Center for Studies in Demography and Ecology

Revising the Malthusian Narrative: the Comparative Study of Population Dynamics in Late Imperial China

by

WILLIAM LAVELY
University of Washington

R. BIN WONG
University of California-Irvine

UNIVERSITY OF WASHINGTON

CSDE Working Paper No. 98-05

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WILLIAM LAVELY
University of Washington

R. BIN WONG
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3 February 1998. A preliminary paper addressing some of these issues was presented at the Annual Meeting of the Association for Asian Studies, New Orleans, April 11-14, 1991. G. William Skinner and Susan Watkins made constructive criticisms of that effort which inspired the present work. G. William Skinner, James Lee, Timothy Brook, Kenneth Pommeranz and an anonymous reviewer provided valuable comments on an earlier draft of this article. The authors alone are responsible for remaining errors. This article complements the comparisons of Chinese and European patterns of economic and political change in Wong's *China Transformed: Historical change and the limits of European experience* (Cornell 1997).

Ever since Malthus, it has been conventional to cast the Chinese and European pre-industrial demographic systems as opposing archetypes. Europe's system was characterized by moderate population growth, fertility control keyed to economic conditions, and favorable living standards, compared with China's rapid growth, periodic mortality crises, and precarious balance of population and resources. Although there is some variation in approaches and vocabularies reflecting disciplinary divisions, and recognition of the substantial variability of institutions within Europe and China, this stylized contrast continues to flourish in the demographic and historical literatures. This is important because Malthusian dynamics underlie a popular and persuasive set of explanations for the divergent paths of Chinese and European economies and societies in the industrial era**.** In this article, drawing on both old and new evidence on demography and economy in late imperial times, we challenge this conventional dichotomy and its empirical underpinnings.

New evidence has already required some revision of the Malthusian contrast. Princeton demographers demonstrated that the Chinese had remarkably low marital fertility relative to pre-industrial Europeans, a difference they attributed to the contraceptive effect of long breast feeding among the Chinese (Barclay et al 1976; Coale 1986). By implication, although China lacked European restraints on marriage, overall levels of fertility were not very different. More recently, the work of James Lee and colleagues, especially Cameron Campbell and Wang Feng, has begun to reshape our thinking about demographic behavior in late imperial China. Most importantly, in our opinion, they argue that female infanticide was used in China as a method of family planning, and show that it was used on a significant scale (Lee and Campbell 1997; Lee, Wang and Campbell, 1994; Lee and Wang, forthcoming). These studies, along with earlier ones on Japan, have started a re-evaluation of what is meant by rational control of fertility, and of the privileged position of Europe in the realm of fertility control (Mason 1997; Skinner 1997). Finally, other scholars have recently challenged the Malthusian image of China by citing Chinese social and political institutions that moderated both fertility and mortality (Li Bozhong 1994; Zhou 1993). These developments notwithstanding, the Malthusian model remains pervasive, and the implications of the new findings are only beginning to be understood.

We summarize the received wisdom in three propositions. The first is that Chinese population growth was governed in the main by mortality, the Malthusian positive check. The common assumption is that Chinese mortality rates were higher than European, a view crystallized by the influential Princeton estimate that average life expectancy at birth of rural Chinese around 1930 was only approximately 25 years (Barclay et al. 1976). A related issue is China's record of cycles of rapid growth and sharp decline, corresponding to the heyday and collapse of dynasties. Famine, rebellion, and foreign invasion are seen as shaping China's population growth over the long run. Periodic mortality crises are essential parts of the Malthusian dynamic (Ho 1959, Chao 1986, Chu and Lee 1994). The Qing dynasty (1644-1911), bracketed by the chaos of the seventeenth and nineteenth centuries, encompasses only the most recent and well-documented of these cycles.

The second proposition is that of demographically-determined poverty. Malthus's influential view that unchecked population growth accounted for the misery of the Chinese peasantry is echoed by contemporary scholars who see population growth and resource limitations as crucial features of the late imperial decline. They cite a variety of indicators of over-population, including ecological destruction, declines in land/man ratios, and erosion of real wages (Ho 1959, Chao 1986). Various characterizations of China's plight—as a "high level equilibrium trap" (Elvin 1973) and as "involution" (Huang 1985, 1990)—enshrine the essential idea of population pressure on resources. These pressures in turn created social problems, political unrest, and rising mortality (Ho 1959; Jones and Kuhn 1978).

The third proposition is that China, relative to Europe, had “weak preventive checks.” Malthus posited an inevitable cycle of population growth, resource depletion, and rising mortality (positive checks) *unless* there were effective mechanisms to limit fertility (preventive checks). He envisioned population-resource dynamics as a self-governing system with feedback loops, a homeostatic system, although he did not use this term. The prevailing view today is that pre-industrial Northwest Europe had effective preventive checks rooted in its unique institutions governing marriage (Hajnal 1982). The Northwest European simple household system, abetted by unigeniture (inheritance by one offspring), controlled entry into marriage by making an economic niche, or appropriate economic prospects, a prerequisite. By contrast, the Chinese joint family system encouraged early and universal marriage.[i] Strong preventive checks are typified by the case of England, where large swings of population growth in the seventeenth and eighteenth centuries were due in the main to fertility change driven by delay of marriage (Wrigley and Schofield 1981).

Malthus was the first to attribute a weak preventive check to China, but the idea remains current in the writings of distinguished contemporary demographers. In the orthodox view, Europe and China were both "natural fertility" populations, demographers' shorthand for a population in which fertility is subject to social control but not limited by individuals to any target family size.[ii] Under natural fertility conditions, China's lack of constraint on marriage is seen as a severe disadvantage. With marriage for Chinese females young and universal, control of fertility had to be exerted on fertility within marriage, an unlikely means for linking economy and childbearing because marital fertility was assumed to be relatively insensitive to economic change. As Ansley Coale put it, "it is difficult to see how restraints on marital fertility (by non-parity specific means such as prolonged breast-feeding or post-partum abstinence) would operate in a homeostatic manner—reducing fertility when population increase puts pressure on resources" (1986:19).

High mortality and cycles of growth and crisis; a population ever close to the margin of survival; weak controls on fertility—these propositions form the demographic story of China’s failure relative to Europe. Yet they have received remarkably little scrutiny. In subsequent sections of this article we will examine their empirical underpinnings by posing the propositions as a set of questions:

(1) Was Chinese population growth more governed by mortality than European? Specifically, were Chinese mortality rates higher than European mortality rates? Did Chinese mortality function to hold population in check, and was it endogenous, that is, arising from population pressure?
(2) Were Chinese nutrition and living standards significantly inferior to those of pre-industrial Europe, and were living standards declining in the nineteenth century as the result of demographic pressure?
(3) Did China have weak preventive checks? In other words, did China lack controls on fertility that could key population growth rates to the economy? Could China's great demographic cycles be other than mortality-driven?

In the concluding section we consider the the limits of our knowledge of late imperial Chinese demography, and what these limits imply for the contrast with Europe. But before we investigate the basic propositions of the contrast, we describe what is known about respective growth rates of the Chinese and European populations.

Population Growth in China and Europe

There is considerable uncertainty about the size and growth rates of the Chinese population in the late imperial period. Qing data are abundant but troubled by error and inconsistency. In Table 1 we have assembled three series of population figures for China Proper.[iii] The first set, labeled "official" derive from government enumerations, and appear in Durand (1960) and Ho (1959). The second series are adjusted estimates made by Dwight Perkins (1969) reflecting his judgement. The third set is an interpolated series by McEvedy and Jones (1978) that follows Perkins' estimates rather closely but tends to split the difference between Perkins and the official series where they diverge.[iv] These series are the most widely used and, some variation among them notwithstanding, represent the received wisdom on population size.

Table 1 here

Temporal detail should not be taken as evidence of accuracy. Annual population estimates are available for many decades of the Qing. This detail has tempted some scholars to employ econometric techniques to analyze time series data at decade intervals (for example Liu and Hwang 1977; Chu and Lee 1994). We have avoided the use of such fine grain data, offering instead a spare outline of late imperial population at 50-year intervals. This caution reflects the judgment of scholars who question the validity of Qing population data on a year-to-year or even a decade-to-decade basis. In his magisterial work on Chinese population Ping-ti Ho declared that the most useful data over the past five centuries come from three periods, the Ming Taizu (1368-1398) period, the period 1776-1850, and the census year 1953 (Ho 1959:97). The official data we offer is mainly limited to Ho's benchmark periods. Ho is highly critical of population estimates based on fiscal units (*ding*), the source of Qing data through 1775. He is more sanguine about the data from 1776-1850 that are based on reports from the collective security system, the *baojia*. Yet even the *baojia* data have serious problems. In a penetrating analysis of disaggregated data from Sichuan, G. William Skinner (1987) demonstrates that annual *baojia* reports were generally manufactured by local-level officials. Skinner notes that periodic intervention by the Emperor brought temporary improvements in *baojia* reporting, citing three dates in particular—1743, 1775, and 1808—as having some empirical basis (1987:68-71).[v] We have noted these three years, as well as the census year of 1953, as "most reliable" in Table 1.

Growth Rates. Our aim is to construct a rough series of growth rates for the Qing, but which series of population figures should we use? Experiments with the various series reveal that, regardless of choice of data series, a similar pattern of growth emerges. In other words, at the general level of description at which we are working, there is very little to distinguish between the various series. Thus, we have elected to use the interpolation of McEvedy and Jones, since it has the convenience of comparable units of time as well as comparative data for Europe[vi] at the same intervals. We wish to stress that this use of their data does not imply an endorsement of their population estimates. Rather, it recognizes that the conventional range of estimates of late imperial Chinese population produce a very similar impression. The basic trajectory of population growth—peaking in the eighteenth century and slowing in the nineteenth—is agreed upon by all. Growth rate data are presented in Table 2. For China, the series yields a growth curve with the following features: growth at approximately 4 per 1000 in the sixteenth century; a crash to negative growth in the Ming-Qing transition; an eighteenth-century boom with growth rising in the second half to 8 per 1000; and a decline in the nineteenth century to growth at about 2 per 1000 (see Table 2). Of course, the 50-year time units obscure many important features of short duration.

