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 (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 the 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 occassioned 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 lead 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 were 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 disposses one another (via brigandage and internal warfare). The result was the disruption of production leading to further demographic decline, rather than a return to equilibirum 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 1789–1849 (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 millenium 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 2007a). 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 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), when fast-rising prices and land rents offer the greatest opportunities for rapid accumulation of wealth by current and aspiring elites, and when state fiscal problems often lead rulers to increase the sale of privilege and rank; both factors tend to accelerate social mobility into the elite ranks. As a result, the peak of elite numbers often lags behind that of general population (the important exception of societies with wide-spread 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 poissible 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 towards the end of a prolonged period 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 intraelite 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 structural factors. After 1250 Egypt was ruled by a particularly cohesive and militarily capable group of elites: specialized slave-warriors known as Mamluks (as evidenced, for example, by their success at repelling the Mongol invasions in the second half of the thirteenth century). English peasants could resist elites by hiding in the hills and forests, of which there was an abundance in a depopulated England. Additionally, the longbow negated the advantage in military power usually enjoyed by the elites. By contrast, Egypt's narrow strip of arable land between uninhabitable desert left no room for evasive tactics. After the Black Death, Mamluks were able to use their tremendous coercive 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 equilibirum" 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 intraelite 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 intraelite 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 intraelite competition (Goldstone 1991:123). Another useful index of intraelite 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 ecclisiastical 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 counter-elites, or dissident elites. Usually, the counter-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 counter-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, intraelite 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 bancruptcy and consequent loss of the military control; elite movements of regional and national rebellion; and a combination of elite-mobilized and popular uprisings following 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 bands 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, disentery, 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. 1988a: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 Bocaccio'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. (1988a: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-bibbings, 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).

In summary, there is a number of social mechanisms by which elite surpluses can be reduced: (1) deaths resulting from civil war, (2) deliberate purges of elites by new rulers, (3) limitations imposed on heir production (celibacy, primogeniture), (4) downward social mobility, voluntary or forced by the state, (5) increased material resources resulting from conquest or improvements in agricultural productivity, and (6) the development of a new political order that directs a greater share of resources to the elites. Several such mechanisms are usually operating in combination; a specific mix depends on cultural peculiarities of societies and historical accidents.

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 occassions 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 occassions 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 by internecine fighting between various elite factions. This can result in very prolongued 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 integrative and disintegrative periods into subphases. Population growth is particularly vigorous during the first, *expansion* phase of the integrative trend. This is a time of relatively stable prices and modest real wage declines (if any). However, as the population density begins to approach the limits set by the carrying capacity, price increases/wage declines accelerate—this is the "stagnation" or "compression," or even more descriptively, *stagflation* (stagnation+inflation) phase. Although the majority of commoners experience increasing economic difficulties during the stagflation phase, the elites enjoy a golden age and their numbers/appetites continue to expand.

The stagflation phase (and the overall integrative trend) is succeeded 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 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 be 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 a 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". It is helpful to be able to indicate the rough state of the dynamical system with a single word. However, there is a lot of variation in the trajectories followed by actual societies. Thus, the boundary between various phases should not be taken as being "hard", but rather as "fuzzy." A reviewer of an early version of the book manuscript even suggested that, instead of dividing the timelines of the societies that we study too neatly, we could allow phases to overlap. There is some merit to this suggestion, because different phases are dominated by different kinds of social processes, and these processes often overlap in time. For example, the onset of political crisis does not always have to coincide with the shift from population growth to population decline, and therefore the dating of the stagflation-crisis transition may be problematic. In the end, we chose to stay with nonoverlapping phases because doing otherwise, we feel, would be too confusing to our readers. But we will not impose these discrete phases on each case study in a procrustean manner.

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.

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. Furthermore, pathogens afflicting historical populations varied in their lethality. A relatively mild pathogen could drive population down slowly (perhaps as a result of recurrent epidemics), resulting in a long decline phase. A severe epidemic, on the other hand would lead to a very short period of drastic population decline, and also to a deeper degree of social disintegration and longer depression phase (as happened in post-Black Death Europe).

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 polyginy and (2) there was a ready source of militarily powerful counter-elites nearby.

Polyginy 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 polyginy 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 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 population changes 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 Albert Einstein once 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, interspered with periods of relative pacification.

To illustrate this dynamic, note that during the disintegrative trend of late-medievial 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.

Exogenous forces

The "standard" demographic-structural model of Section 1.2 focuses on endogenous forces representing internal feedbacks between such structural variables as population, social structure, and instability. Real-life social systems are affected also by many exogenous factors that are not an explicit part of the model. We have alluded to some of them in this section; here is a more systematic discussion of the important external forces (see also discussion in Turchin and Hall 2003).

