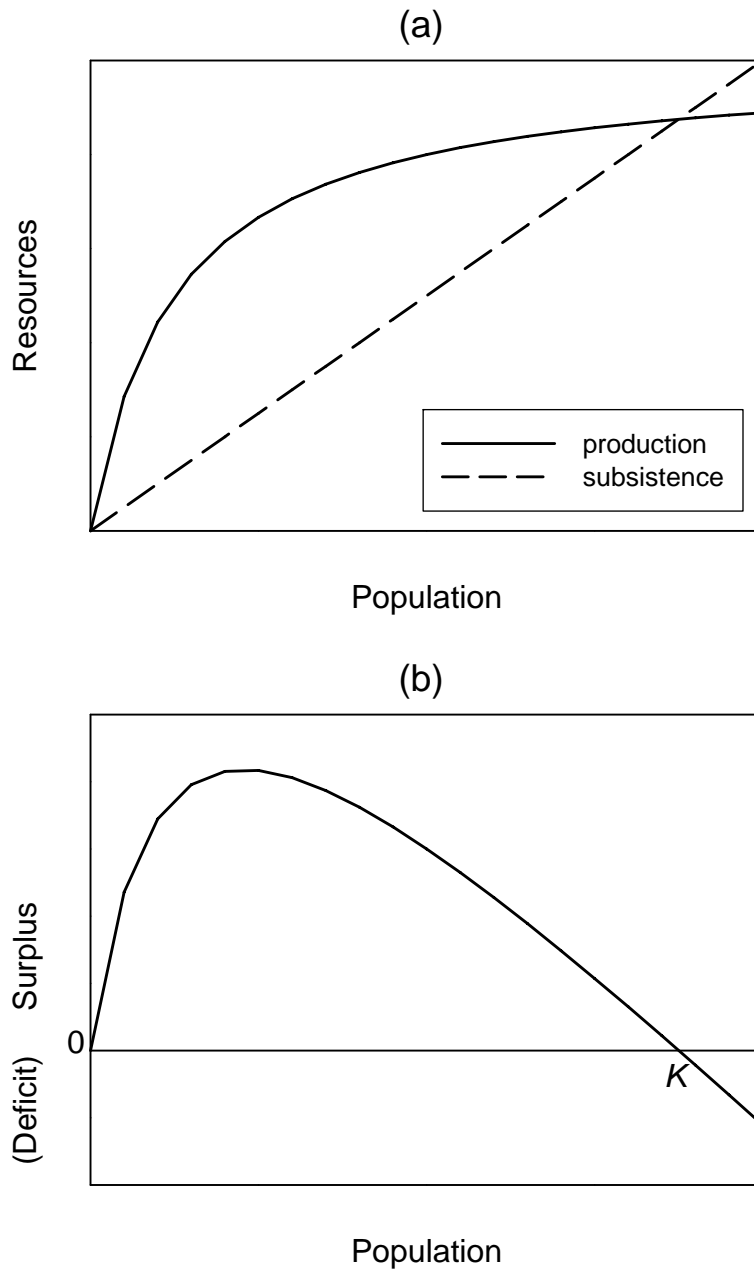


Figure 1.1

Abel, W. 1980. *Agricultural fluctuations in Europe: from the thirteenth to the twentieth centuries*. St. Martin's Press, New York.

Alexander, M. A. 2002. *The Kondratiev Cycle: A Generational Interpretation*. Writers Club Press, San Jose.

Armstrong, S. 1998. Carolingian Coin Hoards and the Impact of the Viking Raids in the Ninth Century. *Numismatic Chronicle* **158**:131-164.