Table 2 here

Juxtaposition with Europe's more moderate growth rates reveals China's distinctively Malthusian pattern (see Figure 1). Europe also experienced a seventeenth-century slowdown in growth, but one far less severe than China's, and rising growth rates through the eighteenth century were also moderate relative to China's. Although China's eighteenth century average annual growth of over 7 per 1000 may not seem extraordinary from the vantage of global population now growing at twice that rate today, it is an unparalleled expansion for a mature agrarian society with a large population base. It implies a doubling of population in a century. This rate of growth alone would seem to justify Malthusian imagry. Only by the nineteenth century, with a "demographic transition" to lower mortality underway, do European growth rates attain China's. This transition, one aspect of the profoundly novel transformation from an agrarian to an industrial society, is fundamentally different from the swings in vital rates that occurred in the prior era.

Figure 1 here

In the Malthusian scheme, fertility is relatively invariant and mortality is dynamic. China's growth cycles are generally assumed to be mortality-driven. Chu and Lee, for example, propose a peasant revolt model of population declines across the sweep of Chinese history that posits changes in mortality conforming to a dynastic cycle pattern of population fluctuations (Chu and Lee 1994). Certainly the Ming-Qing transition of the seventeenth century was a period of epidemics and rebellion. But the causes of slowing growth are not clearly understood. Growth rates appear to decline sharply early in the nineteenth century from around .008 per annum between 1750 and 1800 to around .005 between 1800 and 1850. Genealogical researchers have suggested declining life expectancies in the period, an explanation that fits a Malthusian story of mortality response (Liu 1985; Telford 1990). In the following sections we examine the mortality explanations.

Mortality Levels and Trends

Knowledge of mortality levels in late imperial China is remarkably limited. The largest corpus of data derives from genealogies, a problematic source. Recent studies by James Lee and colleagues based on banner household registers and the Imperial Lineage Genealogy have provided firmer estimates for two eighteenth and nineteenth-century populations.[vii] The only other possibly applicable data comes from twentieth-century populations: Taiwan as recorded by the Japanese occupiers early in the century; John Lossing Buck's Rural Farm Survey of 1929-31; and other scattered populations. We have arrayed a selection of these data in Table 3A, along with comparable data from selected European populations (Table 3B).

Tables 3A and 3B here

The data appear at first glance to support the Malthusian thesis. Life expectancy[viii] of European populations rise in the eighteenth and early nineteenth century, while that of the Chinese populations decline. Yuan's classic study of a genealogy of a southern Chinese family shows life expectancy at a peak of 37 years in the first half of the eighteenth century, down to 34 years a century later (I. Yuan 1931). Ted Telford's (1990) analysis of genealogies of Tongcheng county in Anhui Province show life expectancies at birth dropping from over 40 before 1750 to 33 at the turn of the nineteenth century. Declines in life expectancy in the late eighteenth century are also found by Ts'ui-jung Liu (1985) in her analysis of genealogical sources. In the Zhejiang Shen lineage, life expectancy was around 38 through most of the eighteenth century until dropping to 32 early in the nineteenth. Life expectancy of Hsu (Xu) lineage males drops to the low 20s in the same period, according to Liu. Liu's extensive work on genealogies produces a fairly consistent picture of life expectancies in the low thirties for males.[ix] An influential reanalysis of Buck's Chinese Farm Survey (ca. 1930) found a life expectancy at birth of approximately 25 years, a staggeringly low level (Barclay et al. 1976).

A closer look at the Chinese mortality data reveals a far more ambiguous picture. The genealogy data, in particular, present problems of interpretation, noted by the genealogical demographers themselves (Harrell 1987; Telford 1990). Chinese genealogies have important defects that limit their usefulness for estimating vital rates. They omit infants and children, and report births and deaths incompletely and inconsistently. There is recording bias by age, sex, and class. The diligence of genealogy compilers varies over time, as does the incidence of kinsmen lost to out-migration. There are special problems attached to beginning and end of a genealogical series. The "founder effect" biases the beginning of a genealogy to long life expectancy, since apical ancestors—those remembered by later compilers—seldom die young. Mortality rates are biased upward in the most recent observations, since kinsmen alive at the time of compilation cannot have their deaths recorded. These problems necessitate remedial measures. For example mortality data under age 15 (sometimes age 30) are estimated from model tables (Liu 1985:49) or based on attributed data (Telford 1990).[x] We must keep these problems in mind as we view the long slide of life expectancy traced by the genealogies beginning in the 18th century.

The Liaoning village data, a rural north China population analyzed by Lee and Campbell (1997), are more promising in this regard. The Banner registers were compiled every three years, and although they omitted infants, linkage across registers permitted Lee and Campbell to trace individuals from a young age.[xi] Basing their estimates on household registers created over a 75-year period ending in 1867, they find a male life expectancy at birth of 35.9 for rural Liaoning (29.0 for females) (1997:62). Although there are some fluctuations over the four decades for which Lee and his associates present data, there is no discernable trend (Lee, Campbell, and Anthony 1995:177, Figures 7.1 and 7.2).

The Qing nobility data, studied by Lee, Wang and Campbell (1994) were compiled from the Imperial Lineage Genealogy, a work that shares few of the defects of ordinary genealogies. Birth and death dates are recorded for all males and for most females to the day, and sometimes to the minute. Data from this source are probably the most reliable we are ever likely to have for any pre-twentieth century Asian population, although it is uncertain how representative they could be of Chinese mortality conditions. Lee, Wang and Campbell's analysis of the Qing nobility finds male life expectancy rising sharply in the eighteenth century but dropping from 37 years for cohorts born at the turn of the nineteenth century to 32 for cohorts born three decades later (read from Figure 4 in Lee, Wang and Campbell 1994:401). However, adult life expectancies remained constant or actually improved over the nineteenth century, with the exception of a sharp rise for the birth cohort of the 1860s decade (Lai 1994:211-213). The decline of life expectancy appears to be caused by changes in infant and child mortality—plausibly the result of infanticide—an important issue to which we shall return.

The other major source of pre-industrial Chinese mortality data comes from the twentieth century. The influential Princeton reassessement of the Buck survey of 1929-31 estimated rural male life expectancy at 24.6 years, a level implying that China was a stationary (non-growing) population Barclay et al. (1976:626) This reinforced the view of China trapped in a Malthusian equilibrium. However, this estimate has been challenged on a number of grounds. Caldwell and colleagues (1986) point to other evidence indicating that China's early twentieth-century population was growing. They note that an application of model life tables to the 1953 census age structure, assuming fertility levels extant in the early 1950s, yields a male life expectancy of at least 30 years. They further note that alternative life tables produced from the Buck survey data in 1935 yielded an estimated male life expectancy of 35. Caldwell and colleagues offer an estimate of 32 years (1986:383-387).

If the force of mortality was truly more prominent in China than in Europe, we would expect Chinese life expectancy to be markedly inferior to that of pre-industrial Europe, yet mortality estimates for European populations are in a range quite comparable to China's.

English life expectancy in the eighteenth century ranged in the mid-30s, as did observations from rural Germany, France, and Russia. Only elite populations—Genevan bourgeoisie and the British peerage—exceeded 40 years of life expectancy before the turn of the nineteenth century (Table 3b). The subsequent rise of life expectancy across Europe represents the first phase of a fundamental demographic revolution (the "demographic transition" from high to low mortality and fertility) that did not begin in China until more than a century later.

In summary, the evidence for a decline of Chinese life expectancy in the decades prior to 1850 is problematic, and most observations of eighteenth and early nineteenth century populations put life expectancy for males at above 30 and below 40, a level comparable to commoner populations of pre-industrial Europe. Even if Chinese mortality rose in the early nineteenth century, life expectancy did not fall to levels below the norm for agrarian Europe. If mortality rates at the two ends of Eurasia were in fact quite similar it should be difficult to persist in a belief that Malthusian positive checks were far more prominent in China than in Europe.

Crisis Mortality

Mortality rose in the subsequent Taiping crisis (1851-1864), the most destructive civil war in world history, and in a series of other uprisings and famines in the latter half of the nineteenth century. Should periodic mortality crises be seen as evidence that China's demographic system was mortality-driven? Were the crises the result of over-population, and did they function to hold population in check?

Population and Resource Dynamics. The Malthusian perspective is clear: population growth is the driving force producing disequilibrium between population and resources.[xii] However, the balance of population and resources must be understood to include both a population dynamic and a resource dynamic. Changes in resource bases can create population-resource problems quite independently of population pressures.

Examples abound of shifts in resources unrelated to population change. A drop in annual mean temperatures, for example, can shorten growing seasons and subsequently reduce harvest possibilities, a problem encountered in the "Little Ice Age" (LeRoy Ladurie 1971; Ge 1991:250-251). Alternatively, a sequence of droughts can reduce food availability. The eighteenth-century Chinese state performed functions that extended resources and mitigated the impact of exogenous shocks. The state labored to mitigate the impact of such problems through various forms of famine relief. More generally, this state promoted the maintenance of water works and the clearance of new lands, efforts that aimed to stabilize or increase production on currently cropped land and bring new land under cultivation. Officials and local elites managed large reserves of grain to be sold at reduced prices and lent out in the spring when grain was most scarce. Government policies clearly stabilized fluctuations in resource availability and facilitated net increases in resource utilization and production.[xiii] For the nineteenth century, state capacities and perhaps official willingness to sustain government interventions diminished with adverse effects on the effective population-resource balance. In areas, like those along the Grand Canal, where the eighteenth-century state had spent considerable resources, the shift of government funding to coastal areas in the nineteenth century in response to challenges created by foreigners, diminished the economic well-being of those people abandoned by the state (Pomeranz 1993).