- Geopolitical environment. Strong and aggressive neighbors may take advantage of internal weakness of the state during the disintegrative phase of the cycle. Such predation may deepen the degree of societal collapse. In the worst case the state may be conquered and annexed to a nearby empire (a very powerful expansionist empire, such as that of Chinggis Khan, may simply roll over the studied state and obviate its endogenous dynamics). Alternatively, presence of weak neighbors may permit external conquests that could relieve population pressure in the metropole and provide an outlet for surplus elites, thus lenghtening the integrative phase.
- Disease environment. Some pandemics, such as the Black Death, originate in distant parts of Eurasia and the spread over the whole continent. Such pandemics arose repeatedly within the Eurasia (Turchin 2008). Their effect will depend on the phase of population growth. For a population in the early stages of growth the arrival of an epidemics could mean a minor interruption of the course of expansion. By contrast, a dense population is higly vulnerable to a pandemic, and a severe drop in population numbers could result in a longer and deeper cycle of disintegration.
- Social evolution. Of primary interest is the growth of agricultural technology that affects the carrying capacity of the environment. Significant increases in crop yields, by elevating the carrying capacity, will have the same effect on food prices and consumption levels as substantial population declines.
- Global climate. Its effects are similar to the item above, inasmuch as the long-term fluctuations in temperature and rainfall affect the productivity of crops and the carrying capacity. A society whose population is already pressing on the resources may be tipped off into crisis by a significant worsening of the climate.

- In addition to the recurrent exogenous factors, discussed above, we often need to take into account singular events, or historical accidents that may have signifcant long-term consequences. A good example of such a singular event is the discovery and colonization of the Americas by Western Europeans, which resulted in torrents of precious metals flowing into Europe starting in the sixteenth century. American silver acted as an amplifier that created a stronger and more inflationary growth cycle in the sixteenth and early seventeenth centuries. In other words, the "Price Revolution of the Sixteenth Century" had two causes, monetary and demographic (Fischer 1996:74).

1.4 Empirical approaches

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.

A very useful source of information is archaeological records (e.g. Morris 2005). 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 (Nefedov 2002). Note that such archaeological data often cannot tell us what was the absolute level of population (in people per km^2). 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

***SECULAR TRENDS*=>**	***INTEGRATIVE***		***DISINTEGRATIVE***	
***PHASES*=>**	***Expansion (Growth)***	***Stagflation (Compression)***	***Crisis (State breakdown)***	***Depression*=> Intercycle***
Fundamental Variables				
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 numbers; decline of elite/commoner ratio; modest consumption levels	"Golden Age" increasing numbers; increased competition for elite positions; conspicuous consumption by some segments; appearance of counter-elites	high numbers; factionalization and conflict; high corruption; high income inequality; impoverishment of service elites	reduction of elite 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
Other endogenous variables				
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 networks	increasing in volume and spatial scale	Declining; variable: interrupted by political unrest	local; long-distance 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 non-interventionist, laissez-faire; externally increased interest in conquest	increasing attempts at social reforms, construction of irrigation and other infrastructure; colonization of borderlands; external aggression for acquisition of new territories	social reforms sometimes leading to social revolutions	retrenchment; weakening of the state often results in external invasion

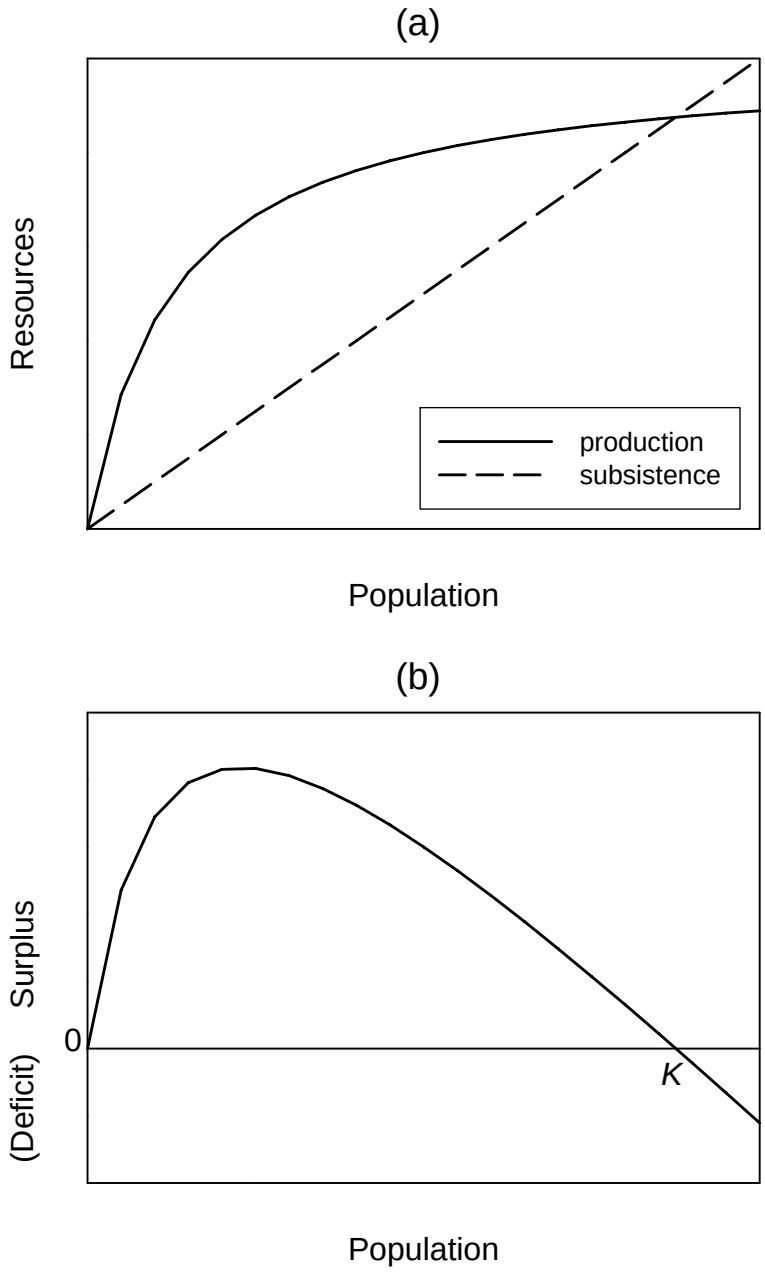
(a)
Resources
production
subsistence
Population
(b)
Surplus
0
(Deficit)
K
Population