- Aston, T. H., and C. H. E. Philpin, editors. 1985. *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*. Cambridge University Press, Cambridge.
- Berry, B. J. L. 1991. *Long-Wave Rhythms in Economic Development and Political Behavior*. Johns Hopkins University Press, Baltimore.
- Betzig, L. L. 1986. *Despotism and Differential Reproduction: A Darwinian View of History*. Aldine.
- Bois, G. 1984. *The Crisis of feudalism*. Cambridge University Press, Cambridge.
- Borsch, S. J. 2005. *The Black Death in Egypt and England: A Comparative Study*. University of Texas Press.
- Boserup, E. 1966. *The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure*. Aldine, Chicago, IL.
- Boserup, E. 1981. *Population and Technological Change: A Study of Long-term Trends*. University of Chicago Press, Chicago.
- Braudel, F. 1988. *The Identity of France. Volume II. People and Production*. Harper Collins, New York.
- Brenner, R. 1985a. Agrarian class structure and economic development in pre-industrial Europe. Pages 10-63 in T. H. Aston and C. H. E. Philpin, editors. *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*. Cambridge University Press, Cambridge.
- Brenner, R. 1985b. The agrarian roots of European capitalism. Pages 213-327 in T. H. Aston and C. H. E. Philpin, editors. *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*. Cambridge University Press, Cambridge.
- Cameron, R. 1989. *A concise economic history of the world: from paleolithic times to the present*. Oxford University Press, New York.
- Chu, C. Y. C., and R. D. Lee. 1994. Famine, revolt, and dynastic cycle: population dynamics in historic China. *Journal of Population Economics* 7:351-378.
- Clark, G. 2007. *A Farewell to Alms: A Brief Economic History of the World*. Princeton University Press, Princeton.
- Cohen, J. E. 1995. *How many people can the Earth support?* W. W. Norton, New York.
- Collins, R. 1979. *The credential society: an historical sociology of education and stratification*. Academic Press, New York.
- Collins, R. 1993. Maturation of the state-centered theory of revolution and ideology. *Sociological Theory* 11:117-128.
- Crawford, M. 1993. *The Roman Republic*, 2nd edition. Harvard University Press, Cambridge.
- Dobb, M. 1963. *Studies in the development of capitalism*. International Publishers, New York.
- Dupâquier, J., J.-N. Biraben, R. Étienne, C. Pietri, P. Luce, H. Bautier, H. Dubois, A. Higounet-Nadal, C. Klapisch-Zuber, A. Sauvy, and E. Le Roy Ladurie. 1988. *Histoire de la population française. I - Des origines à la Renaissance*. Presses universitaires de France, Paris.
- Dyer, C. 1989. *Standards of living in the later Middle Ages*. Cambridge University Press, Cambridge.
- Earle, T. 1997. *How chiefs came to power: the political economy of prehistory*. Stanford University Press, Stanford, CA.
- Easterlin, R. 1980. *Birth and Fortune*. Basic Books, New York.
- Easterlin, R. A. 1996. *Growth triumphant: the twenty-first century in historical perspective*. University of Michigan Press, Ann Arbor.
- Fischer, D. H. 1996. *The great wave: price revolutions and the rhythm of history*. Oxford University Press, New York.
- Goldstein, J. 1988. *Long cycles*. Yale University Press, New Haven, CT.