Population growth, of course, can affect the resource base. Negative effects of population growth came from land clearance leading to subsequent ecological degradation. Southern Shaanxi is a good example (Fang 1979; Chen and Zou 1988; Xiao 1988). In the eighteenth century migrants to this region opened new lands in mountain valleys and up the hillsides. Timber, paper and iron complemented wheat, millet, corn and sweet potato cultivation to create a commercialized and diversified agrarian economy able to support growing numbers of people. In the late eighteenth century, it was one of the areas affected by the White Lotus Rebellion. By the second half of the nineteenth century the exhaustion of the region's resource base became even more apparent. Where once there had been several large timber companies employing several thousand workers each, there were now none; where there once had been some 200 paper manufacturers, there were only two or three. The timber base had been destroyed and the soil had been exhausted.[xiv]

But there are other regional examples, such as Jiangnan, where the increasing efficiency of resource use, of both land and labor, made it feasible for a limited amount of land to support larger populations in the eighteenth and nineteenth centuries (Li Bozhong forthcoming). Indeed, the numbers of peasants suffering resource depletion like that of Southern Shaanxi were likely outnumbered by those in wealthier areas who avoided serious population pressure. More generally, population growth can be associated with economic changes making it possible for larger populations to continue at similar or even better standards of living over time. Esther Boserup has argued for demographic growth causing technological change, while others have imagined such growth leading to negative economic consequences.[xv] On balance, the linkages between population growth and economic change are therefore both recursive and contingent. A Malthusian population pressure model seems inadequate to explain either Chinese cases specifically or the dynamics of population-resource relationships more generally.[xvi]

Population Growth and Rebellion. Another sign of population pressure sometimes invoked by China historians is widespread social protest. Economic hardship, propelled by population growth, is identified as the stimulus behind popular challenges to political order.[xvii] For small-scale protests, such as tax resistance, grain seizures and rent resistance, people appear to protest when their expectations of appropriate or acceptable actions by officials, merchants and landlords are violated. While people may be poor, and at times certainly hungry, there is no clear relationship between the frequency of small-scale protests and either population density or growth.[xviii] For large-scale rebellions, the logic of population pressure creating the poverty driving people to rebellion is also unclear. For instance, population pressure has been cited as a problem in early seventeenth-century China to help explain the late Ming dynasty peasant rebellions. Rebellions certainly mobilized large numbers of peasants who hoped that their struggles would usher in a more prosperous age, but the spread of protests reflects the collapse of political capacities to sustain local social order more than it does any Malthusian population pressures. Had the seventeenth century rebellions been due to Malthusian pressure, it is unclear why the pressure of population receded in the eighteenth century, a period of very rapid population growth.

Major rebellions in the eighteenth and nineteenth centuries do not in the main appear to be driven by Malthusian pressures. In the late eighteenth century, we encounter the White Lotus Rebellion, 1793-1805, a conflict engaging more than 100,000 rebel troops at its height and costing the government some 120 million taels to suppress (Jones and Kuhn 1978: 136-44). This disturbance occurred in the mountainous border region astride the boundaries of Hubei, Sichuan and Shaanxi provinces. Immigration to this region had created a larger population than had previously been present in the area, but we have little information to suggest that people were poorer in the late eighteenth century than they had been in the mid-eighteenth century. What we do know is that rebellion was a defensive reaction to increased state efforts to assert political control over this border region. Official anxieties about heterodox belief in a kind of millenarian Buddhism propelled the state to launch large-scale military campaigns to cleanse the countryside of the White Lotus doctrine.[xix] People, only a fraction of whom were devotees of White Lotus Buddhism, resisted government attempts to impose militarily their control over this mountainous, border region. The White Lotus Rebellion does not appear to stem from population pressure.

Similar difficulties for a population pressure thesis may be suggested for mid-nineteenth century rebellions. The Taiping Rebellion was initiated by a group of eclectic religious believers whose precarious livelihoods in Southwest China persuaded them to seek fortune, security, and redemption through a journey north to the Yangzi River and then an eastward march from central China to the lower Yangzi. There was growing competition for land in Southwest China, a struggle exacerbated by a state unable to adjudicate alternative claims to resources. But were these people in fact experiencing declining living standards due to population pressure? Possibly, but more clearly they were poorer than those people living in more fertile regions to which rebels moved, seeking to promote their beliefs that wealth should be redistributed so that those with little could enjoy a more prosperous life (Kuhn 1978; Shih 1967). Explaining why people in the wealthier parts of central and eastern China became involved in rebellion and smaller-scale social protests is perhaps more important since the Taiping Rebellion could not have become the world's largest domestic war without widespread participation. Here the reasons for both small-scale rent and tax protest as well as participation in rebellion rest less with material insecurities induced by population pressure than with economic distress caused by a silver deflation and subsequent commercial stagnation and rising real tax burdens.[xx]

In the same years as Taiping rebels were moving from southwest China to Jiangnan, rebellions took place in other parts of China. The Nian Rebellion to the north of the Taiping's activities along the Yangzi River arose out of a fragile ecology in which, as Elizabeth Perry has shown, poor peasants and more marginal folk had habitually turned to banditry to help sustain themselves. The Nian Rebellion, she explains, was an extension of survival strategies to a larger-scale collective action (Perry 1980). Elsewhere, Muslim protests were rooted in long-standing cleavages. In northwest China, developing religious disputes within Islamic communities became a source of conflict that promoted strained relationships with dynastic officials, resulting in armed battles. In southwest China, competing claims to mining sites sparked Muslim and other Chinese to engage each other in conflicts that the state was unable to adjudicate peacefully (Liu and Smith 1980: 211-21). Protests and rebellions arose across a range of situations in mid-nineteenth-century China in areas that likely had quite different rates of population growth and varying economic conditions. In only one case, the Nian Rebellion, does it appear reasonable to stress resource scarcity as the key factor behind the outbreak of violence.

Although we consider most nineteenth-century rebellions to be due to exogenous causes, we do not argue that nineteenth-century China was innocent of Malthusian crisis. The problem of famine in north and northwest China between 1876 and 1879 indicate that some parts of China were indeed bumping up against resource constraints. Where drought failed to wither the crops, armies interrupted the agricultural cycle and extracted much of what was left. We can expect that mortality rose as increased malnutrition made people more vulnerable to disease and some succumbed directly to starvation.[xxi] While population pressure seems most salient in the north and northwest during for the half century between the 1870s and 1920s, the decline in government capacities to intervene to meet periodic harvest shortfalls and to stabilize production undoubtedly aggravated the situation.

Demographic Effects of Crisis. Setting aside the effect of weak government on population-resource conditions, we must ask how significant crisis mortality was to long-run population growth. Some demographers question whether crisis mortality has any long-term effects, citing evidence that crisis losses are replaced by a fertility response.[xxii] Even when we acknowledge the possible role of crisis mortality in explaining a slow down in population growth, we must ask how widespread the phenomenon was.

In a study of Ming gazetteers, James Tong classifies only 2.4 percent of 303,869 county years as having moderate or minimum survivability (Tong 1991:92, Table 4.5).[xxiii] The percentage probably rises in the Qing dynasty, but Tong's findings for an earlier period remind us that crisis mortality is out of the ordinary.[xxiv] The Chinese situation appears to be little different than the standard case of England where crisis mortality has been shown by Robert Fogel, arguing on the basis of Wrigley and Schofield data, to account for less than six percent of overall mortality between 1541 and 1750 (Fogel 1991:36). This squares with Watkins and Menken's conclusion that long-term population growth is the product of "normal levels of mortality and fertility" (1985:666).

Crisis mortality from famine certainly represents a Malthusian positive check but its significance in nineteenth-century China should not be exaggerated. Mortality from rebellions no doubt also contributed to slowing of population growth, but it is far from clear that social conflicts arise from population pressure. Even if the mid-century rebellions are considered as demographically induced, we still must explain the slowing of population growth that began decades before the rebellions. If as has sometimes been argued, normal mortality was rising in the period, possibly due to falling living standards and inadequate nutrition, the case for the Malthusian positive check would be far more persuasive than evidence of crisis mortality alone can support. We examine this possibility in the next section

Nutrition and Living Standards
Scholars have a general sense that increases in cultivated area did not keep pace with population growth in the eighteenth century, with the result that nineteenth-century peasants on average worked smaller farms than their predecessors. Assuming an absence of significant change in the organization and technologies of production, this decline in per capita cultivated area would spell a decline in standards of living. The economist Kang Chao, for instance, has worked from the classical economist's vantage point to see ever larger populations barely sustained at subsistence levels; he sees falling standards of living over a long sweep of centuries which resulted in the creation of a surplus population that could not create enough product to support itself (Chao 1986:7). The empirical support for his position is hazardously thin, but his suspicion that the Chinese lived near a subsistence minimum is echoed in other work as well, including Philip Huang's two books on North China and the Yangzi delta (Huang 1985; 1990). Huang carries forward into the twentieth century the argument that Chinese peasants lived at a subsistence level, ever subject to population pressure, though he neither defines "subsistence" clearly nor contrasts what must have been different "subsistence" levels in north and south.[xxv]

Both Adam Smith and Thomas Malthus were convinced that the Chinese endured poverty and dietary conditions unthinkable for Europeans. Malthus, echoing Smith, wrote,

> If the accounts we have of it [China] are to be trusted, the lower classes of people are in the habit of living almost upon the smallest possible quantity of food, and are glad to get any putrid offals that European laborers would rather starve than eat (1960:49).[xxvi]

There is no reason to doubt the credibility of the observation, since poverty undoubtedly existed in eighteenth-century China. But some foreign observers may have been reacting to food supply issues in cultural terms of taste and convention more than scientific terms of nutritional quality. A Chinese merchant observing the eighteenth-century London underclass might have reacted with similar revulsion. In any case, given what we know about the eighteenth-century economy more generally, it is quite unlikely that the average Chinese was eating garbage.

Other European writers, including careful first-hand observers, came away with quite a different assessment. Witness, for instance, Robert Fortune, a Scotsman who did not hold a very high opinion of Chinese agriculture: "for a few cash . . . a Chinese can dine in sumptuous manner upon his rice, fish, vegetables and tea; and I fully believe, that in no country in the world is there less real misery and want than in China" (1847: 121, cited by Anderson 1988: 96). In another volume he wrote, regarding the diet of tea-picking laborers:

> The food of these people is of the simplest kind--namely rice and vegetables, and a small portion of animal food, such as fish or pork. But the poorest classes in China seem to understand the art of preparing their food much better than the same classes at home. With the simple substances I have named, the Chinese labourer contrives

> to make a number of very savoury dishes, upon which he breakfasts or dines most sumptuously. In Scotland, in former days—and I suppose it is much the same now—the harvest labourer's breakfast consisted of porridge and milk, his dinner bread and beer, and porridge and milk again for supper. A Chinaman would starve upon such food. (1857: 42-43, cited by Anderson 1988: 96).