Figure 1.1

Chapter 10. General Conclusions

The main goal of this book has been to determine how well the predictions of the demographic-structural theory map onto empirically observed patterns in the studied historical societies. We focused on 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. In our empirical investigation we attempted to measure as best as we could the dynamics of these variables. Where possible we looked at data that directly demonstrate the dynamics of the key variable, and where this approach was impossible we searched for proxies. Secular cycles also affect many other aspects of historical societies, and where such data were available, we included them in the analysis. Our empirical investigation looked at eight secular cycles in four countries. In this concluding chapter we summarize our results and delineate promising future avenues of research.

10.1 Population numbers

The match between theoretical predictions on population dynamics and empirical patterns was quite good. Generally speaking, integrative phases were characterized by sustained long-term population growth, although this ascending trend could be interrupted, and even temporarily reversed when factors not taken into account by the theory intruded. The most conspicuous example is the population declines in the Republican Rome during the First and Second Punic Wars. Where our data are particularly good, as in the case of early modern England, we observe much smaller fluctuations, for example, in the 1560 in England (see Figure 3.1a). The general rule is, nevertheless, that the effect of such setbacks during the expansion phase is temporary, and any losses are made up quickly.

Disintegrative phases were generally periods of population decline or stagnation. Dramatic population declines took place during the crisis phases of the Plantagenet, Capetian, Principate, and Muscovy cycles. We argue that the Republican cycle also ended with a population decline in Italy, but this remains controversial. In two cycles, the Tudor and Valois, absolute population numbers declined less dramatically, and the general trend was stagnation, rather than collapse. However, we showed that in the Tudor case, population pressure on resources (population relative to the carrying capacity) exhibited a very substantial decline (by 35 percent between 1650 and 1750). We would not be surprised to find out that a comparable decline affected the population pressure in the Valois cycle. Finally, our examination of the Romanov cycle stopped at the crisis stage, and therefore we do not offer estimates of how population pressure declined over the course of the complete disintegrative phase (we will pursue this question in future work).

Among the various economic trends that could serve as proxies for population dynamics, the most useful, without any doubt, is the real wage. Where our data is good, the inverse relationship between the population pressure on resources and the real wage is very tight (e.g., Figure 3.10). However, this relationship holds only before the Industrial Revolution—after 1800 in England the relationship between population and real wages was completely transformed.

There are some early indications that a most useful noneconomic proxy for population pressure will be the average height of populations (Komlos 1990, Steckel 2004, Koepke and Baten 2005). The basic idea of the approach is that the population pressure on the resources results in reduced levels of nutrition. Inadequate nutrition of growing human beings (infants and juveniles) result in stunted adult stature. Thus, it should be possible to observe population

fluctuations indirectly by measuring how average heights of individuals changed with time (Figure 10.1).

Figure 10.1 Average heights of Europeans during the two millennia CE. Data from skeletal material (Koepke and Baten 2005). Note that heights are plotted on an inverse scale, so that the peaks in the graph correspond to population peaks (because periods of high population density should be correlated with low average heights).

Table 10.1 A summary of the chronological sequence of secular cycles in Western Europe. This chronology focuses on the dominant state within Western Europe: first on the Roman Empire, then shifts to medieval German empires, and finally to France.

Secular cycle	*Integrative phase*	*Disintegrative phase*
Republican Rome	350–130 BCE	130–30 BCE
Principate	30 BCE–165 CE	165–285
Dominate/Merovingian	285–540	540–700
Carolingian	700–820	820–920
Ottonian-Salian	920–1050	1050–1150
Capetian	1150–1315	1315–1450
Valois	1450–1560	1560–1660
Bourbon	1660–1780	1780–1870

In our earlier work (Nefedov 1999, Turchin 2003b) we proposed a tentative chronology for secular cycles in western Europe (Table 10.1). There is a remarkable degree of congruence between this chronology and the fluctuations of average heights in Europe (note that the data in Figure 10.1 were not used in any way in helping to construct the chronology of secular cycles). Interestingly, the relative height of peaks in the graph corresponds well with what we know about the relative height of population peaks achieved during various secular cycles. Thus, the population peaks during the Roman period were much higher than during the Middle Ages. The drastic population collapse of the sixth century, in particular, is very well reflected in the remarkable increase of average stature. On the other hand, population peaks of the last medieval (Capetian) and the first early modern (Valois) cycles matched and even exceeded those of the Roman times.

10.2 Elite dynamics

Data on elite dynamics was harder to obtain than general population data, and we were often forced to rely on informed judgements by specialists. Nevertheless, quantitative estimates of elite/commoner ratios were available in the Plantagenet, Tudor, Capetian, and Muscovite cases. Less quantitative estimates in other case studies were in agreement with the predictions of the theory regarding the development of elite overproduction (peaking during the crisis phase) and its abatement (with the trough during the expansion phase of the next cycle). We found that various measures of conspicuous consumption provided useful proxies for the expansion and contraction of elite numbers and appetites. One proxy variable that it should be available in many case-stuides is the construction rate of temples or churches (for example, Figures 2.5 and 6.1). Consumption rates of such luxury goods as wine in England (where commoners drank beer) can sometimes give us an excellent insight into how the "footprint" of the elites changed with time (between 1300 and 1460 the amount of wine that the English elites drank experienced a four-fold decline, see Section 2.5).