- Goldstone, J. A. 1991. *Revolution and Rebellion in the Early Modern World*. University of California Press, Berkeley, CA.
- Goldstone, J. A., editor. 1998. *The encyclopedia of political revolutions*. Congressional Quarterly, Washington.
- Goldstone, J. A. 2002a. Population and security: how demographic change can lead to violent conflict. *Journal of International Affairs* **56**:3-21.
- Goldstone, J. A. 2002b. *Revolution: Theoretical, Comparative, and Historical Studies*, 3rd ed. Wadsworth, Fort Worth.
- Grigg, D. 1980. *Population growth and agrarian change*. Cambridge University Press, Cambridge.
- Griziotti-Kretschmann, J. 1935. *Il problema del trend secolare nelle fluttuazioni dei prezzi*, Pavia.
- Gurr, T. R. 1980. *Handbook of political conflict*. Free Press, New York.
- Hilton, R. H. 1985. Introduction. Pages 1-9 *in* T. H. Aston and C. H. E. Philpin, editors. *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*. Cambridge University Press, Cambridge.
- Hobsbawm, E. J. 1962. *The Age of Revolution, 1789-1848*. New American Library, New York.
- Ibn Khaldun. 1958. *The Muqaddimah: An Introduction to History*. Translated from the Arabic by Franz Rosenthal. Pantheon Books, New York.
- Inayatullah, S. 1997. Ibn Khaldun: The strengthening and weakening of asabiya. Pages 25-32 *in* J. Galtung and S. Inayatullah, editors. *Macrohistory and macrohistorians*. Praeger, Westport, CT.
- Johnson, A. W., and T. Earle. 2000. *The evolution of human societies: from foraging group to agrarian state*, 2nd edition. Stanford University Press, Stanford, CA.
- Kamen, H. 1971. *The iron century: social change in Europe in 1550-1660*. Weidenfeld and Nicholson, London.
- Kondratieff, N. 1984. *The long wave cycle /*. Richardson & Snyder, New York.
- Kosminsky, E. A. 1956. *Studies in the agrarian history of England in the thirteenth century*. Oxford University Press, Oxford.
- Le Roy Ladurie, E. 1974. *The Peasants of Languedoc*. University of Illinois Press, Urbana.
- Lee, R. D. 1986. Malthus and Boserup: a dynamic synthesis. *in* D. Coleman and R. S. Schofield, editors. *The state of population theory: forward from Malthus*. Blackwell, Oxford, UK.
- Li, R. S. K. 2002. Alternative routes to state breakdown: towards an integrated model of territorial disintegration. *Sociological Theory* **20**:1-23.
- Macunovich, D. J. 2002. *Birth Quake: The Baby Boom and Its Aftershocks*. University of Chicago Press, Chicago.
- Merton, R. K. 1968. The Matthew Effect in science. *Science* **159**:56-63.
- Meskill, J., editor. 1965. *The pattern of Chinese history: cycles, development, or stagnation?* D. C. Heath, Lexington, MA.
- Parsons, J. 2005. Population control and politics. *Population and Environment* **12**:355-377.
- Pearl, R., and L. J. Reed. 1920. On the rate of growth of the population of the United States since 1790 and its mathematical representation. *Proceedings of the National Academy of Sciences of the USA* **6**:275-288.
- Postan, M. M., and J. Hatcher. 1985. Population and class relations in feudal society. Pages 64-78 *in* T. H. Aston and C. H. E. Philpin, editors. *The Brenner debate: agrarian class structure and economic development in pre-industrial Europe*. Cambridge University Press, Cambridge.
- Reischauer, E. O. 1960. The dynastic cycle. Pages 114-118 *in* E. O. Reischauer and J. K. Fairbank, editors. *East Asia: the great tradition*. Houghton Mifflin, Boston.
- Ricardo, D. 1817. *On the principles of political economy and taxation*. John Murray, London.
- Romano, R. 1967. *I prezzi in Europa dal XIII secolo a oggi*. Giulio Einaudi, Torino.
- Schlesinger, A. M. J. 1986. *The cycles of American history*. Houghton Mifflin, Boston.

- Simiand, F. 1932. *Les fluctuations économiques á longue période et la crise mondiale*. Félix Alcan, Paris.
- Skocpol, T. 1979. *States and social revolutions: a comparative analysis of France, Russia, and China*. Cambridge University Press, Cambridge, UK.
- Sweezy, P., M. Dobb, K. Takahashi, R. Hilton, C. Hill, G. Lefebvre, G. Procacci, E. Hobsbawm, and J. Merrington. 1976. *The transition from feudalism to capitalism*. NLB, London.
- Thorold Rogers, J. E. 1862. *A History of Agriculture and Prices in England*, 7 vols. Clarendon Press, Oxford.
- Tignor, R., J. Adelman, S. Aron, S. Kotkin, S. Marchand, G. Prakash, and M. Tsing. 2002. *Worlds Together, Worlds Apart: A History of the Modern World from the Mongol Empire to the Present*. W. W. Norton, New York.
- Tuchman, B. W. 1978. *A distant mirror: the calamitous fourteenth century*, 1st edition. Knopf, New York.
- Turchin, P. 2003a. *Complex Population Dynamics: A Theoretical/Empirical Synthesis*. Princeton University Press, Princeton, NJ.
- Turchin, P. 2003b. *Historical dynamics: why states rise and fall*. Princeton University Press, Princeton, NJ.
- Turchin, P. 2005. Dynamical feedbacks between population growth and sociopolitical instability in agrarian states. *Structure and Dynamics* **1(1)**:Article 3.
- Turchin, P. 2006. *War and Peace and War: The Life Cycles of Imperial Nations*. Pi Press, NY.
- Usher, D. 1989. The dynastic cycle and the stationary state. *American Economic Review* **79**:1031-1044.
- Wickham-Crowley, T. P. 1997. Structural theories of revolution. Pages 38-72 in J. Foran, editor. *Theorizing revolutions*. Routledge, London.
- Wickham, C. 1981. *Early medieval Italy: Central power and local society, 400-1000*. Macmillan, London.
- Wood, J. W. 1998. A theory of preindustrial population dynamics (with discussion). *Current Anthropology* **39**:99-135.