Fortune was observing mid-nineteenth century China, a land we conventionally view as already subject to economic decline. How much truer his assessment may have been for the century preceding. No wonder that two distinguished specialists have judged the eighteenth-century Chinese peasant better off than his French counterpart.[xxvii]

Arguments for low and even falling standards of living in the nineteenth century must be qualified in several ways. First, it is important to confirm that China's cultivated area did expand considerably over the eighteenth and into the nineteenth century. In 1729, land registered for taxes was more than three times the land registered around 1600 for tax purposes (Peng 1990: 117). The clearance of frontier land and mountain land continued through the eighteenth century; in the nineteenth century additional land was opened in Taiwan, the northwest and the northeast (Peng 1990: 119-278). Many millions of people were supported through migration to areas with newly opened land. Second, as the example of China's most advanced agricultural region, Jiangnan, demonstrates, a smaller farm size could actually prove to be a more efficient unit of production, using family labor more fully through the year as subsidiary crops and handicraft activities were added to the main crop (Li Bozhong forthcoming). Third, in this same region, the increased application of commercial fertilizer raised yields. Fourth, a phenomenon of more general significance was the expansion of commerce through which people were able to specialize in certain products and exchange them for other goods; division of labor and production for the market increased peasant family incomes in ways that per capita cultivated area figures cannot reflect.[xxviii]

Fifth, there is considerable variation in living standards both between regional economic systems and within them.[xxix] As in Europe, there were in China areas with relatively high standards of living for which recent scholarship even suggests rising, not falling standards of living. Fang Xing has made estimates of Jiangnan peasant consumption in the late sixteenth-early seventeenth century with those for the nineteenth century and finds that the proportion of income devoted to non-grain food consumption rises, from which he concludes that peasants were enjoying a better diet of higher quality non-grain items (Fang Xing 1996). Higher levels of consumption are consistent with Li Bozhong's recent findings that labor productivity on Jiangnan farms, contrary to conventional assumptions about population pressure, actually rose in the Qing dynasty as peasants were more successful in combining small-scale intensive agriculture and household handicrafts than they had been in earlier times (Li Bozhong forthcoming: chapter 8).[xxx] These arguments and evidence suggest a need to revise the traditional notion that living standards were everywhere falling in the late Qing.

In short, the fragmentary evidence on nutrition offers little ground for concluding that Chinese living standards were either clearly lower than European living standards or at crisis levels. Nutrition was not clearly inferior in China, but even assuming it was, the mortality effects would be unclear. Though superficially straightforward, it is in fact very difficult to link mortality levels to resource availability directly. Few people die of starvation outside of crisis conditions. Many may suffer chronic malnutrition but the mortality effects of this condition are difficult to specify even among contemporary populations (Carmichael 1985, Livi-Bacci 1985, Scrimshaw 1985, Taylor 1985). Still, modern scholars continue to associate food supply conditions with levels of mortality (McKeown and Record 1962; Simon 1985: 218).

Other factors which clearly could affect mortality did vary among Chinese and European settings. For instance, urban centers are acknowledged to have been far more risky environment than the countryside. By the early nineteenth century Europe's peasant population appears to have supported many more towns and nearly the same total urban population as China did but with only one-third the rural population (DeVries 1984: 263-64). A higher proportion of Europeans lived in cities and towns and were therefore exposed to the public health hazards typical of cities. All other factors being equal, Chinese mortality levels would have been lower for just this reason alone.[xxxi]

These brief comparisons of Chinese and European nutrition and living standards encourage caution in accepting the conventional assumption that the Chinese people suffered significantly higher rates of mortality than Europeans did. In short, the linkages between nutrition, living standards and population in China appear basically similar to those reviewed at length by Massimo Livi-Bacci for European cases. Livi-Bacci shows that poverty and famine affect populations but that mortality crises are not generally linked to nutritional factors. In the long run there is no clear relationship between nutrition and population change (Livi-Bacci 1991). Nevertheless, some early nineteenth-century Chinese populations probably experienced a decline in standards of living in the recession triggered by a serious silver deflation. But evidence for elevated levels of mortality only comes later, during mid-nineteenth-century rebellions and later famines. If a broad mortality response to changing economic conditions seems unlikely to explain the decline in population growth rates, we must turn to the fertility side in order to explore other possible explanations.

Preventive checks: Fertility and Infanticide

A commonly held belief until very recently, although not shared by Malthus himself, was that the Chinese had unusually high fertility (Wolf 1985:155-156). Princeton demographers who reanalyzed the Buck survey presented evidence that Chinese marital fertility was little more than half the level of that of Northwest Europe (Barclay et al. 1976). They hypothesized that lengthy breast feeding in China could account for the difference, since lactational amenorrhea could produce long spacing between children. Although the assertion that Chinese marital fertility was relatively low has been challenged, it is supported by a convincing variety of historical and contemporary sources (Wolf 1985; Coale 1985). Chinese low marital fertility combined with the custom of early and universal marriage for women yielded overall fertility at levels comparable to the Northwest European regime of high marital fertility and restricted marriage.

Yet even if we can show broadly similar rates of fertility in China and Northwest Europe, we cannot necessarily claim that China had an effective preventive check. The purported defect of Chinese fertility is not its level but its responsiveness to economic signals. Wrigley and Schofield could show that English fertility responded to economic change by way of changing rates of marriage. What mechanism could produce this homeostatic response in the Chinese case? If marriage of females was young and universal, that left adjustments to marital fertility. It is most unlikely that length of breast feeding was varied, consciously, or unconsciously, to alter fertility; besides, weaning was probably sufficiently late that additional breast feeding would have had no additional contraceptive effect. For this reason, leading demographers have suggested that China had a weak preventive check (Coale 1986:19; Lee 1986:123-125).

This conclusion, at first glance a reasonable one, appears upon further scrutiny to be more a product of the undeveloped state of Chinese historical demography than of any lack of potential mechanisms of fertility control. There is a profusion of candidates, any of which could have operated in a homeostatic manner. Malthus speculated about the fertility-moderating effects of Chinese slavery and religious orders (1960:212-213). Marriage customs (including little-daughter-in-law marriage, "delayed transfer," and the taboo on widow remarriage) could have influenced fertility substantially in various locales.[xxxii] Sojourning, an important economic behavior in some regions, could have limited fertility by disrupting family life.[xxxiii] Recently, some scholars have argued that contraception and abortion were practiced to a signficant degree in late imperial China.[xxxiv] A lack of systematic data on these mechanisms means that any assessment of their demographic influence is necessarily speculative. Possibly they all exerted some force on late imperial population growth. Among the possible mechanisms, we consider infanticide to be the most likely to have such influence. In the next section, we set out our reasons and speculate on the range of its effects.

Infanticide. Infanticide has long been recognized as a universal phenomenon, but its importance as a demographic behavior is a relatively recent discovery. Students of Tokugawa Japan were among the first to demonstrate how infanticide was used as a rational method of birth control, not only to limit the size of families, but to select the sex of children (Smith and Eng 1977; Hanley and Yamamura 1977; Skinner 1989). G. William Skinner proposes that family system norms specify the relative desirability of differently configured offspring sets (1997:66), however, the norms do not specify the mechanism for achieving demographic objectives. "Child control" and "child transfer," terms that encompass infanticide, abandonment, out-adoption, or sale of children, have clear advantages over birth control because they permit parents to select children on the basis of their characteristics such as sex and health. It can be used to improve the "quality" of progeny and to shape the gender configuration of offspring as well as their number and the spacing between them (Skinner 1997:67). A strong preference for sons is implied by the patrilineal joint family systems found in China, Korea, and south Asia. Female infanticide represents one method of achieving demographic objectives.[xxxv]

Female infanticide in late imperial China has been known heretofore mainly by qualitative evidence,[xxxvi] but recent studies have begun to provide some quantification. James Lee and colleagues have presented the most compelling systematic evidence on infanticide in late imperial China, demonstrating that it was used by high class and low, and on a major scale by populations outside the lower Yangzi. Lee and Campbell's (1997) study of a Banner village in nineteenth century Liaoning Province reveals dramatic rates of female infanticide in a commoner population. Over the period they study (1792-1867), Lee and Campbell estimate that from a fifth to a quarter of girls were victims of infanticide (1997:65-70). For the Imperial Lineage Genealogy of the Qing dynasty, Lee, Wang and Campbell find that in the course of the eighteenth century, female infant mortality more than doubled, due entirely to increased deaths in the first day of life. Although male infant mortality fell in the period, there is also evidence of male infanticide, as neonatal mortality (deaths in the first month of life) rose sharply in the period. Lee and colleagues attribute the rise to economic pressure on Imperial Lineage members, who lost some of their emoluments in the period. The low nobility was more likely to eliminate daughters. Over the period 1700-1840, about 10 percent of female infants were killed, but in the 1780s, the rate was as high as 20 percent (Lee, Wang, and Campbell 1994:400).[xxxvii]

Our understanding of infanticide in China must take us outside of moral categories. Malthus himself could not conceive of infanticide as other than a desperate act. Its existence in China he took as proof of China's poverty.[xxxviii] Yet it was clearly practiced in a routine manner, in response to economic circumstances, by the prosperous as well as the destitute. Infanticide is intentional mortality and thus unlike conventional mortality, which people can neither plan nor avoid. To quote Lee et al., it is "an active, rational, individual-level response to changing circumstances" (1994:410); or as Watkins and van de Walle put it, it is a "flexible and timely way of relating the number of children to the family's resources" (1983:14); or as Skinner stresses, it is a way of "manipulating the final size and configuration of offspring sets" (1997:66). In other words, it is the functional equivalent of family planning.