One apparently ubiquitous feature of elite overproduction is the growing economic inequality. We were able to obtain time-series measures of inequality (by looking at the ratio of

top fortune to contemporaneous mean or median income) for the Plantagenet, Valois, and Republic cycles. Certain indicators of intraelite competition that have been proposed in the context of the Tudor-Stuart cycle turned out to be useful in other case studies: litigation (the Muscovy cycle), education (the Romanov cycle) and the dueling rate (the Valois cycle).

10.3 The state

Data on the fiscal health of states was available for every studied cycle, although their quality varied from case to case. Nevertheless, the data were good enough to yield several surprises. It is true that there was at least some evidence of fiscal difficulties associated with the crisis stages in all case studies. However, this is not a very strong result, because preindustrial states constantly overextended themselves under the pressure of war and state fiscal difficulties, or even bancruptcy, did not necessarily result in state breakdown. In one case study, the Republican Rome, there is no evidence of serious fiscal difficulties until after the civil war broke out. Republican Rome was also one case in which the state had the least degree of autonomy from the elites, the senatorial class. As we noted in Section 6.6, the theory needs to be modified to take such cases into account.

Furthermore, although in some cases we observed declining real revenues during the stagflation phase (the Plantagenet and Tudor cycles), in others (e.g., the Romanov and, probably, the Musocovite cycles) the state was actually able to continue rising *per capita* real taxes until the moment of the crisis (and in the Muscovite case such exactions were an important contributing factor to triggering crisis). However, what is important is not whether the revenues declined in absolute terms, but whether they declined relative to expenses. For example, Goldstone's (1991, 2008) study of what would be in our terminolgoy the Bourbon cycle showed that both real revenue and taxation per capita grew until the eve of the French Revolution. However, the fiscal collapse of the state was one of the clearest elements of the late eighteenth century crisis in France. The problem was that the state expenses grew much faster than revenues due to a vastly expanded cadre of elite office holders and rising military expenses.

The fiscal dynamics during the disintegrative secular phases, however, yielded some surprises. Our initial expectation was that during these periods states should be uniformly incapable of gathering enough revenue they needed for functioning. Instead, we found that typical dynamics of state revenues went through a veritable roller-coaster. Periodically rulers succeeded in persuading the populace and elites to aquiesce to high taxes, but such episodes of internal accord did not last very long. As a result we observed wild swings in the revenues during the disintegrative parts of the Plantagenet (Figure 2.6), Tudor (Figure 3.3), Valois (Figure 5.2), Muscovite (Figure 8.3), and Romanov (Figure 7.7) cycles. These revenue swings are apparently associated with the father-son dynamics. Civil wars not only induce, after a lag, a powerful desire for social peace, but also make the elites more amenable to compromise with the state on the need for taxation. The next generation (which did not directly experience civil war) is much less willing to yield to the state's demand for revenue. The growing antagonism between the state and the elites is one of the factors that may bring about another round of civil wars.

10.4 Sociopolitical instability

Sociopolitical instability is a key variable of the demographic-structural theory, and it is gratifying that we were able to obtaine quantitative estimates of its dynamics for all studied cycles. The simplest method for quantifying sociopolitical instability is to plot the number (per unit of time) of "instability events," such as peasant uprisings, regional rebellions, coups d'état, civil wars. In making these estimates we were greatly aided by the previous work of such authors as Pitirim Sorokin (1937) and Charles Tilly (1993). We present such graphs for the Plantagenet

(Figure 2.7), Capetian and Valois (Figure 5.3), Republic (Figure 6.5), and Principate (Figure 7.5) cycles.

Indices of instability based on the analysis of the written sources have the advantage that they can be developed for any period, for which we have sufficient density of sources. The drawback of this approach, however, is that it is inherently subjective. Actual instability occurrences are first filtered through the perceptions of contemporaries, later affected by various biases of compilers of historical chronicles, and, finally, the modern investigator has to decide whether any particular disturbance qualifies as "major" to be included in the list of instability events. We need a better, more objective method for quantifying instability, and it is fortunate that an excellent proxy variable is offered by the frequency of coin hoards. We have been able to use compilations of coin hoards to estimate instability dynamics in the Plantagenet (Figure 2.7), Tudor (Figure 3.4), Capetian (Figure 4.2), Republic (Figure 6.5), Principate (7.6 and 7.7), and Muscovite (Figure 8.1) cases. It is gratifying that the instability indices based on written sources and the coin hoard proxy are largely in agreement. When two sets of numbers, obtained in a completely independent manner, show similar patterns, our confidence that both methods generate reasonable results is boosted.

In one case, the Romanov cycle, we decompose generic instability into three component processes: peasant disturbances (Figure 9.9), worker strikes (Figure 9.11), and revolutionary activity as indicated by the number of "named executions" (Table 9.6). For a number of case-studies (see Figures 2.9, 2.10, 3.6, 9.10 and Table 4.4) we were also able to locate the data on violent crime. We should note, however, that the crime rate, being usually an expression of violence beween individuals, is a distinct variable from sociopolitical instability (intergroup violence), and these two variables do not have to fluctuate in synchrony.

In summary, we have a rich database on the dynamics of sociopolitical instability. These data show that the dynamics of instability are complex, and evolve on at least two distinct temporal scales. At the scale of centuries, there was a marked tendency of instability events to be bunched in some periods but not others. These instability waves recurred with a period of roughly two (sometimes, three) centuries, so that a century of high instability was followed by a century of lower instability. The pattern is most clear where we have long-term data. For example, between 1150 and 1700, there were three instability waves in France, arriving roughly every two hundred years (Figure 5.3, see also coin hoard trends in Figure 4.2). Additionally, there are multi-century hoard compilations for two European regions, which exhibit a very similar pattern (Figure 10.2 and 10.3). The graphs show very clear instability waves during the late medieval period and the seventeenth century.

Figure 10.2 Temporal distribution of coin hoards found in northwestern Germany (Ilisch 1980: Table 6). The four curves show the number of hoards per half-century found in four regions: East Westphalia, West Westphalia, Pfalz/Saar, and Nordrhein.

Figure 10.3 Temporal distribution of coin hoards found in the Czech Republic (Bohemia, Moravia, and Silesia) (Nohejlova-Pratova 1955).

As we show in chapters dealing with specific cases, instability waves were dynamically associated with demographic dynamics, but there was a phase shift between the two variables. Stagflation phases, when population numbers peaked, were relatively peaceful and orderly, and instability reached a peak during the following phases of crisis and depression. This empirical pattern is precisely what the demographic-structural theory predicts.

Can we make the above statement more precise and quantitative? Given the limitations of historical data and the complexity of the dynamical pattern (variability in oscillation periods and phase shifts, as well as such complicating factors as the father-and-sons cycles), we need to employ an appropriately coarse-grained procedure. This question, then, can be approached as follows. First, we identify the population growth and decline phases. Although quantitative details of population dynamics for historic societies are rarely known with any precision, as we saw in the preceeding chapters, there is usually a concensus among demographic historians about when the qualitative pattern of long-term growth changed. Second, we count instability events, using the indices of instability based on the written sources (we do not do it here, but the same approach can be also applied to instbaility proxy data, such as incidence of unrecovered coin hoards). Finally, we compare the incidence of instability events per decade between the population increase and population decrease phases. The results of applying this procedure to all seven complete case-studies (omitting the Romanov cycle) are shown in Table 10.2. The empirical regularity is very strong: in all cases instability is greater during the declining, compared to growth phases (t-test: $P << 0.001$).

Table 10.2 Instability events per decade during the population growth and decline secular phases: the seven complete secular cycles studied in this book.

	Growth phase		*Decline phase*	
Secular Cycle	*years*	*Instability*	*years*	*Instability*
Plantagenet	1151–1315	0.78	1316–1485	2.53
Tudor	1486–1640	0.47	1641–1730	2.44
Capetian	1216–1315	0.80	1316–1450	3.26
Valois	1451–1570	0.75	1571–1660	6.67
Republican	350–130 BCE	0.41	130–30 BCE	4.40
Principate	30 BCE–165	0.61	165–285	3.83
Muscovite	1465-1565	0.60	1565-1615	3.80
Average (±SE)		**0.6 (±0.06)**		**3.8 (±0.5)**

This is a striking result, and it is, apparently, not limited to the secular cycles studied in this book. For example, we can apply the same procedure to the more than two millennia of the Chinese imperial history. We take population data from Zhao and Xie (1988), and the instability data from Lee (1931) (for a more detailed discussion of these data series, see Turchin 2003b: Section 8.4). Focusing on the periods when China was unified under one dynasty, we obtain results shown in Table 10.3. Again, the pattern is consistent and striking.

Table 10.3 Instability events per decade during the growth and decline secular phases: the Chinese dynastic cycles.

	Growth phase		*Decline phase*	
Secular Cycle	*years*	*Instability*	*years*	*Instability*
Western Han	200 BCE–10	1.5	10–40	10.8
Eastern Han	40–180	1.6	180–220	13.4
Sui	550–610	5.1	610–630	10.5
Tang	630–750	1.1	750–770	7.6
Northern Sung	960–1120	3.7	1120–1160	10.6
Yuan	1250–1350	6.7	1350–1410	13.5
Ming	1410–1620	2.8	1620–1650	13.1
Qing	1650–1850	5.0	1850–1880	10.8
Average (±SE)		**3.4**		**11.3**

Thus, when instability is examined on an appropriately coarse temporal scale (essentially, centuries), there is an excellent match between theoretical predictions and observed empirical patterns. However, the complicating factor is that instability also fluctuates on a finer time scale, that of human generations. This pattern is especially clear during the disintegrative phases of secular cycles, when peaks of particularly intense internal warfare recur at an interval of 50±10 years, with periods of fragile peace between them. Such "fathers and sons" dynamics, to a greater or lesser degree, occurred during the disintegrative phases of all eight case studies that we examined in this book. In addition, fathers-and-sons cycles were discernable during integrative phases in medieval England, where baronial rebellions tended to occur every 60 years between 1100 and 1500 (Figure 2.7) and in nineteenth century's Russia (Figure 9.9 and 9.10 and Table 9.6).