The terminology used to classify infanticide tends to obscure its systemic role. Infanticide is literally mortality and a Malthusian vice, but its relegation to the category of "positive checks" colors it an unduly Malthusian hue. Lee and Campbell call it a positive check, but also refer to it as "post-natal abortion" (1997:70). The latter nomenclature at least highlights the rational, preventive aspect. If it functions as birth control, undertaken voluntarily by people concerned as much with future as with present hardship, then infanticide is as prudential and "preventive" as it is positive. However we categorize it, we must distinguish infanticide from conventional infant mortality, the kind that is unwanted by parents. Only then can its systemic role be accurately assessed.[xxxix]

It is obvious that female infanticide, on the scale observed by Lee and colleagues, would have a substantial effect on rates of population growth. Elimination of infant females instantly reduces family size, but it also forever prevents its victims from reproducing. In this latter sense it is the demographic equivalent of perpetual spinsterhood, a crucial element of northwest Europe's nuptiality-based demographic system.[xl] But the demographic effect of female infanticide in China has never been estimated. This is in part a defect of our most common demographic tools, which focus on the fertility of females under the assumption of a balance of the sexes in the population.

Effects of infanticide. We propose to estimate the potential effect of female infanticide on growth rates, simulating China's population under the fixed assumptions of the stable population model (Dublin and Lotka 1925). A stable population is a theoretical population, one in which age-specific fertility and mortality rates are fixed over time. Each combination of fertility and mortality implies a stable age structure and a fixed rate of growth, known as the intrinsic growth rate *r*. The intrinsic rate of growth can thus serve as an index of growth under hypothetical scenarios of fertility and mortality. Our approach is an expansion of the classic stable population model to include a separate factor for intentional female infant mortality. Previous attempts to assess the effects of mortality in damping population growth have compared the joint influence of mortality and fertility on population growth (Weiss 1972). To highlight the role of nuptiality, the European Historical Fertility Project further decomposed fertility into components of marriage and marital fertility (Coale and Treadway 1986). In like manner we partition mortality into "unintentional" and "intentional" components.[xli]

We have used the model to estimate rates of growth under various assumptions of female infanticide and life expectancy (net of infanticide). Table 4 compares stable population Net Reproduction Rates and intrinsic rates of growth across a plausible range of life expectancies and rates of female infanticide. Marital fertility and proportion married are fixed at the rates estimated by the Princeton reanalysis of the Buck survey (Barclay et. al. 1976:614) which were conveniently (for our purposes) adjusted for the high (116) sex ratio of births in the survey (1976:634).[xlii]

Table 4 here

The model demonstrates the potential effect of female infanticide on population growth rates. For example, a life expectancy of 35 with no infanticide implies a growth rate of .013. A drop in life expectancy to 27.5 years reduces the growth rate to .005, less than half. An equivalent drop in the growth rate would be produced by a 20 percent rise in female infanticide. In other words, female infanticide, if practiced universally at the rates observed by Lee and colleagues among the Qing nobility and a Liaoning banner community, would reduce growth rates by .008, roughly the same as the drop in the century 1750-99 and 1850-99 (Table 2 and Figure 1). Of course, the actual population, subject to interannual fluctuations and long-term trends, is not a stable population; the model merely provides an indicator of the magnitude of infanticide's potential effects.

From this exercise we conclude that it is possible that a substantial portion of the decline in population growth in the 19th century could be explained by a rise in female infanticide. Because infanticide would rise in response to economic distress, a concomitant rise in unintentional mortality could be expected; thus intentional mortality could be the major, but not the sole source of the slowdown in growth. It is notable that the fertility-driven decline of English growth rates between 1551 and 1661, made famous by Wrigley and Schofield (1981: 192-284), is of approximately the same magnitude. The intrinsic rate of growth dropped from approximately .008 to -.001 in the 110-year period (1981:243). Of course, we lack the elegant data that could demonstrate that infanticide explains declining growth. Our simulation only demonstrates the the very considerable *potential* of infanticide as a homeostatic mechanism.

Conclusions

The foregoing sections have examined the empirical underpinnings of the three Malthusian propositions about China's demographic system posed in our introduction. In summary we found the following:

(1) There is scant evidence that Chinese mortality rates in the late eighteenth and early nineteenth century exceeded those of agrarian Europe before the Industrial Revolution; moreover, there is at best ambiguous evidence of a rise in mortality in early nineteenth-century China. Prominent crisis mortality of the late Qing is largely attributable to causes exogenous to the demographic system.

(2) The evidence is weak that nutrition and living standards were significantly lower than those of agrarian Europe, or that they were declining in the early nineteenth century, or that population growth was responsible for economic decline.

(3) There are a number of mechanisms that had the potential to restrain fertility in response to economic conditions. Chief among them is female infanticide, plausibly practiced on a scale which could have significantly dampened population growth.

If we have raised "reasonable doubts" about the Malthusian propositions, there remains the problem of the extraordinary amplitude of China's demographic cycles observed in Figure 1. Does China's record of demographic boom and bust, relative to European moderation, sustain the Malthusian judgment? Not necessarily. There is reason to doubt even the fundamental estimates of China's population in historical times. China's dramatic swings in population may be in part a statistical artifact because the quality of official population counts, the ultimate source of all estimates, are a function of state capacity.

The limitations of the Chinese state's abilities to collect accurate population information were clearly explained by Ping-ti Ho in his classic study (1959). We should expect the capacity for enumeration to be at a minimum when a new dynasty had not yet reestablished a bureaucratic infrastructure or when dynastic power was in decline. Part of the decline in registered population that took place in the late Ming and early Qing dynasties is likely to be an artifact of weak government ability to register people and their land. It should scarcely surprise us that Chinese enumerations in late imperial times were flawed, since census-taking did not become a developed capacity of European states until the nineteenth century. Nor should the broad variations in enumeration quality tied to the dynastic cycle prompt much wonder. More remarkable, in our opinion, is the periodic ability of eighteenth and early nineteenth-century Chinese officials to mount serious efforts at population registration. These efforts alert us to the abilities of officials to undertake more systematic efforts despite their inabilities to sustain them. In the long run, these variations generally conform to the dynastic cycle, but in the short run need not.[xliii]

A plausible revision in late Ming and early Qing population estimates would greatly attenuate the contrast between Chinese and European growth rates. Recent scholarship suggests that Ming population has been underestimated. Ping-ti Ho gives a 1393 estimate of 65 million. Timothy Brook revises this to 75 million based on the finding that early to mid-Ming gazetteers routinely reported higher figures for person per household than used by Ho (Brook forthcoming, chapter 1 footnote 13). G. William Skinner puts the peak Ming population at 200 million in 1585 (1977:19) as compared with Perkins' range of estimates for 1600 (shown in Table 1) of 120-200 million. If Ming population was at least 180 million in 1600, then it is plausible that it was at least 180 million in 1700. That would imply an average growth rate in the eighteenth century of no more than .0057, which accords with Michel

Cartier's recent estimate of .006 per year for the period (Cartier 1995:211). This is about the same as Europe's growth rate in the latter half of the eighteenth century. It is also probable that China's downward swings in growth in crisis periods were not as extreme as portrayed in Figure 1.[xliv] Our aim is not to ajudicate conflicting population estimates, but to note that the direction of recent scholarship on Chinese population size suggests that Chinese and European growth rates were far more similar than implied by earlier estimates.

Revising the Malthusian narrative of Chinese population dynamics alters one feature of our conventional view of China's nineteenth-century decline, but this does not imply that our larger picture of dynastic decline is necessarily in error. Rather it should encourage us to specify more precisely the dynamics of change in order to explain how Chinese politics, economy and society were changing in what became China's last dynastic decline. Surely there were mounting ecological problems, momentous challenges to rural social order, disturbing demands made by Western states, and ample evidence of ineffective government. But we have yet to reconcile such difficulties with evidence of commercial growth, urban social change, and new state institutions and expanded capacities that reflect more positive possibilities. Rather than read nineteenth-century history backward from the Qing dynasty's early twentieth-century collapse, we might better understand the complex of mid- and late nineteenth-century changes by looking forward from eighteenth- and early nineteenth-century dynamics.

Future work will no doubt advance our understanding of China's population dynamics. To date there have been more careful reconstructions of European historical populations than exist for Chinese ones. This has made comparison difficult. Not only is far more known about specific European populations, but we also recognize that the case most widely cited, namely the English, does not in fact represent any European-wide norm. There is considerable variation in levels, timing and rates of change in fertility and mortality across European populations.[xlv] In contrast, we have yet to create a range of empirically-established variation within which to place the few studies of Chinese historical populations that we do have. Instead the genealogical populations, mainly from the lower Yangzi region, and the banner and Imperial Lineages populations, each reflect particular institutional situations. We might well imagine that the demographic behaviors of Chinese peasants who were neither part of complex households nor embedded in strong lineages would behave differently than individuals who were. For example, the relatively rapid growth of North China in the latter half of the nineteenth century compared with absolute population decline in the Middle and Lower Yangzi regions,[xlvi] might reflect not only the differential effects of rebellion but higher rates of fertility among North China peasants. Whatever future research suggests about variation in Chinese demographic behaviors, we are confident that they will more likely parallel variations found in Europe and not, to the contrary, sustain the Malthusian contrast conventionally assumed by so many.

Our assessment of Chinese population dynamics impells us to consider the similarities with Europe, as well as the differences. The Chinese valued male descendants in ways that Europeans did not, and, placed few obstacles in the way of marriage. But the social and cultural differences clearly separating China and Europe should not obscure the larger similarities. Reproduction in China, as in Europe, appears to be moderated by cultural practices that responded to resource constraints and operated to hold living standards at a level above subsistence.

The weak and contradictory data on China's demographic system are insufficient to sustain the conventional contrast between a China on the edge of subsistence compared with European living standards comfortably preserved by preventive checks. There is little evidence that mortality in China prior to 1850 was higher than in Europe prior the onset of the European mortality transition, or that population/resource ratios were more volatile. More likely is a range of living standards across both China and Europe that in broad measure overlapped. Regardless of the differences that may have separated Chinese and European living standards in the three centuries before 1850, the dramatic changes and starkest differences emerged in the next century when urban factory industrialization pushed the European economy upward. One must suspend all knowledge of these transformations in order to imagine how much China and Europe shared before these revolutionary changes took place. At a time when modern economic growth was as yet unimagined by Malthus and his contemporaries, Eurasia shared a common pre-industrial world of possibilities and constraints.