Finally, there was a class of instability events that did not fit either secular or fathers-and-sons rhythms. The examples include the mid-first century crises in the Principate (most notably, the "year of three emperors," 68-69 CE), the "mid-Tudor crisis" (between 1539 and 1563), and the Pugachev rebellion in Russia (1773–75). These crises were not predicted by the demographic-structural theory, and their occurrence reiterates the point that we made repeatedly in the previous chapters—that the theory does not describe historical dynamics in all of its complexity. Clearly, there are other mechanisms, apart from overpopulation and elite overproduction, that can bring about political crises, rebellions, and outbreaks of civil war. On the other hand, these "non-demographic-structural crises" were milder, both in intensity and, especially, duration, compared to demographic-structural ones. Thus, although the theory does no explain all instances of instability, its prediction of alternating secular trends of stability versus instability is supported in all eight empirical case-studies.

10.5 Are there general laws of historical dynamics?

We end the overview of empirical results on a more speculative, even provocative note (in the sense that we wish to provoke controversy). There is a long-standing debate among scientists and philosophers on whether history has general laws. In the nineteenth century some thinkers, emboldened by spectacular successes in physics and biology, argued that the scientific study of history, which means searching for general laws, is possible. For example, in the epilogue to his novel *War and Peace* Leo Tolstoy proposed that the laws of history could be discovered by employing the methods similar to those used in statistical physics or evolutionary biology, and this view was shared by many nineteenth century historians (Beard 2002). During the twentieth century the opinion among the philosophers and historians swung in the opposite direction. For example, the philosopher Karl Popper (1957) thought that historical processes were too complex and history was too different from natural sciences to have general laws such as discovered in physics or biology.

The general thrust of our research program goes very much against this consensus. A basic premise of our study is that historical societies can be studied with the same methods physicists and biologists used to study natural systems. We started with a general theory, which has been formalized in our previous work by translating it into mathematical models (e.g., Turchin 2003b: Chapter 7). As a result of this formalization, we have a set of specific and quantitative predictions about a suite of demographic, economic, social, and political variables (detailed in Chapter 1, see Table 1.1). As discussed earlier in this chapter, not all predictions of the theory have been borne out by the data. Such an outcome should be expected, since theories in natural sciences are also not expected to be right all the time. For most variables, the match between model predictions and empirical time series was quite impressive. Furthermore, where the theory failed (as in its prediction of revenue dynamics during the disintegrative phases) it did so in an interesting way. Instead of the theoretically predicted pattern, we saw another one, and

where there are recurring patterns, there may be general processes underlying them. In other words, the observed regularities suggest how the theory could be improved. Such an iterative approach—in which theoretical predictions are contrasted with the data, the theory is modified in light of the obtained results, and then new data are brought in to test the predictions of the modified theory—is at the heart of making scientific progress in both natural and social sciences, and, we believe, in historical applications, as well.

The general implications of our results, then, are that some sort of general regularities of the historical process appear to exist. At present time we cannot state them in the same precise form as formulations of many physical laws, with defined mathematical forms and universal constants. Perhaps "laws of history" will never attain the same level of precision as in some areas of physics (the future will show). But it is possible to formulate some of the general principles of the theory, which have received broad empirical support, albeit in a more qualitative fashion. Here is our preliminary attempt of doing so, with the understanding that proposed generalizations are tentative and will be, hopefully, improved with subsequent empirical and theoretical research.

One generalization can be called the neo-Malthusian principle: during periods of sustained population growth, if the output of the agrarian economy does not keep pace with the population, a number of relative price trends will be observed. One trend is rising prices for basic foodstuffs, energy, and land. Another one is falling real wages for labor. These trends are simply a consequence of the law of supply and demand. Thus, as the supply of labor increases, and if the demand for it is limited (which it is in agrarian economies), the price of labor inevitably decreases. We saw this pattern in all empirical studies with greater or lesser degree of clarity, depending on the quality of the data. The most striking illustration of this principle is Figure 3.10b, showing a very close relationship between the population pressure on resources and the real wages in England, 1150–1800.

Another generalization, dealing with the elite dynamics, is also a consequence of the law of supply and demand. The principal kind of wealth in agrarian societies is land. The elite landowners profit from overpopulation in two ways. First, they are consumers of labor: they need peasants to work their land, servants for domestic chores, and craftsmen and artisans for producing items for status consumption. Second, their property, land, produces food and other commodities, such as fuel and raw materials, the demand for which increases together with growing population. Because the items that they consume become cheaper, while the items that they produce increase in value, the elites greatly profit from overpopulation. The process, however, is dynamic, and favorable economic conjuncture for the elites means that, first, their numbers increase from both biological reproduction and upward social mobility, and, second, they become accustomed to ever greater levels of consumption. In the end, elite numbers and appetites outgrow their "carrying capacity" (based on the labor of commoners). Just as overpopulation results in large segments of commoner population becoming immiserated, elite overproduction similarly results in large segments of elites becoming impoverished (not in absolute terms, as with common populace, but relatively to the standards of consumption needed to maintain the elite status). This generalization, thus, may be called the principle of elite overproduction. One consequence of this dynamic is that the rate of elite overproduction should be shifted in phase (lag behind) the rate of general population growth. The case studies examined in this book provide ample empirical support for this model prediction: whereas population growth rate peaks during the expansion phase, elite overproduction develops during the stagflation phase.