The danger of the Malthusian contrast is that it could mislead us about the ultimate divergence of European and Chinese population-resource relationships. The reasons for this divergence range far beyond demography. We will never know whether European economic growth in the seventeenth and especially eighteenth centuries could have kept pace with population expansion in rural areas, because conditions changed too quickly. First, urbanization and overseas migration absorbed substantial proportions of Europe's rural populations; then, the nineteenth-century urban factory transformed the economy. Across both China and Europe the agrarian economy expanded to support a growing population. The stability of the ratio between population and resources in China between 1550 and 1850 was probably not so very different from Europe's, even if the levels of these ratios varied across both China and Europe. After 1850, Europe broke free from resource constraints as urban industrialization created a new world. For more than another century after that, China remained an overwhelmingly agrarian society in which population-resource ratios ebbed and flowed without any definite economic or demographic break with the past.

Assessments of China's population history should guard against implicit contrasts with a Europe that had already been transformed by the economic changes of the nineteenth century. The proclivity to believe that Europe more successfully controlled its population growth and was therefore able to develop its economy has led China specialists to imagine that excessive population growth lies at the heart of China's historical economic backwardness. This set of assumptions promotes acceptance of an outdated contrast between a stagnant late imperial Chinese economy and a dynamic early modern European one. Just as this contrast of economies is no longer persuasive, we argue that the conventional contrasts of population dynamics in late imperial China and early modern Europe are misconceived and poorly supported.

Footnotes

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Table 1

Population Estimates of China Proper (in millions) from Three Sources, 1393–1953

Year	Official	Perkins	McEvedy and Jones
1393	64**	65-80	
1400			75
1491	84**		
1500			100
1600		120-200	150
1650	88	100-150	130
1700	101		150
1743*	164		
1750	180	200-250	215
1775*	264		
1800			320
1808*	350		
1850	430	410	420
1893		374**	
1900			450
1953*	526**		

*Denotes years deemed most reliable. See text for explanation.
**Adjusted to exclude populations of Manchuria, the northwest, and Tibet.

Sources: For official data: 1393, 1491, 1650 and 1700 from Zhao and Xie 1988: 374; 377-383. Others from Ho 1959: 10, 281-282 as well as Durand 1960: 231,240. 1953 Census from China SSB 1986:1. Perkins 1969:216. McEvedy and Jones 1978:170-174.

Table 2

Population (in millions) and Implied Annual Rates of Growth for Europe and China, ca. 1400-1950

Year	Population, Europe	Population, China	Growth Rate, Europe	Growth Rate, China
1400	60	75		
			.0030	.0029
1500	81	100		
			.0021	.0040
1600	100	150		
			.0010	-.0028
1650	105	130		
			.0026	.0029
1700	120	150		
			.0031	.0072
1750	140	215		
			.0050	.0079
1800	180	320		
			.0077	.0054
1850	265	420		
			.0077	.0014
1900	390	450		
			.0056	.0031
1950 (1953)	515	526		

Source: McEvedy and Jones 1978:18, 171.

Table 3A

Life Expectancy at Birth of Various Chinese Historical Populations

Population	Period	Life expectancy at birth (E_0)	Source
Guangdong lineage (males)	1600-1699	33	I-Chin Yuan 1931:168-169 Cohort data
	1700-1749	37	
	1750-1799	35	
	1800-1849	34	
Tongcheng lineages Anhui Province (males)	1690-1709	46	Telford 1990:133 Period data.
	1710-1729	42	
	1730-1749	41	
	1750-1769	40	
	1770-1789	38	
	1790-1809	33	
Zhejiang Shen (males)	1725-1739	38	Liu 1985:52 Period data.
	1740-1754	38	
	1755-1769	38	
	1770-1784	38	
	1785-1799	36	
	1800-1814	36	
	1815-1829	32	
	1830-1844	32	
Qing nobility (males)	1700-1710	22	Lee, Wang, and Campbell 1994:401 Cohort data read from Figure 4.
	1750-1760	31	
	1800-1810	37	
	1830-1840	32	
Liaoning villages (both sexes)	1798-1801	43	Lee, Campbell, and Anthony 1995:177 Period data read from Figure 7.2
	1801-1804	33	
	1810-1813	33	
	1813-1816	33	
	1816-1819	39	
	1819-1822	32	
	1828-1831	32	
	1837-1840	33	
Taiwan (males)	1906	27.7	Barclay 1954:154 Period data.
	1909-1911	32.4	

Table 3B

Life Expectancy at Birth of Various European Historical Populations

Population	Period	Life expectancy at birth (E_0)	Source

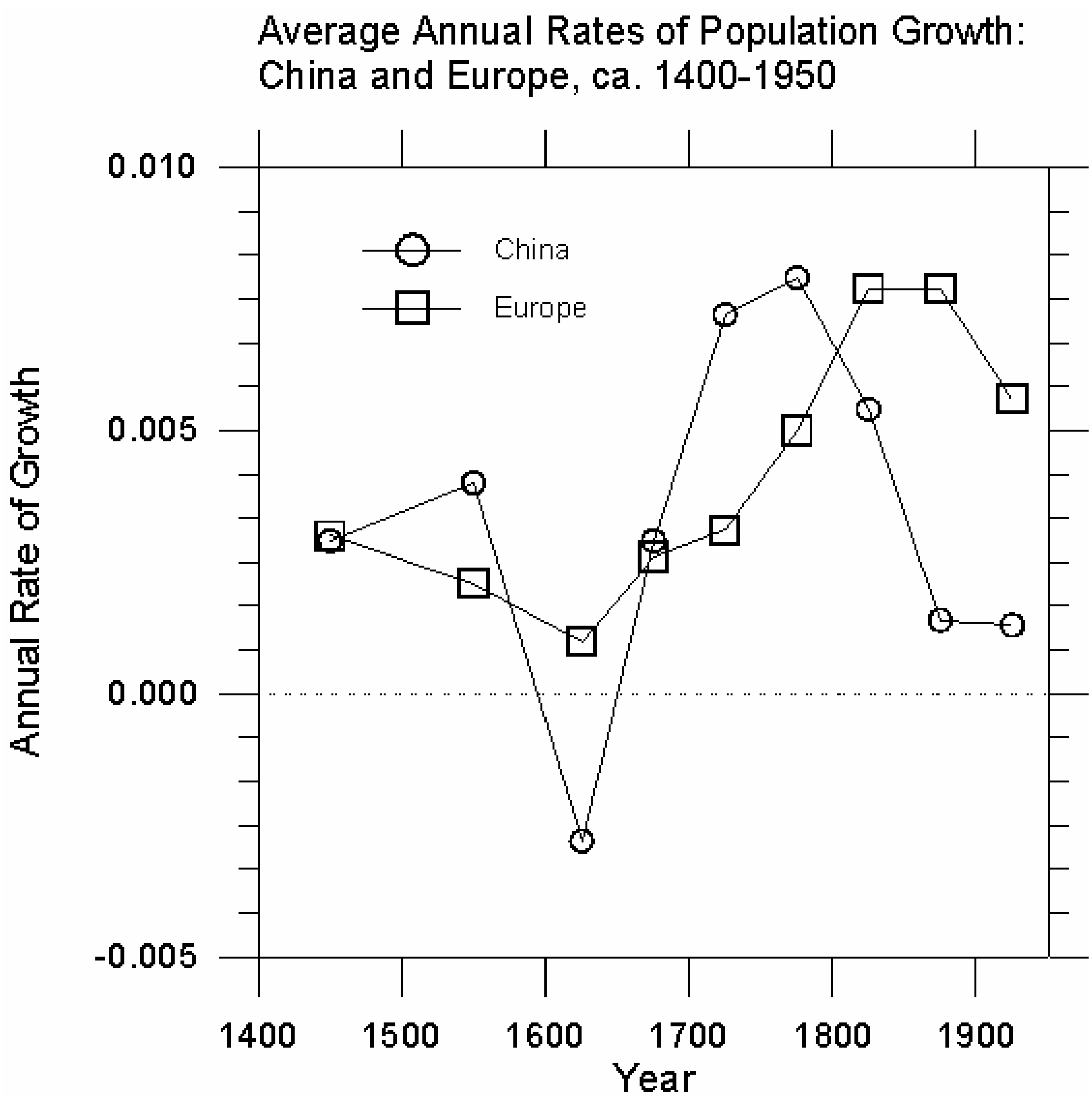
England	1541	33.8	Wrigley and Schofield 1981: Table A3.1 Period data.
	1571	38.2	
	1601	38.1	
	1631	38.7	
	1661	35.7	
	1691	34.9	
	1721	32.5	
	1751	36.6	
	1781	34.7	
	1811	37.6	
	1841	40.3	
German villages	Pre-1800	35.5	Knodel 1988:59. Cohort data.
	1800-49	38.7	
Geneva (males)	1550-1599	28.6	Henry 1956:156 Cohort data.
	1600-1649	30.9	
	1650-1699	33.3	
	1700-1749	40.7	
	1750-1799	46.6	
	1800-1849	52.0	
French villages	Pre-1750	25	Flinn 1981:130-131. Model West female E_0 implied by mean l_{10}
	1740-90	30	
	1780-1820	36	
British Peerage (males)	1330-1479	24.0	Hollingsworth 1965:358 Cohort data.
	1480-1679	27.0	
	1680-1729	33.0	
	1730-1779	44.8	
	1780-1829	47.8	
	1830-1879	49.8	
Moscow Region	1745-1763	24.2	Blum and Troitskaja 1996:324.
	1851-1858	24.4	
Bunjakovskij	1874-1883	30.9	

Table 4

Intrinsic Rate of Growth *r* Implied by Various Combinations of Life Expectancy at Birth and Levels of Female Infanticide in a Model Chinese Population

	Assumed Rate of Female Infanticide		
Life expectancy at birth (E_0)	None	10 percent	20 percent
27.5	.005	.001	-.003
30.0	.008	.004	.000
32.5	.010	.007	.002
35.0	.013	.009	.005
37.5	.015	.011	.007

Note: Model marital fertility and proportions married are from the Chinese Rural Farm Survey of 1929-31 as adjusted by Barclay et al. 1976:614. The model total fertility rate (TFR) is 5.5; the model Gross Reproduction Rate (GRR) is 2.66. Mortality schedules are Coale-Demeny Model West Female.



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[i] The contrast of demographic systems is located within a broader debate over comparative family systems. Hajnal (1982) emphasizes the sharp contrast between the Northwest European "simple household" system and Asian "joint household" systems. Goody (1990) counters that the contrast is overdrawn and stresses the continuities of family forms across Eurasia. At issue are the explanations for European (and Japanese) success in industrialization (Wolf and Hanley 1985).

[ii] In the jargon of demographers, natural fertility populations are not subject to "parity-specific control," that is, control with respect to the number of children ever born to a couple. Parity-specific control implies that individuals consciously alter their behavior as

they approach some target family size. Louis Henry (1961) first noted the characteristic pattern of marital fertility in populations that did not practice parity-specific control, and coined the term "natural fertility" to describe it. The term is now contentious because of growing evidence that families in populations prior to sustained fertility decline can and do regulate the number and sex of their children in rational ways. See, for example, critiques by Skinner (1997:66-68) and Mason (1997:447-448).

[iii] China proper excludes provinces of former Manchuria, the northwest, Tibet, and Taiwan.

[iv] Recent Chinese scholarship continues to use official figures from the Qing dynasty Veritable Records, e.g., Zhao and Xie 1988:372-84 and Z. Yuan 1994:18-32, or follow Ping-ti Ho's estimates (Ge 1991:246).

[v] Skinner shows that local officials used formulaic methods to increment annual population reports; this tended to inflate population estimates over time. Taeuber and Wang (1960) made similar complaints about the *baojia* data, based on provincial aggregates. Skinner concludes that the *baojia* figures probably considerably overstate China's population by the mid-19th century. He offers an estimate of 380 million for 1850, compared with Perkin's estimate of 410 and the official figure of 430 million. These alternative estimates are crucial to estimates of growth rates in the nineteenth century, however, they do not alter the general picture of declining population growth in the nineteenth century.

[vi] Europe includes Russia west of the Urals. For details see McEvedy and Jones 1978:16-17.

[vii] Lee and Campbell describe the former population as a group of Han Chinese peasants who were part of the banner system, a regime of population registration, land management, occupational specializations and social organization unusual among Han Chinese. The Imperial Lineage is even more distinctive because because lineage members were ethnically Manchu and among the most elite members of late imperial Chinese society. Thus, while the quality of these data sets may exceed that of other data sources on Chinese demographic history, their generalizability may also be more open to question.

[viii] Here and elsewhere, the life table measure of average years of life expectancy at birth (E_0) is referred to as "life expectancy."

[ix] Liu Ts'ui-Jung's study of four southern lineages in the sixteenth to nineteenth centuries finds life expectancies of 27 to 35 depending on the lineage (1995:108-120). Her valuable analysis of 49 lineages from late Ming to late Qing (1992:137-163) refrains from estimating life expectancy at birth. In nine of 49 lineages, male life expectancy at age 15 (E_{15}) is 30-35 years; for 33 lineages, E_{15} is 35-39 years; and for seven lineages E_{15} is 40 years or above. Using Coale-Demeny model West male life tables, these figures imply life expectancy in a range from 23 to 39 years, with a median of 30-33 years.

[x] Telford notes that as the Tongcheng genealogies become more inclusive of infants and children (a group more vulnerable to mortality), life expectancies decline. For this reason

he rejects the life expectancies of over 40 years that occur for pre-1750 cohorts, and speculates that the true peak of life expectancy was less than 40 (1990:133). He charts a decline in male life expectancy in the period 1790-1879, but the basis for this decline is unclear. The genealogies contain virtually no direct evidence of mortality under age 10—child mortality is extrapolated from adult mortality—but the differences over time in adult mortality are small and inconsistent (1990:130, Figure 8). The rise of mortality in the Shen lineage studied by Liu (1985) is more plausible because mortality rates appear to rise across the range of observed data, but here again, we cannot rule out the possibility that improved recording of births and deaths contributed to rising mortality rates.

[xi] The Banner registers are "Household and Population Registers" of the Eight Banner Han Chinese Army which were used to register the population of northeast China (Lee and Campbell 1997:16-17).

[xii] Malthus saw social institutions as mediating the relationship between population and resources. He believed, for example, that unigeniture imposed greater demographic restraint than a regime of partible inheritance, and thus preserved living standards. In an earlier article analyzing Chinese population and land data from north China in the early twentieth century, we found that a combination of land transfers, labor markets, and lower rates of reproduction among poorer households made partibility viable in the long run (Lavely and Wong 1992).

[xiii] On famine relief, see Will 1990; on water works see Morita 1974; land clearance is analyzed by Peng 1990 and Wang, et al. 1991; on food supply management and granaries see Will and Wong 1991.

[xiv] While China's northwest periphery more generally suffered population decline in the second half of the nineteenth century, both this region and other peripheries in China have been the targets of large-scale migrations after 1949. For figures on the size of regional populations in China between 1953 and 1993 see Cartier 1995:215.

[xv] Esther Boserup notes that agrarian societies can shift their food supply strategies from extensive land to intensive land systems as their populations grow and thereby escape Malthus's positive check (Boserup 1983: 187). Boserup's generally optimistic view of economic responsiveness to population growth (Boserup 1965, Boserup 1981) has gained support among some scholars, but analysts of China generally do not find positive economic changes in response to demographic change.

[xvi] R. Lee (1986) offers a sophisticated model of population growth and technological change in which both Malthusian and Boserupian dynamics each play roles in creating multiple relationships between population and technology. The empirical challenge is to delineate where particular cases fit within the model. At present, too little is known about Chinese technological change.

[xvii] A comparison of Chinese and European tax resistance and grain seizures can be found in Wong 1997:209-51 where it is argued that the immediate elements of these small-scale

protests are similar in China and Europe, but the larger political and economic contexts framing these elements give the protests different kinds of historical significance.

[xviii] Tong (1991) in his analysis of collective violence in the Ming dynasty argues that conditions of hardship combined with a weak state presence to create the motive and opportunity for a wide range of small-scale and large-scale protests. The incidence of hardship doesn't follow population pressure in any obvious fashion

[xix] The late eighteenth and early nineteenth-century essays on the White Lotus rebellion collected in He Changling 1821: *juan* 89 collectively create a vivid portrait of state military efforts to rid a difficult terrain of people feared sympathetic to White Lotus doctrine. For an analysis of government penetration of this region and creation of a coercive presence see Gaustad n.d: chapter 4.

[xx] On Taiping period tax resistance see Wong 1997:238-43.

[xxi] Foreign and domestic observers alike recorded their grim assessments of this period. For Qingzhou in Shandong the Dutch Minister J. H. Ferguson estimated between thirty and sixty percent of the families in many villages had been wiped out by famine, while the English Baptist missionary Timothy Richard reported a death rate reaching ninety percent in some smaller villages (Bohr 1972: 15). Shanxi governor, Zeng Guochuan reported in late 1879 after the famine had ended that some eighty percent of the population had been affected, with sixty to seventy percent suffering from typhoid fever (Bohr 1972: 23). Throughout North and Northwest China Bohr estimates some nine and a half million people may have died (Bohr 1972: 26). Subsequent troubles in the early 1920s and again in the late 1920s in parts of north and northwest China punctuate the fragile balance between population and resources. Also see L. Li 1991.

[xxii] Charbonneau and LaRose 1979: 345-369; Bongaarts and Cain 1980. Using simulations and other evidence, Susan Watkins and Jane Menken (1985) argue that famines would have little effect on moderating population growth rates in large populations (an idea also developed by Chao 1986:26-32). They argue for the limited influence of famine on Chinese populations, even for the 19th century, a period of population stagnation.

[xxiii] James Tong's study of Ming rebellions classifies counties simultaneously by the nature of calamities and by offsetting factors such as prior harvests and famine relief efforts. For example, county-years classified as having maximum survivability could fall into three categories: (1) those with no reported calamity; (2) those with ordinary calamities, without "extensive and intensive qualifiers, and without accompanying report of damage of human lives, crop, livestock, and property, along with at least one offsetting factor, including bumper harvests in the previous year, famine relief, and local construction;" (3) "those with extensive or intensive calamities with accompanying reports of limited damage to human lives, crop, livestock, and property, along with at least two offsetting factors." County years with moderate or minimum survivability include any with reports of famine or "extensive or intensive damage to human life, crops, livestock or poverty, extensive or prolonged famine, or widespread death due to starvation, or outward migration from

famine-stricken area, abandonment, sale, or pawning of children or family, cannibalism, or public sale of human flesh" (Tong 1991:89-90, Tables 4.1 and 4.2).

[xxiv] G. William Skinner, in a more general vein, has stressed that "the major catastrophes that have punctuated Chinese history were almost always limited in scope," rarely affecting more than one or two macroregional systems (Skinner 1985:284).

[xxv] Huang's retracing of the conventional portrait of population and resources, specifically drawing it for the twentieth century, is challenged by other work. In separate books, Loren Brandt and Thomas Rawski present related arguments that China's early twentieth-century economy enjoyed growth and development (Brandt 1989; Rawski 1989). A key feature of these changes was rising labor productivity captured by higher wages. If correct or even if merely appropriate for some areas, their arguments further undermine the popular image of Malthusian crisis looming in China in the twentieth century, reducing if not erasing entirely the contrast we continue to perceive between the population and resource situation of Europe and that of China in modern times.

[xxvi] Smith writes,

> The poverty of the lower ranks of people in China far surpasses that of the most beggarly nations in Europe... The subsistence which they find ... is so scanty that they are eager to fish up the nastiest garbage thrown overboard from any European ship. Any carrion, the carcase of a dead dog or cat, for example, half putrid and stinking, is as welcome to them as the most wholesome food to the people of other countries (1937: 72).