A third possible generalization deals with the causes of sociopolical instability. The demographic-structural theory proposes three principal causes of the onset of a disintegrative

trend (that is, a lengthy period of heightened instability): overpopulation, elite overproduction, and the fiscal crisis of the state. As we discussed in Section 10.4, however, some causal factors are relatively more important than others. In particular, a factor that appears to be always associated with high instability (at least, in the eight case studies that we examined) is the elite overproduction. Overpopulation, by contrast, results in popular immiseration and discontent, but as long as the elites remain unified, peasant insurrections, slave rebellions, or worker uprisings have little chance of success, and are speedily suppressed. Furthermore, when population declines during the disintegrative periods, there is often a substantial lag time between population density reaching a low level and the time when internal peace and order are restored. The third commponent, the fiscal crisis of the state, is usually present, but sometimes is missing as triggering factor leading to civil war (see Section 10.4). Thus, overpopulation and fiscal crisis are important contributing factors, but the dominant role in internal warfare appears to be played by elite overproduction leading to intraelite competition, fragmentation, and conlict, and the rise of counter-elites who mobilize popular masses in their struggle against the existing order.

The three generalizations that we have just discussed are only a sample from many more potential generalizations, arising from recurrent patterns that we noted in the case studies. For example, there may be a general principle underlying the shifts in social mood from a desire for change to yearning for peace and stability, which appears to play an important role in creating relatively peaceful interludes during the disintegrative trends (what we termed the fathers-and-sons cycles) and in ending the disintegrative trend, a reversal that starts the new secular cycle. It is possible that this pattern can be quantified, perhaps by using content analysis of speeches, political writings, and newspaper editorials, but this remains as a task for the future.

Our concluding thoughts are these. We believe that we showed that it is possible to obtain quantitative empirical estimates for many variables that are needed to test theories of historical dynamics. Furthermore, our models, and the demographic-structural theory in particular, have matured to the point where they can make quantitative and testable predictions. Many of these predictions are supported by the data; others failed, but often in interesting ways that suggest further development of the theory. The historical process is very complex, we have to live with severe data limitations, but nevertheless it is possible to apply the standard scientific approach to the study of history. We are optimistic about the future prospects of History as Science.