[xxvii] Ping-ti Ho writes: "The average peasant in early Ch'ing [Qing] China in all probability was a happier person than the average peasant in France in the age of Louis XIV and Louis XVI" (Ho 1959: 213). Jacques Gernet, has asserted confidently that "The Chinese peasant of the Yongzheng [1723-1735] and first half of the Qianlong [1736-1765] eras was in general better nourished and more comfortable than his French counterpart during the reign of Louis XV." (Gernet 1972: 420-21). The English translation erroneously states "in general, much better and much happier"(1982: 481). Ho's and Gernet's assessments contradict arguments by European specialists that common folk in Europe had better food, clothing, and articles of daily use than people in China; the general difficulty with these latter assertions by European specialists about China is their routine reliance on other European specialists who know no more about Chinese conditions than they do themselves, e.g., Jones 1987: 5 citing Hajnal 1965: 131).

[xxviii] The importance of Smithian dynamics to economic development in both late imperial China and early modern Europe is argued in Wong 1997:9-52. Increases in productivity attending commercialization were probably the most important component of economic growth before the Industrial Revolution.

[xxix] What G. William Skinner refers to as macroregions, are internally differentiated, semi-autarkic regional economies with a core-periphery structure (1977). He further

argues that macroregional economies have their own temporal cycles (1985).

[xxx] Other work in progress suggests that the caloric intake of at least some Chinese agricultural laborers in the seventeenth and eighteenth centuries was in the same range as English workers in the late eighteenth and early nineteenth centuries. See Pomeranz 1997:10-11 which combines unpublished estimates made by Ming-te Pan with published data on England. Pomeranz's presentation of nutritional estimates is part of a larger argument he makes about the similarity of Chinese and European living standards in the eighteenth century. This comparability of living standards is in turn part of his larger analysis comparing and connecting partters of economic change in Asia, Europe, and the New World (Pomeranz, forthcoming).

[xxxi] Chinese cities were plausibly healthier than European. Because nightsoil was collected in cities and used in nearby fields, Chinese cities did not have the sewage problems typical of European urban centers. However, the epidemiological conditions of pre-modern Chinese cities are not as well understood as those of Japan and Europe. See, for example, Hanley 1987 and Macfarlane 1997. On China, see Dunstan 1975.

[xxxii] Arthur Wolf and Chieh-shan Huang demonstrate that little-daughter-in-law marriage, which they refer to as "minor marriage," is less fertile than other marriage forms (1980:165-172). Wolf argues that minor marriage is one explanation for moderate fertility in China (1985:180-181). Little daughter-in-laws are also less likely to survive to reproduce (Wolf and Huang 1980:167). "Delayed transfer" of brides postponed the consummation of marriage, sometimes for extended periods, and spinsterhood was prevalent in some local enclaves of South China (Topley 1975; Stockard 1989). Early cessation of childbearing was also promoted by taboos on widow remarriage. "Chaste widowhood," a neo-Confucian virtue, was ignored in some places (Wolf and Huang 1980:226) but had cult status in others (T'ien 1988). Given the high mortality levels of late imperial China, the probability that widowhood would curtail reproduction was considerable. For example, assuming a stable population with a male life expectancy of 32.5 years and a male marriage age of 25, there is a 30 percent chance that a surviving woman would be widowed within twenty years, and a 14 percent chance she would be widowed within ten (Coale and Demeny 1966).

[xxxiii] Sojourning in late imperial China took many men away from their residence and families, sometime for a lifetime. For instance, in Huizhou prefecture, home to many merchants:

> When a family in our region has two or more sons, only one stays home to till the fields. The others are sent out to some relative or friend to do business in a distant city. Equipped with straw sandals, an umbrella and a bag with some food, the boy sets out on a journey to some place in Chekiang [Zhejiang] or Kiangsi [Jiangxi], where a kind relative or friend of the family will take him into his shop as an apprentice. He is about 14 years old at this time. He has to serve an apprenticeship of three years without pay, but with free board and lodging. Then he is given a vacation of three months to visit his family, who in the meantime have arranged his marriage for him. When he returns to his master he leaves his wife in his old home. Every three years

he is allowed a three months' vacation with pay which he spends at home (Hu 1948, Appendix 4, quoted in Skinner 1976:345).

As described, this custom would have depressed the fertility of all but first sons in Huizhou. It is unclear whether the Huizhou custom varied with economic conditions, but in other locales, sojourning was clearly a response resource constraints (Li Bozhong 1994:49-52).

[xxxiv] Lee and Campbell's study of a Liaoning banner population finds an early onset of infertility and patterns of child spacing suggestive of conscious fertility control (1997:83-102). Based on their study of the Imperial Lineage Genealogy, Lee, Wang, and Campbell (1995) forward the thesis that the Qing nobility consciously spaced births by varying coital frequency (Lee and Wang, forthcoming). Li Bozhong argues that population growth in mid-Qing Jiangnan was moderated by the use of abortafacients and male oral contraceptives based on traditional medicine (1994:46-49). However, Francesca Bray raises doubts about the frequency with which abortion was practiced in late imperial China. She suggests that physicians were reluctant to prescribe drugs for abortion unless a woman's health was in serious danger because abortion interupted a natural process; she also suggests that in the Buddhist view typical among common people it would be considered a sin (Bray 1997:323,341). While it is impossible to rule out some influence of contraception and abortion on late imperial population dynamics, to date the evidence does not permit more than conjecture.

[xxxv] Skinner makes the significant point that the ideally-configured offspring set in such family systems include daughters as well as sons (1997:68). Male infanticide is difficult to detect against the backdrop of strong male preference, but recent studies suggest its presence. See (for example) Lee and Campbell 1997:70.

[xxxvi] See B. Lee 1981 and Waltner 1995. The practice varied regionally. From the Northern Song (960-1127) onward, its highest prevalence was in the southern tier, especially in the watershed of the Yangzi River (T'ien 1988:26). In 1484 the emperor received a report that female infanticide was widespread in Zhejiang, Jiangxi, Fujian, and Nan Zhili (present-day Jiangsu and Anhui), all in east-central China (T'ien 1988:28). Reports of female infanticide in the Lower Yangzi and southern coastal provinces were common in Qing local gazetteers and in the writings of western observers (Feng 1986:320-321; Doolittle 1865:203-209). In 1936, the anthropologist Fei Hsiao-t'ung found a juvenile sex ratio (males per 100 females) of 131 for Kaihsienkung [Kaixiangong] near Wuxi in Jiangsu province, which his informants stated was due to female infanticide (Fei 1939:22;33-34). Experimental county censuses conducted in the 1930s in Jiangsu and Fujian found juvenile sex ratios of over 120 males per 100 females (Lavely 1990). There is thus a continuous, if largely unquantifiable, record of the practice over several hundred years, centered in the lower Yangzi region

[xxxvii] The generalizability of these populations to the rest of China is, as we noted earlier, an important question that merits additional research and evaluation. As a population closed to migration, the Banner households may have been under greater demographic pressure than other rural populations. As an elite Manchu population, it is unclear how closely the

behavior of the imperial clan paralleled that of the Chinese elite. The use of infanticide by social elites is observed in other cultures. See, for example, Dickemann 1979.

[xxxviii] Commenting on infanticide in China, Malthus wrote:

> Relative to this barbarous practice, it is difficult to avoid remarking, that there cannot be a stronger proof of the distress that have been felt by mankind for want of food, than the existence of a custom that thus violates the most natural principle of the human heart (Malthus 1960:25).

[xxxix] Although we argue that female infanticide was often a response to economic circumstances, this is not to say that discriminatory treatment of females was limited to particular age groups or circumstances. It seems clear that relatively high female death rates at every age were a chronic condition in late imperial China. Females who survived infancy faced a gamut of hazards through childhood and early adulthood, with clear effects on female survivorship. But we emphasize here that infanticide could be invoked as needed.

[xl] Infanticide was also practiced in Europe, but at less demographically significant rates. Infanticide was generally aimed at children deemed illegitimate (Kertzer 1993; Macfarlane 1997). Abusive childcare practices (Shorter 1975) are seen by some scholars seen by some scholars as evidence of latent demand for fertility control (Knodel and van de Walle 1986:405-406).

[xli] In a stable population maternity function,

$$\sum p(x)\, f(x) = NRR$$

where p(x) is the probability of survival from birth to age x and f(x) is the probability that a female age x will give birth to a female, and NRR is the Net Reproduction Rate, the rate at which a woman reproduces herself in the span of a generation. f(x) can be decomposed into marital fertility and nuptiality components; in like manner, p(x) can be decomposed into components of intentional and unintentional mortality. The intrinsic rate of growth r is a function of the Net Reproduction Rate and the mean length of a generation. The intrinsic rate of growth *r* is approximated by lnNRR/T (the natural log of the Net Reproduction Rate divided by the mean length of a generation).

[xlii] All known Chinese historical populations correspond to a natural fertility pattern, implying no parity-specific control. Levels of marital fertility appear to vary within a fairly narrow range. The adjusted Buck marital fertility is approximately 20 percent higher than other observed (and presumably unadjusted) populations (for examples, see Table 1 in Wang, Lee, and Campbell 1995:385). Our choice of the adjusted Buck estimate yields higher growth than the alternatives but does not affect the crux of our argument concerning the influence of female infanticide on rates of growth.

[xliii] For example, G. William Skinner's analysis of Sichuan *baojia* registers details the manner in which a nineteenth-century decline in dynastic power led to an ever-increasing

official population overcount. Within this secular trend he further specified the moments when registration efforts in that province were more effective (1987).

[xliv] Stevan Harrell has recently argued that the demographic effects of dynastic transitions are not as extreme as official population counts portray (1995:9-10). Skinner argues that official counts for the mid-nineteenth century are exaggerated. He estimates 1850 population at 380 million (1987:75). This estimate implies growth rates in the latter half of the nineteenth century more than double that presented in Table 2 and Figure 1, .0034 compared to .0014.

[xlv] For a comparison of population growth rates in seven European countries since 1600 see Livi-Bacci 1992:69 where the unusual character of English rates is made clear. For a graphic representation of variation among life expectancies and fertility rates among a group of 17 European countries see Livi-Bacci 1992:102.

[xlvi] Skinner (1977:213) estimates that North China grew from 112 to 122 million between 1843 and 1893, while in the same period the Lower Yangzi population fell from 67 to 45 million and the Middle Yangzi fell from 84 to 75 million.