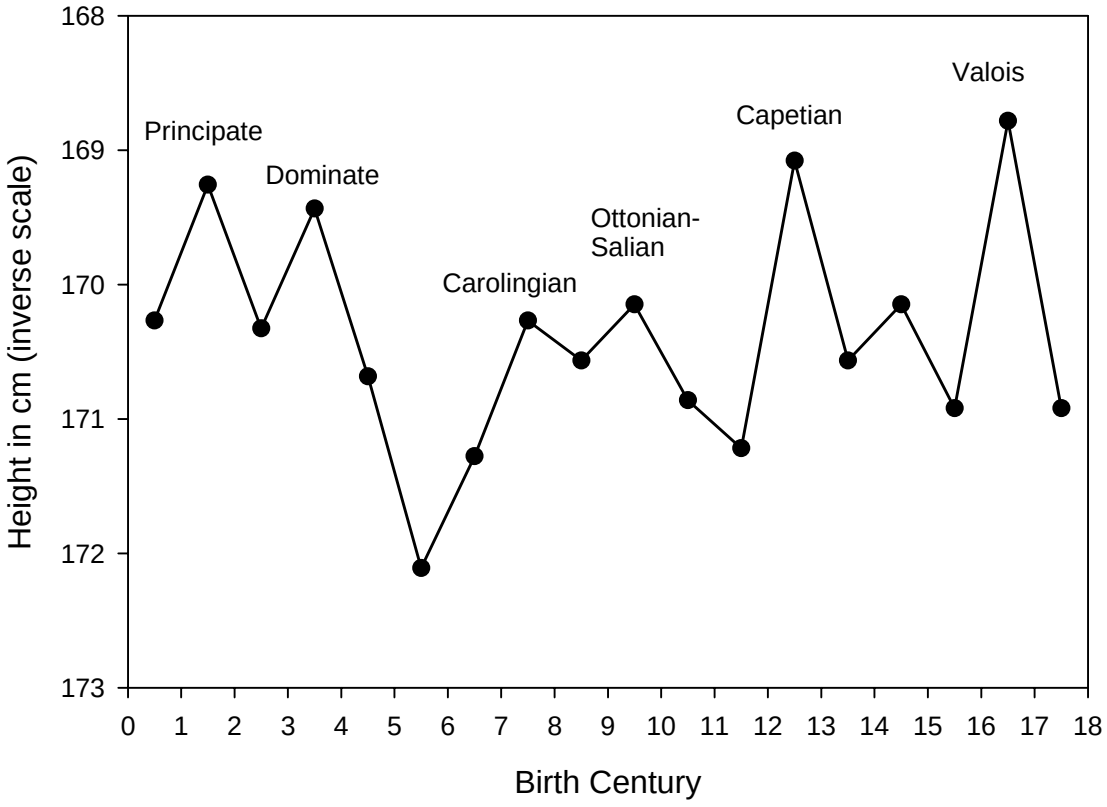

Figure 10.1: Average heights of Europeans

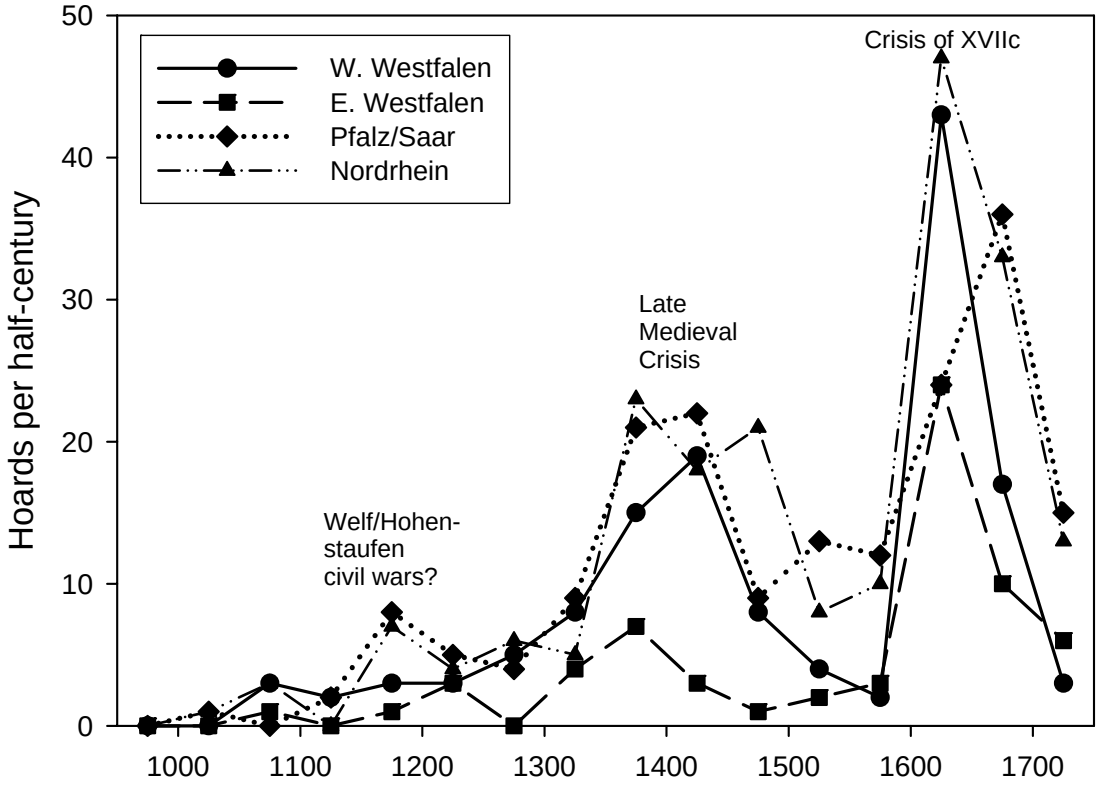

Figure 10.2: Hoards in NW Germany

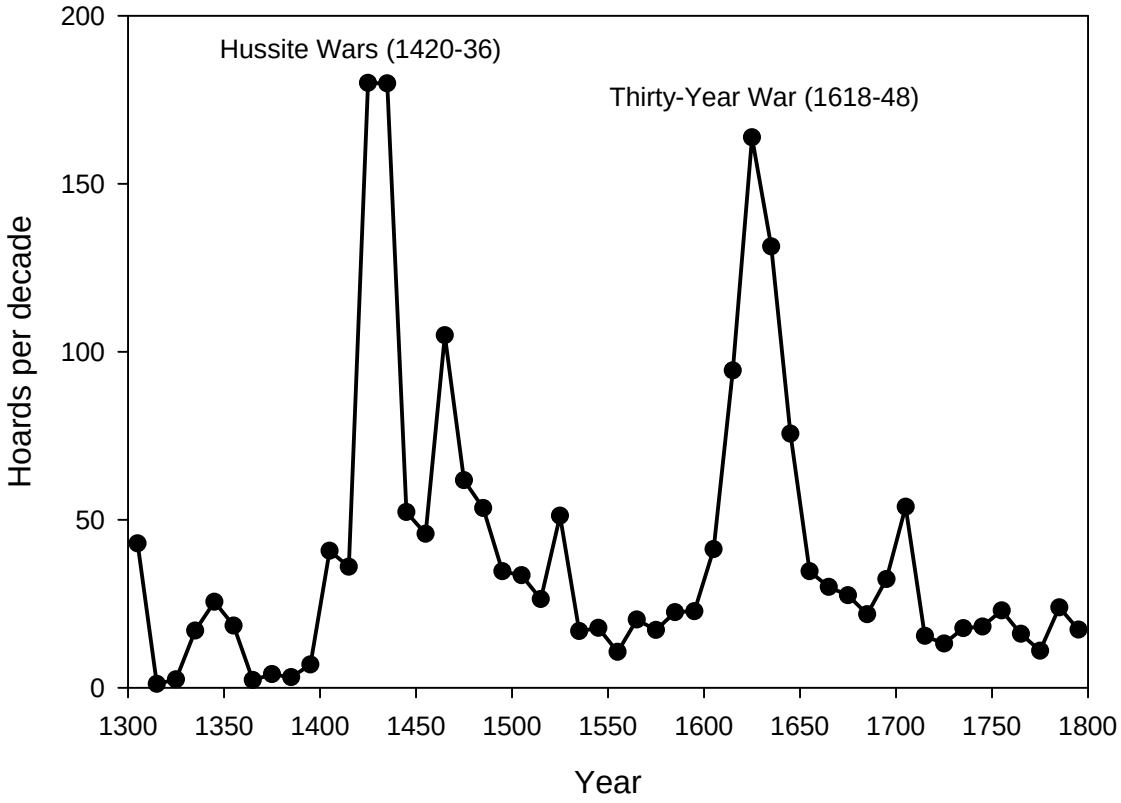

Figure 10.3: Coin hoards in Bohemia, Moravia, and Silesia

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